

# **The integration of practical tasks in teaching Natural Sciences in Grade seven**

**by**

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MAY THE SOUL OF MRS ELIZE RANDALL REST IN PEACE.

## Abstract

The study was carried out to investigate how teachers integrate practical tasks at school level. The main aim was to explore the manner in which the teachers who participated in this study assisted the learners to develop 21<sup>st</sup> century scientific skills through the teaching of Natural Sciences in Grade 7 classes. The study was conducted in three districts of the Department of Education in the Limpopo Province. The study was qualitative in nature and used a case study research design. The techniques used to collect data included document analysis, lesson observations, semi-structured interviews and the researcher's diary. Furthermore, the study used content analysis to analyse the data. Literature was reviewed and underpinned by the Profile of Implementation, which served as the theoretical framework of the study.

These two sources of information contributed greatly to the final establishment of realities concerning the way these teachers attempted to develop skills in the learners. The findings of the study were interpreted based on the reviewed literature and the theoretical framework. Conclusions emerged that the teachers in this study integrated practical tasks in a traditional manner rather than using 21<sup>st</sup> century approaches in many cases. The most affected areas included practical lesson preparation, and presentation and assessment. In many cases, the teachers handled and used apparatus while the learners observed the unfolding events. Additionally, inadequate amounts of time allocated for the teaching of Natural Sciences, coupled with a lack of appropriate resources are some of the factors which disadvantaged the majority of the learners in this study from developing the potential to implement Science in real-life situations.

**Key words:** Science practical tasks, practical lesson preparation; assessment

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## **List of abbreviations**

|        |                                                     |
|--------|-----------------------------------------------------|
| C2005: | Curriculum 2005                                     |
| CAPS:  | Curriculum and Assessment Policy Statement          |
| CPD:   | Continuing Professional Development                 |
| CPTD:  | Continuing Professional Teacher Development         |
| DBET:  | Department of Basic Education and Training          |
| DoE:   | Department of Education                             |
| FET:   | Further Education and Training band                 |
| GET:   | General Education and Training band                 |
| NAEP:  | National Assessment of Educational Progress         |
| NDBET: | National Department of Basic Education and Training |
| NCS:   | National Curriculum Statement                       |
| NS:    | Natural Sciences                                    |
| RNCS:  | Revised National Curriculum Statement               |
| SA:    | South Africa                                        |
| SPA:   | Science Practical Assessment                        |
| TAS:   | Teachers Assessment Scheme                          |
| UK:    | United Kingdom                                      |
| US:    | United States                                       |

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## CHAPTER 1

### ORIENTATION OF THE STUDY

The teaching and learning of science involves the development of a range of process skills that may be used in everyday life, in the community and in the workplace. Learners can gain these skills in an environment that supports creativity, responsibility and growing confidence (Department of Education, 2002)

#### 1.1 Introduction

Science in the 21<sup>st</sup> Century is dependent on skills development in schools (Department of Education, 2002). The implication of this is simply that science teachers should strive to support learners to acquire and apply skills rather than gain knowledge only (du Toit, du Toit & Reddy, 2008; Harreveld, 2007; Hattingh, Aldous & Rogan, 2007; Kotze, 2008; Le Grange, 2008; Maree & Fraser, 2008). I believe that science teaching and learning that promotes knowledge and concept formation at the expense of skills development does not do justice to the learners. Consequently, I developed an interest in understanding how the teaching and learning of practical tasks actually occur in primary schools in the province where I teach (Limpopo). According to the National Department of Basic Education and Training (NDBET), a learning environment that is conducive to learning process skills is a prerequisite for the acquisition thereof (Department of Education, 2002). Therefore, an investigation into how primary schools implement the policies for Natural Sciences (NS) regarding practical tasks may assist in making decision-makers aware of whether current teaching practices ensure positive transformation and delivery of quality science learning, as expected.

The background for the investigation is discussed in Section 1.2 to familiarise the reader with the conditions under which the sampled schools operated. Section 1.3 presents the problem statement, which necessitated the investigation. The rationale for the study is provided under Section 1.4, followed by the significance of the study in Section 1.5. The aim and objectives are presented in Section 1.6, whereas the

research questions are formulated in Section 1.7. Section 1.8 provides the conceptualisation of terms. An overview of subsequent chapters is presented in Section 1.9, followed by the chapter summary in Section 1.10.

## **1.2 Background of the study**

In this section, I present a brief background to the study to help readers gain insight into the environment in which the study took place. I also discuss the curriculum of the Pre-1994 and the Post-1994 Education System in South Africa.

### **1.2.1 Population of the study**

The investigation was conducted in three circuits of the Department of Basic Education and Training (DBET), located in the Limpopo Province in South Africa. The Limpopo Province is one of the largest and poorest provinces, situated on the north-eastern border of South Africa. The province, having only one city, is mostly rural and is characterised by educational challenges that include a lack of infrastructure to support teaching and learning, large classes, very few teachers who are qualified in science teaching, and a low pass rate of Grade 12 (Gr. 12) learners in their end of year examinations (DoE, 2010a).

Most of the schools within two of the circuits share similar economic conditions, that is, a lack of adequate educational resources, and that they are as such categorised as quintile 1 schools (DoE, 2012). Quintile 1 schools are the poorest schools which fully depend on government funding. Many quintile 2 schools are found in urban areas and they are partially funded by the government. However, quintile 1 and 2 are no-fee schools (DoE, 2012). That means that these schools have no legitimate rights to charge the learners fees. Although the schools which are categorised as quintile 2 do not charge school fees, the parent community make voluntary payments to the school. Within the district in which the study is undertaken, 150 schools are declared as quintile 1 and 8 schools declared as quintile 2 schools (DoE, 2012). Each of the indicated total number represents both primary and secondary schools.

### **1.2.2 The new curriculum of the post-1994 education system**

Since 1994, the democratic South African government has introduced “various educational changes intended to redress the social, injustices committed by the apartheid regime” (Bantwini & King-McKenzie, 2011:5). In 1998, the South African National Department of Education introduced Curriculum 2005 (C2005) as the new curriculum for the 21<sup>st</sup> Century (Reddy, 2006; Vermeulen, 2003). The name Curriculum 2005 was used simply because the policy and decision-makers hoped that the new curriculum would be fully implemented in grades R-12 by the year 2005. The C2005 was outcomes based (Vermeulen, 2003; DoE, 2002), which means that the type of science education which the government aimed to promote was based on the learner’s ability to perform prescribed skills as an indication that effective teaching and learning took place.

The government clearly described the aim of science teaching in the 21<sup>st</sup> Century. By introducing the new curriculum for NS, the South African government aimed to establish a concrete science foundation on which to produce scientifically literate citizens who would be capable of competing nationally and internationally (DoE, 2002; Kotze, 2008). Moreover, the government expects such literate citizens to contribute to the economic development of the country (Bantwini, 2010; DoE, 2007a). The acquired skills can contribute in the economic development of the country because there is a strong relationship that exists between scientific skills and the level of economic growth (DoE, 2002). In support of this, Maree, Aldous, Hattingh, Swanepoel and Van der Linde (2006) view the relationship between science and the socio-economic context under which teaching and learning occurs as an ongoing issue. The essence of these skills that the education system highlights is that they can be used in everyday life in the community and in the work environment (DoE, 2002).

The South African government’s objective is to ensure that the learners are taught to apply science knowledge and skills meaningfully in a real-life context as early as primary school education (DoE, 2002; 2011; Vermeulen, 2003). In other words, the learners are supposed to be prepared in such a way that they do not only gain knowledge and values, but also an understanding of what they learn and the ability to further use the acquired skills in their adult life (DoE, 2001; Kotze, 2008). The application of science knowledge and skills is compulsory for all learners in the

intermediate and senior phases of the General Education and Training (GET) band, as well as in the Further Education and Training (FET) band DoE, 2002). In terms of the education restructuring done by the South African post-1994 education system, Grade 7, which is the first level of the senior phase, was supposed to form part of secondary schools. However, Grade 7 still operates in primary schools in many provinces in South Africa.

The South African government aimed to move or shift away from the pre-1994 science education practices. It was vital that the post-1994 education system shifted away from the tendency towards knowledge acquisition only to gain knowledge, skills and values is, in fact, emphasis has been placed on the development of practical or process skills, which received little attention in the teaching of science previously (Hattingh, et al. 2007). Researchers report that in pre-1994 science education, the focus was placed on learners mastering content knowledge rather than on the development of skills (Baker, 1994; du Toit, et al. 2008; Hattingh, Rogan, Howie & Venter, 2005; Maree, et al. 2006).

The NS Learning Area (subject) was introduced to promote the concept of scientific literacy that was envisaged by the post-1994 education system. Therefore, the skills which Grade 7 learners were expected to master were clearly indicated in the NS curriculum. Those skills include following instructions, handling equipment, making observations, recording information, measuring and interpreting information (DoE, 2002). Practical skills were expected to be practised across the three identified learning outcomes (LOs), namely, scientific investigation, constructing science knowledge and science, society and the environment (DoE, 2002). Assessment served as the mechanism for measuring skills achievement.

The department of education took initiatives to ensure the smooth implementation of the curriculum. The first step was to orientate NS subject teachers in the new curriculum. Consequently, training workshops were organised and teachers were capacitated to teach NS. To supplement school-based science literacy, the South African government established science centres throughout the country, for example, the Interactive science centre in Cape Town, the Giyani science centre, and the Johannesburg science centre (Muwanga-Zake, 2009).

Still, the new curriculum could not yield the expected results (DoE, 2002). Evidence emerged when the performance results of the Grade 12 learners in science education were consistently low nationally (DoE, 2010b; 2010c). Internationally, the Third International Mathematics and Science Study Repeat Survey showed that the South African learners did not perform well in Science (Maree, et al. 2006). Consistently poor performance clearly suggests that the curriculum experienced serious challenges that required urgent attention. The policy and decision-makers attempted to review the curriculum in order to remedy the embarrassing science education results.

Therefore, C2005 was revised in 2001 (DoE, 2002). The new curriculum revision was a response to the general outcry based on poor learner performance (Howie, Scherman & Venter, 2008). Constant poor performance culminated in accusations levelled against curriculum developers due to the complexity of the curriculum design and terminology (Vermeulen, 2003). C2005 was amended, retaining the emphasis on knowledge and practical skills development, and was called the Revised National Curriculum Statement (RNCS) or National Curriculum Statement (NCS) as it was later called (DoE, 2002).

However, the South African education system is far from full implementation of the official policy (Maree & Fraser, 2008). In support of the fact that delivery of educational expectations is not yet fully achieved, Howie et al. (2008) reflect that the education system of South Africa has experienced several reforms since its inception in 1994. In South Africa, a noticeable pattern has emerged that once a new Minister of Education is appointed into office, the curriculum is altered. Thus the reformation of the curriculum seems to have developed into a normal practice, which is not surprising because the issue of curriculum change is experienced throughout the world (Rogan & Aldous, 2005). The cause in this case seems to be continuous poor learner performance, irrespective of the great efforts taken to improve teaching and learning.

Realising that the curriculum amendments done still did not yield fruitful outcomes, the South African government embarked on another endeavour to amend the

curriculum. In 2009, the curriculum was again reformed under the fourth Minister of Education since its inception in 1998. In this case, the national education system introduced a single comprehensive Curriculum and Assessment Policy Statement (CAPS) document in the year 2010. However, CAPS was implemented in the senior phase with effect from January 2012 (DoE, 2011). CAPS therefore replaced the RNCS, commonly known as the NCS. By amending the NCS for NS, the NDBET aimed to improve the implementation of the official policy in the form of exploring appropriate routes towards the achievement of science knowledge, skills and values (DoE, 2011).

Although the new curriculum experienced several amendments, skills development remained intact as it remained deeply rooted in the curriculum starting with C2005, the RNCS or the NCS and then CAPS. However, CAPS covers three types of Specific Aims which are supposed to be achieved by Grade 7 learners during the NS teaching and learning process. The practical skills which learners in Grade 7 classes are expected to learn are clearly listed under Specific Aim 2, which is investigating phenomena in Natural Sciences (DoE, 2011). The same skills listed in paragraph five under the subheading 'new curriculum of the post-1994 education system' are captured in CAPS.

However, the policy stipulates that "at least the first six skills must have been assessed at a grade appropriate level" (DoE, 2011). The seventh skill on the list, to design or plan an investigation, is not compulsory. Therefore, teachers are at liberty to teach the learners this sophisticated skill at their will. Table 1.1 shows the three types of specific aims covered in CAPS (DoE, 2011).

|                |                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Specific Aim 1 | Knowing Natural Sciences                                                                               | This involves knowing, understanding, and making meaning of sciences in a way that enables learners to make many connections between the ideas and concepts in their minds. The following cognitive (thinking) skills comprise the range of skills that learners should develop: acquisition of knowledge; understanding, comprehending, making connections between ideas and concepts to make meaning of Natural Sciences; applying knowledge of Natural Sciences in new and unfamiliar contexts; analysing, evaluating and synthesising scientific knowledge, concepts and ideas. |
| Specific Aim 2 | Investigating phenomena in Natural Sciences                                                            | Learners must be able to plan and carry out investigating as well as solve problems that require some practical ability. The skills relating to doing practical work in Natural Sciences are: following instructions; handling equipment or apparatus; making observations; recording information or data; measuring; interpreting and designing/planning investigations or experiments.                                                                                                                                                                                            |
| Specific Aim 3 | Appreciating and Understanding the History, Importance and Applications of Natural Sciences in Society | The skills that are to be developed in the process of achieving Specific Aim 3 are cognitive rather than the practical skills in Specific Aim 2. These are: understanding the history and relevance of some scientific discoveries; the relationship of indigenous knowledge with natural sciences; the value and application of natural sciences knowledge in industry, with respect to career opportunities and in everyday life and developing language skills, that is, reading and writing.                                                                                    |

**Table 1.1: Curriculum and Assessment Policy Statement Specific Aims**

The development of this study was influenced by the information provided in this background. The question that kept surfacing was why science performance consistently remained poor despite the efforts of the post-1994 education system to improve curriculum implementation. Specifically, this study is concerned with practical skills development as a significant component of the Grade 7 NS curriculum.

### 1.3 Problem statement

The demonstration of scientific practical skills in a real-life situation is a great challenge for Grade 7 learners in some of the schools in and around the Limpopo Province. As Head of Department for NS in the senior phase at a school, I realised during classroom visits, which formed part of my managerial duties, that most learners in the Grade 7 classes demonstrated an inability to use science skills practically.

Progression in science is determined by the abilities and competences an individual learner is able to demonstrate (DoE, 2002, 2007b). An individual learner has an obligation to prove their readiness to progress. Usually, a teacher applies subject knowledge to assist the learners in developing the ability to apply process skills in real contexts (Harreveld, 2007). This could be why the Department of Basic Education took initiatives to ensure that teachers received training based on the new curriculum. This, however, does not mean that the capacity building workshops were aimed to replace or completely wipe out traditional teaching approaches that these teachers had acquired during their training as professionals. Rather, they were applied to add to the already existing traditional science teaching approaches so that teachers would be able to successfully implement the curriculum.

Surprisingly, the development of abilities seems to still be far from obtainment (Clough & Olson, 2008; Rogan, 2004). The Grade 7 learners consistently show an inability to perform practical work assigned to them. The post-1994 education system took many initiatives, which included the introduction of the new curriculum, provision of policy implementation guidelines, ensuring accessibility of funds for learner support materials, supply of learner-teacher support materials (LTSM), effecting curriculum amendments where necessary and capacitating NS teachers with skills to enable them to better implement the new curriculum. Irrespective of these initiatives, the poor performance continued and was a central issue. The poor results in both annual national assessment and end of year examinations, especially in Grade 12, suggest that there are problems with regard to the new curriculum implementation (DoE, 2010b; 2010c). Therefore, there was a great need to investigate how teachers actually help learners to develop the ability to apply practical skills in a real-life context as early as Grade 7. Investigating how teachers support the development of practical skills may contribute to understanding the problems leading to learners' poor performance.

Contrary to poor results, the official policy stipulates that "all learners can and will succeed" (DoE, 2001, p.6). That means that all learners have the potential to acquire knowledge and skills, such as the science skills prescribed for the learners who enter the first level of the senior phase (DoE, 2002). However, the policy is silent on the

matter of teaching, which is done by the teachers, although, for the learners to learn successfully, the guidance of the teachers is a necessity.

The truth is that the ability to use particular skills does not develop automatically in learners. The assumption is that learners develop abilities through “hands-on practical work” in a real context (Hattingh, et al. 2005:21). I believe that meaningful acquisition of skills results from engagement in the task rather than observation or listening to narratives. This implies that even if science teachers commit themselves in demonstrating or explaining practical activities theoretically, their commitment may not yield effective development of the skills in the learners. In my opinion, there is a great gap between doing the activity on behalf of the learners and allowing the learners to do the activity by themselves. The difference is that when the learner does an activity, for example, connects a bulb to a battery to give light, the challenges which a learner sometimes experiences often results in an interest to reach the goal destination. The experience the learner gains by doing an activity has a great impact and is not easily forgotten, unlike knowledge learnt through observation or listening.

Apart from consistency in the demonstration of inabilities to use skills and poor science results production in general, I have had informal discussions with a few learners and their responses show a development of negative attitudes towards science education. Negative attitudes certainly affect performance in science (Mulholland & Wallace, 1994). On this issue, Mather (1994:228) holds the belief that girls prefer not to “continue in the field of Science, both when choosing courses at school and in career options”. I assume that should the cause of negative attitudes towards science learning be left unattended, it may culminate in the negligence of science learning. This is one area that needs to be looked at.

Although there are positive changes, like organisation and attendance of capacity building workshops, creation of science centres, provision of textbooks and availability of funds for curriculum development taking place since the new curriculum (C2005) was introduced, there is still no performance improvement in NS. Many learners continue to perform below the expected levels regardless of several attempts made to redress past teaching practices of the NS subject (DoE, 2010c).

Therefore, perpetual poor performance coupled with the deteriorating interest in science education intensified the need to conduct an investigation into practical tasks integration.

#### **1.4 Rationale for the study**

This study was initiated mainly to investigate how teachers integrate practical tasks as part of their strategies for teaching NS to Grade 7 classes. Investigating the ‘how’ part of the practical work may shed light on why the development of scientific skills in learners is so poor. This is why the study is exclusively concerned with how science practical activities, particularly in Grade 7, are done rather than Natural Sciences teaching as a whole. A discussion on NS teaching and learning will play an important role in this study. Why conduct this research? First and foremost, the reason is to know the nature of the practical tasks that are offered, to understand how teachers design lessons to present such activities, how practical tasks are implemented in reality, how the development of scientific skills in learners is assessed and also the resources used to aid the integration process. The aspects of lesson planning, presentation and assessment are interrelated to the extent that they cannot be easily separated from one another, especially with the main focus on understanding practical tasks integration (DoE, 2007b; 2011). Not only do they supplement each other, but there is also a mutual relationship that exists amongst these three aspects.

Another reason for conducting this study was to understand why some learners show poor practical skills development despite consistent contact between teachers and learners during NS lessons. Evidence of poor performance appeared in the reports issued by the Limpopo Provincial Department of Basic Education and Training (LPDBET) annually. The reports indicate that many schools in the Further Education and Training band (especially Grade 12) reflect poor end of year results annually (DoE, 2010c). Out of the nine provinces in this country, the Limpopo Province obtained the second last position in terms of the Grade 12 learner performances issued for the year end of 2012. In 2010, the Member of Executive Council (MEC) of education in the Limpopo Province, Dickson Namane Masemola, raised a thorny concern that “the Province experienced its worst performance ever in the Grade 12 overall results by obtaining a disappointing 48.9% pass rate” in 2009 (DoE, 2010c:3). Although the province improved notably by obtaining 57.9% in 2010,

learner performance was still below the 60% provincial target rate set for 2009 (DoE, 2010c).

However, the Grade 12 overall learner performance increased gradually in the Limpopo Province (DoE, 2011). This was seen when the Grade 12 end of year results in the Limpopo Province manifested a higher pass rate, for example, in 2012 the pass rate stood at 66.9% and increased to 71.8% in the year 2013 (DoE, 2014). The province managed to increase learner performance by 4.9% between 2012 and 2013. That means that in four years' time, from 2009 to 2013, the province succeeded in increasing the learner performance pass rate by 22.9%. Yet, the 2013 provincial target rate of 75% was not achieved. In terms of these results, science is one of the subjects in which learners did not perform well (DoE, 2010c).

Performance in science as a subject is problematic (Maree, et al. 2006). The fact is that the LPDBET took initiatives to organise capacity building workshops for science teachers before implementation of the NCS could be effective (Bantwini, 2010). Because Grade 7 is the entrance level of the senior phase which is responsible for constructing a strong science foundation, the NS teachers were given chances to attend workshops. If many Grade 7 learners demonstrate an inability to apply practical skills realistically as policy requires them to do, it warrants an investigation based on how the teachers actually assist the learners to acquire such skills. By initiating a study of this nature, I hoped to acquire insights into how different schools assist learners on their journey to gain science process skills and at the same time promote an interest in science learning.

## **1.5 Significance of the study**

In general, the act of capacitating learners with science process skills is one way towards the future economic development of this country (Bantwini, 2010; DoE, 2007b). The current study should play a significant role in bringing to light how some teachers integrate science practical tasks in real-life contexts. My report, particularly the findings and recommendations, can be used by science teachers, school principals, heads of department at school level, and curriculum advisors to understand some of the strengths and weaknesses, or barriers towards effective delivery of quality science education. In turn, the individual stakeholder may use the

findings and recommendations as a stepping stone towards renovation of current practical task practices. Again, these findings may encourage teachers who experience difficulties when teaching practical tasks to overcome uneasiness with science and to regain confidence in their roles as science teachers (Baker, 1994).

This report may serve as an eye-opener for the LPDBET to realise how practical task integration occurs at school level. Where possible, the LPDBET may find some of the current practical task practices worthy to be recommended for future usage or they may identify a need for innovation. In other words, the findings and recommendations may serve as a reference for capacity building workshops or other intervention strategies and planning. Besides this, educational policy and decision-makers may wish to use the findings and recommendations of this study when planning for curriculum innovations.

Furthermore, the outcomes of this study add information to the existing literature about practical task integration. Significantly, there has been limited research done thus far, especially in the area of process skills development for learners at the entrance level of the senior phase. Most of the local (South African) studies focus attention on science teaching and learning in secondary schools in general, meanwhile fewer studies focus on process skills development in primary schools, especially for Grade 7, which is the entrance level of the senior phase. Finally, other researchers who develop an interest in investigating similar phenomena could use this report in further study.

## **1.6 The aim and objectives of the study**

The main aim and objectives of this study are based on the problem and the rationale discussed above in order to assure that the findings answer the research questions.

### **1.6.1 The aim**

The aim of the study was to gain an understanding of how teachers integrate practical tasks when teaching Natural Sciences to Grade 7 classes.

### **1.6.2 The objectives of the investigation**

The following objectives underpin the aim of this investigation:

**1.6.2.1** To develop a better understanding of how teachers design lessons that present practical tasks. To achieve this objective, the available documents were analysed and the participants were also interviewed.

**1.6.2.2** To investigate the teaching strategies used by the participants so as to ensure that practical tasks become effective in the science classroom. This objective was achieved by observing lessons and conducting interviews.

**1.6.2.3** To understand the way process skills development in learners is measured or assessed. This objective was achieved by analysing the learners' workbooks, the assessment instruments, memoranda and performance record sheets. In addition to this, the lesson observations contributed towards the comprehension of how progress is monitored as assessment was done during the practical lessons.

## **1.7 The research questions**

The main research question for this study was actually derived from the problem statement outlined above. The main research question was:

*How do teachers integrate practical tasks as part of their strategies for teaching Natural Sciences in Grade 7 classes?*

The main research question is underpinned by the following three sub questions:

*1. How are practical task lessons for Grade 7 Natural Sciences learners designed?*

By investigating how the lessons used to teach Grade 7 learners practical tasks are designed, I was able to discover whether teachers design the lessons according to the requirements of the department. In other words, this question enabled me to find out whether reliable sources are used when teachers design practical lessons and also whether these lessons include the theme, objectives, apparatus, the implementation strategies, the roles of the facilitator and the learners, as well as the assessment strategies. Additionally, I was able to collect adequate data surrounding practical task lessons design.

## *2. How are lessons involving practical tasks enacted in Grade 7 classes?*

By including this sub-question in the study, I was privileged to visit the research site, that is, the environment in which practical tasks are enacted and to closely observe what teachers actually do to develop process skills in learners.

## *3. How are learners' Natural Sciences practical skills assessed?*

Since it is important to know whether the teaching and learning process is effective or not, this sub-question enabled me to understand how teachers assess the development of skills in learners.

### **1.8 Conceptualisation of terms**

Qualitative researchers are inclined to define the terms that they use during the research process. To clarify the concepts used in this study, I present the following terms:

#### **1.8.1 Science practical tasks**

In this study, science practical tasks refer to investigations carried out with certain objects and ideas and/or learning about objects and ideas (Abrahams, Reiss & Sharpe, 2011). According to Kotze (2008), and Maree and Fraser (2008), science practical tasks refer to a range of activities or process skills which people need to use in everyday life.

#### **1.8.2 Practical lesson preparation**

Here, practical lesson preparation refers to a legitimate document which incorporates the specific skills that learners are expected to apply in a real-life context (Fisher, 2003).

#### **1.8.3 Practical task assessment**

In this study, practical task assessment is considered as a process of gathering information about the development of scientific skills in learners (DoE, 2007a). Therefore, assessment is closely related to the scientific skills taught and learned at school level (Van Aswegen & Dreyer, 2007).

## **1.9 Overview of subsequent chapters**

This research programme was designed to investigate how teachers integrate practical tasks as part of their strategies for teaching NS to Grade 7 classes. I gained an understanding of whether the manner in which teachers integrate practical tasks ensures the delivery of quality science education or not. The quality assurance was assessed through checking whether teachers plan lessons for the integration of practical tasks according to the standardised lesson plan format, present practical tasks guided by the lesson plan, and finally assess learners' development skills using assessment instruments or rubrics appropriate for assessing 21<sup>st</sup> century scientific skills.

### **1.10 Summary**

This chapter has addressed the background of the investigation taking into account the educational transition in South Africa from the pre-1994 education system to the post-1994 education system. The problem statement revealing the cause of the investigation was discussed. Furthermore, the rationale for the investigation as well as the research aim and objectives were discussed. The sub-research questions are structured in such a way that they encompass the main research question. Finally, the research question and sub-questions each followed by a brief explanation were presented.

The introductory chapter presented the background of the investigation, the problem statement, the rationale, the significance, the aim and objectives, and lastly the research questions. The remaining chapters present a review of the literature (Chapter 2), the research design and methodology (Chapter 3), the research findings (Chapter 4) and chapter 5 provides a discussion of the findings, the conclusions and the recommendations based on the reviewed literature and the data collected.

## CHAPTER 2

### A REVIEW OF LITERATURE

“Deficiencies in practical skills and conceptual understanding of (process) are passed on from teacher to learner who then becomes a teacher-from one generation to the next” (Muwanga-Zake, 2009: 5).

#### 2.1 Introduction

In this chapter, I present a discussion of literature related to science practical task integration, which resulted from a review of mostly related research, which further enabled me to identify the gaps or contradictions in the research corpus. Existing gaps in the reviewed literature urged the development of a study of this nature.

Therefore, I discuss the results of the reviewed literature in a sequential order. Firstly, I present a discussion which highlights the nature of the Natural Sciences (NS) subject. The views of various researchers and the skills associated with practical tasks come thereafter. A discussion on lesson planning for the teaching and learning of NS succeeds the views and skills discussion. Although the discussion on lesson planning is presented third, its significance should not be underestimated because it is the base on which the fundamental aspect of this study is rooted. Next, practical task implementation as the core aspect follows the lesson plan discussion. Here, I reflect on how education systems of diverse countries of the world integrate science practical tasks at school level. Fifth, teacher factors are presented, followed by a discussion of the types of assessment to be used for practical tasks. Seventh, I present science practical task assessment practices internationally, followed by assessment feedback. Finally, the theoretical framework underpinning this study is presented. I close the chapter with a summary.

#### 2.2 Scope of the Natural Sciences subject

The South African Post-1994 Education System introduced NS as one of the subjects (so-called learning areas) covered by the C2005 in 1998 (DoE, 2002). After C2005 was abandoned, NS was retained in other educational policies, for instance

the South African National Curriculum and Assessment Policy Statement (CAPS), as a compulsory school subject in the intermediate and senior phases (DoE, 2011). The literature indicates that this subject was also compulsory before curricula C2005 and NCS (DoE, 2002) and is still compulsory in what is commonly known today as CAPS (DoE, 2011). Before the name conversion, the NS subject was offered as general science in South African schools up to 1999.

Originally, NS subject emanated from science education (Hume & Coll, 2008; DoE, 2011). Millar (2004) mentions that science is often viewed simplistically as a body of knowledge built up from the natural world that people live in, without people realising that the processes of acquiring such knowledge is an integral part of science. Science is defined internationally, for example, by the National Assessment of Educational Progress (NAEP), which is the structure responsible for collecting and reporting information based on what learners in the United States (US) know and are capable of doing in science, as “a way of knowing about the natural world based on tested explanations supported by accumulated empirical evidence” (DoE [US], 2009:10). Scholars, for example, Reiss (2010) and Allchin (2011), support the view that science is a way of knowing about natural processes.

In the South African context, science is viewed as “a systematic way of looking for explanations and connecting up the ideas” people have about the world (DoE, 2011:11). Seemingly, South Africa has adopted the view of other countries. Here, science goes beyond the body of knowledge that Millar refers to. Notably, science is shaped when people, especially scientists and researchers, attempt to understand the natural world through observing, codifying and testing existing ideas (DoE, 2002). Clearly, the inquiry processes that scientists perform when attempting to understand the natural world distances science from being seen as a mere body of knowledge, as explained in the National Science Education Standards in the US (National Research Council [NRC], 2000).

Therefore, when planning NS teaching and learning, it is imperative to clearly outline the purpose of each lesson (Abrahams & Saglam, 2010; Millar, 2004). International researchers like Abrahams and Saglam (2010) consider development of skills in learners, encouragement of accurate observations and careful recording of

information as the main purpose of teaching and learning science. In a similar vein, Millar (2004) views the purpose as a means to help learners so that they notice a phenomenon, and look at the phenomenon in more detail than before so that, if possible, the phenomenon can be understood and remembered in the future.

According to the DoE, the teaching and learning of NS serves two purposes. Firstly, the purpose is to “enable the learners to make sense of the world in scientific terms and prepare learners for continuing with a science(s) into the FET phase ... and beyond” (DoE, 2011:12). Secondly, the teaching and learning of NS serves as a mechanism to establish a foundation for science learning through the development of skills (Kotze, 2008). Bantwini (2010) and Maree et al. (2006) share the notion of building a science foundation. They motivate that building a science foundation will produce scientifically literate citizens who will be capable of using knowledge and skills, compete nationally and internationally and, as a result, contribute significantly to economic development in South Africa.

Without doubt, the literature reveals the education of scientifically literate citizens as a global issue (Bantwini, 2010; DoE, 2011; Gott & Duggan, 2007; Maree, et al. 2006; Millar, 2004; Rybakova, 2008). Furthermore, Taylor, Jones, Broadwell and Oppewal (2008) highlight that science education policies across the world emphasise continuous development of scientifically literate citizens. Conversely, Rybakova (2008) states that science and education are key factors in as far as progress in terms of economy and civilisation of any country is concerned. The emphasis suggests that it is quite difficult for a country to prosper and develop successfully when its sciences lack development and, again, when there is no adoption of scientific advances (Gvozdeva & Vysotskii, 2006). Clearly the literature shows science literacy as an essential goal for the 21<sup>st</sup> Century (DoE [US], 2009).

To make this millennial goal achievable, the officials responsible for designing the NS curriculum in South Africa opted to organise the subject into four knowledge strands (DoE, 2011). According to the Natural Sciences curriculum policy document, each of the Knowledge and Strands is developed progressively across the three years which a learner is expected to complete within the Senior Phase ( Grades 7 to 9) (DoE, 2011). The Knowledge and Strands included are (DoE, 2011:12):

- Life and Living (which lead to Knowledge and Strands for life sciences in FET).
- Matter and Materials (which lead to the Knowledge Strands for life sciences in FET).
- Energy and Change (which lead to Knowledge and Strands in both life Sciences and physical sciences).
- Earth and Beyond (which leads on to Knowledge and Strands in both life Sciences and geography).

It is from within the parameters of the Knowledge and Strands outlined that I developed an interest in inquiring into scientific skills development. However, I wish to point out that focusing solely on scientific skills development does not necessarily deny the fact that science comprises of both content and practices (DoE, 2007b; DoE [US], 2009; du Toit, et al. 2008; Hume & Coll, 2008; Howie, et al., 2008; Le Grange, 2008). Le Grange (2007:587) and Hume and Coll (2008:1202) view the component 'practices' simply as the "doing of science". The activity of doing science is carried out by human beings (Phillip & Smith, 2008). However, this activity labelled as science practice seems to be limping behind other activities (Lindemann-Matties, Constantinou, Junge, Köhler, Mayer, Nagel, Raper, Schüle & Kadji-Beltran, 2009). Actually, what does science practice entail?

### **2.3 Science practical tasks**

The ability to use knowledge and skills or process skills is indispensable, especially in the 21<sup>st</sup> Century because it enables people to have "high level thinking skills called 21st century learning skills" which are helpful in solving new problems of the new world (Can Sahin, 2009:1464). The literature shows science practical tasks as a means of developing process skills that are transferable to learners (Abrahams & Saglam, 2010; Kotze, 2008; Le Grange, 2008; Maree & Fraser, 2008). Hume and Coll (2008) argue that for skills to qualify as scientific, they should be utilised within the context of science and should further be informed and guided by scientific theory. Therefore, it is improper to regard any skill as scientific.

Research considers the scientific skills which people may need to use in everyday life as a range of process skills (Kotze, 2008; Maree & Fraser, 2008). In the South

African curriculum, scientific skills are simply referred to as “process skills” (Le Grange, 2008:167). This concept resulted from the combination of two separate terms namely “process” and “skills” (Le Grange, 2008:167). Specifically, this concept refers to the learner’s cognitive ability to create meaning and structure out of newly acquired information and life experiences (DoE, 2007b). Le Grange (2008:168) argues that process skills are not “discrete but bound up in Science content knowledge”, even if it sounds possible to discuss them as an essential component of science. The implication is that there is a powerful connection between science practical skills and content knowledge (Le Grange, 2008). Examples of process skills referred to here are documented in the South African policy for the Natural Sciences under the heading “process skills” (DoE, 2007b:3).

Internationally, the United Kingdom (UK) views practical tasks in science as “doing things with objects and ideas and/or learning about objects and ideas” (Abrahams, et al. 2011:38). The concept ‘things’ is ambiguous; perhaps it emphasises the fact that the terminology may vary, for example, practical activities are sometimes called experiments (Frost, 2010). By this, Frost (2010:191) illustrates that there are certain practical activities which are “well tried and tested” and that teachers are aware of what is supposed to happen during the activity. Frost (2010:191) argues that practical work is a general term which refers to a range of activities that “make different demands on the skills of both teacher and pupils” but has purposes that are not the same.

According to Kotze (2008), science practical tasks are done to enhance skills development in learners. Similarly, Hume and Coll (2008, cited in Atkin & Black, 2003) consider the purpose being to provide learners with the opportunity to gain the procedural and conceptual knowledge necessary to conduct an inquiry in a way that reflects the actual work done by scientific communities. In contrast, a study conducted by Barber, Chapman, Ellis-Sackey, Grainger and Jones (2011:32) shows that those teachers held a different view concerning practical task implementation. The responses given by the teachers during the study which Barber et al. (2011:32) conducted in England, with a focus on physics activities, indicated that the teachers only viewed practical activities as a useful instrument for the completion of

“coursework and development of the more traditional science enquiry skills, such as planning, obtaining evidence and drawing conclusions”.

Fundamentally, practical tasks are regarded as an important feature in 21<sup>st</sup> century science teaching and learning (DoE, 2007b; 2011; Abrahams & Saglam, 2010). However, it should be noted that the importance of practical tasks in science has long since been valued. According to Abrahams and Saglam (2010), for example, Kerr undertook a study forty-six years ago to examine the views of teachers concerning the importance of practical tasks as an essential feature of science education. Therefore, the value of science practical tasks has been known for many years. In addition to this, Shaha (2011:3) argues that practical work is an “innate” component of science education. Surprisingly, the importance of practical tasks in school science seems to be often taken for granted and not given the necessary attention it deserves (Barber, et al. 2011).

Furthermore, science practical tasks are categorised in a similar manner across several countries, for example, Frost (2010) indicates that in the UK, practical tasks are undertaken in three ways of classification (adapted from Woolnough and Allsop 1985), namely, illustrative practicals designed to illustrate particular scientific phenomena; exercises to develop practical skills and techniques, and lastly, investigative practical work and problem-solving in order to learn how to investigate and to solve problems. In South Africa, the practical skills which learners in the intermediate and senior phases are expected to develop and master through learning NS are presented as follows (DoE, 2011:18):

- Follow instructions,
- Handle equipment or apparatus,
- Make observations,
- Record information or data,
- Measure,
- Interpret, and
- Design/plan investigations or experiments.

This list of practical skills is clearly outlined in the CAPS document under Specific Aim 2: Investigating phenomena in Natural Sciences, which categorically relates to

doing science or practical tasks and investigations (DoE, 2011). Although there are seven skills listed, the policy requires the Grade 7 learners to have mastered and be assessed in at least the first six skills annually (DoE, 2011). The skills are aligned to what the learners would do in a normal course of performing practical tasks, although they would not be applied to every activity in the same way (DoE, 2011). The seventh skill, which is design investigations or experiments, is not compulsory for the Grade 7 learners (DoE, 2011). This is a sophisticated skill which calls for scientific inquiries in the same way as scientists do (Akerson & Hanuscin, 2007).

CAPS, unlike C2005, the RNCS and the NCS, prescribes scientific skills precisely. Previously, the NS curriculum included practical tasks under the so-called Learning Outcome 1: Scientific Investigations (DoE, 2002). Learning Outcome 1 expected the learners to at least demonstrate the abilities which include problems of making, observing, surveying and measuring, comparing and determining the effect of certain factors (DoE, 2002).

In summary, doing science remains deeply rooted in the teaching and learning of NS irrespective of curriculum revision (DoE, 2011; Lelliot, Mwakapenda, Doidge, du Plessis, Mhlolo, Msimanga, Mundalamo, Nakedi & Bowie, 2009). Hattingh et al. (2007) explain that doing science is experimentation and problem solving rather than the memorisation of facts and theories. However, science practical work should not be viewed as a mere component which can easily be separated or detached from the teaching and learning of science education (Le Grange, 2008). Without commitment and proper planning, it is not simple to fast track the development of the targeted essential scientific skills in learners. In fact, precise planning is essential to engage learners in “efficient practical sessions with a purposeful hands-on minds-on approach” (Barber, et al. 2011: 30).

## **2.4 Practical tasks lesson design**

A practical task lesson plan is a detailed legitimate document which incorporates the specific skills that learners are expected to apply in a real-life context (Fisher, 2003). Barber et al. (2011) put it simply that a lesson plan has to precisely clarify the targeted learning outcomes associated with the practical activity. Clarification of the outcomes helps practical activities to receive intensive attention during planning

rather than to be considered as a “soft target” (Barber, et al. 2011:27). The indication is that the task of designing a lesson plan is not as simple as one may think. Therefore, it is imperative for teachers to base their thoughts on what they expect the learners to achieve (Rodrigues, Tavares, Ortega & De Mattos, 2010).

The reality is that today’s learners are not like the generation of learners born before information technology became available to the general public (Can Sahin, 2009). Today’s learners spend most of their time “using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age” (Can Sahin, 2009:1465). These activities give the learners an advantage in knowing and developing the ability to use some scientific skills before they are taught at school level. Therefore, when designing a practical lesson, it is advisable to take every learning environment and individual learner into account (Can Sahin, 2009).

The key issue is for teachers to have clear knowledge of what they want to achieve (Millar, 2004). In this case, Hume and Coll (2008) emphasise knowledge about how scientists think, work and what makes an inquiry genuine. Knowledge of skills assists the teacher to identify the objectives and also make decisions regarding appropriate strategies and methods to be used for the realisation of the set objectives (Millar, 2004). In short, and very importantly, the learning content demands adequate organisation, otherwise it may be difficult to yield or achieve the envisaged learning outcomes (Liu & Wang, 2010).

For that reason, Taylor et al. (2008) suggest good care as the best mechanism that teachers can adhere to in order to plan for the scientific skills that they want to teach the learners. Unless practical tasks are designed with a specific and progressively challenging objective in mind, the development of skills in the learners is likely to remain difficult to achieve (Millar, 2004). On this note, Metcalf, Evans, Flynn and Williams (2009) argue that teachers are expected to design lesson plans that create ample opportunities for learners to succeed academically.

The development of scientific skills in learners is seldom possible without proper planning (Millar, 2004). Rodrigues et al. (2010) view the concept of planning in an educational perspective as an essential human activity whereby teachers in particular think, organise actions and make decisions about their actions and further

adjust resources prior to putting anything into motion. The advantage here is that the planning stage offers the teacher with a better position to match the needs of the learners and to provide the necessary support needed to achieve the set goals (Metcalf, et al. 2009). For that matter, Metcalf et al. (2009) believe that teachers run the risk of opening a vacuum for accidental activities that are not according to the set academic goal, especially when their teaching and learning process is not carefully planned. This view clearly reflects the importance and complexity of planning (Metcalf, et al. 2009), especially as it is an ongoing process (Rodrigues, et al. 2010).

Designing a lesson needs adequate time (Barber, et al. 2011) for planning, organising and arranging resources. If adequate time is allocated to planning, it could help to make practical tasks less of a “soft target” (Barber, et al. 2011:27) when it comes to planning learning in restricted time. Therefore it is imperative for the teacher to indicate in the lesson plan the specific time scheduled for running the activity. Furthermore, time necessitates the breaking down of the lesson into manageable stages.

A lesson plan serves different purposes. The main purpose of a lesson plan is to provide a clear direction towards managing the entire teaching and learning process, as well as managing the environment (Shaha, 2011). A lesson plan provides direction by way of clearly outlining the objectives, the strategies for the realisation of the abilities and all the necessary steps to be followed during the presentation (Fisher, 2003). Furthermore, a lesson plan indicates whether an individual or a group of learners is supposed to carry out the practical activity, the roles that the learners and the teacher are expected to play during the demonstration, the assessment strategy to be used, the apparatus to be used and safety issues (Fisher, 2003). The implication is that a lesson design is a prerequisite for the smooth integration of practical activities in the teaching and learning of NS (DoE, 2007a).

However, a study conducted by Taylor et al. (2007) provides evidence of poor lesson preparation by some teachers. Akerson and Hanuscin (2007) argue that poor lesson planning is caused by the fact that teachers possess limited knowledge and experience in as far as generation of scientific activities is concerned. Furthermore, teachers not only seem to be failing to understand science as a process of

generating new knowledge, but they also fail to involve the learners in the whole scientific process (Jacobs, Martin & Otieno, 2008). This may be a result of teachers' inadequate scientific knowledge (Taylor, et al. 2007).

The teacher carries the responsibility for designing lessons (Le Grange, 2008; Metcalf, et al. 2009; Rodrigues, et al. 2010). In contrast, Can Sahin (2009) considers the responsibility of designing a practical lesson plan as not only consigned to the teacher, but to the learners as well. This sounds rather impossible, but if the skill wherein it is argued that learners design investigations and even ask the investigative questions is taken into account, it becomes clear that learners can be engaged in the design process (Akerson & Hanuscin, 2007; DoE, 2011). The engagement of learners as a component of the designing team benefits the learners by making them aware of the expectations of the teacher, aware of what to do next during the activity and also enables them to construct background knowledge from which to perform an activity. This proves that it is possible to involve the learners in the designing process (Robertson, 2007).

Although lesson design is an obligatory exercise of the teacher (Frost, 2010), in the South African situation, Onwu and Mogari (2004) found that lesson design continues to be characterised by a lack of structure and the absence of activities that promote development of investigative and questioning skills. The studies conducted by Onwu and Stoffels (2005), and Stoffels (2005, cited in Lelliott, et al. 2009) disclose that the lessons which science teachers prepared for large, under-resourced classrooms in the Limpopo Province were typically traditional and teacher-centred. A similar situation was revealed by a study conducted in nine secondary schools in Mpumalanga wherein eighteen video-taped science lessons were identical to the lessons prepared during the Pre-C2005 days (Rogan, 2004).

Worse, a study conducted by Bantwini (2009) reveals that some teachers do not prepare lessons before getting to classrooms. Bantwini (2009) explains further that in the Post-1994 system, it has become possible for teachers to do whatever they like. The prohibition or ban by teacher unions on subject advisors from visiting classrooms resulted in some teachers no longer bothering to prepare lesson plans (Bantwini, 2009). It seems that the banning practice affected even school-based

authoritative figures, such as HoDs, to the extent that they became reluctant to monitor lesson plans. It seems that some teachers realised that this loophole existed and decided to use it for their own advantage.

In short, a well-designed practical task lesson incorporates all the necessary aspects, which include the theme, the goals to be achieved, the resources for the achievement of the set goal, and the methods and steps for carrying out the task (Millar, 2004). Millar (2004) further highlights that a practical task lesson plan needs to indicate the appropriate strategies to be employed, i.e. showing whether the activity is to be done by an individual or a group of learners (Millar, 2004), otherwise it is unclear how the activity is planned to unfold. A lesson plan is succeeded by the implementation thereof.

## **2.5 Implementation of practical tasks**

In South Africa, there is still a lot of work required in curriculum implementation (Rogan & Grayson, 2003). The reason is that implementation of visionary and educationally sound ideas embedded in the policy documents, often proves to be a slow and hard process (Rogan & Grayson, 2003). Once curriculum implementation becomes slow and difficult, it obviously affects the development of scientific skills in learners.

Schools often take the importance of practical tasks for granted (Barber, et al. 2011). Moreover, Barber et al. (2011:27) argue that the way practical tasks are treated makes it is hard to answer questions such as, “What is the purpose of this practical?” or “What is the purpose of practical work in Science lessons in general?” Millar (2004) attempted to answer questions such as these sometime ago. According to Millar (2004:8), the main business of practical work in the teaching and learning of NS is to assist the learners make links between what he refers to as two “domains of knowledge: the domain of objects and observable properties and events on the one hand, and the domain of ideas” on the other hand, as represented in figure 2.1.

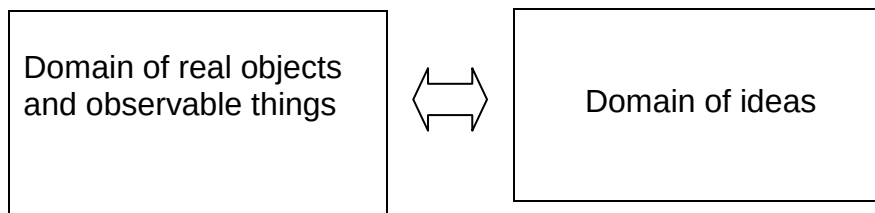


**Figure 2.1: Practical work: linking two domains of knowledge (Millar, 2004)**

The suggestion here is that objects need to be presented to the learners, especially during practical sessions, in order to draw their attention to a phenomenon, to isolate and scrutinise the different parts of it, and finally communicate to show how the learners think about these objects (Millar, 2004). The intention is to develop connection between an observation and a way of thinking about it, and also the link between the world and a mental representation of the world. Perhaps this is why the literature defines practical tasks in a way that associates it with activities that often take place in a laboratory (Barber, et al. 2011).

Practical work is not restricted to a single environment like a laboratory. Millar (2004:2) explains that practical task integration is not confined to a school laboratory with sophisticated apparatus, but it also occurs in a classroom or in “an out-of school setting”. Van der Valk and de Jong (2009) support the point raised by Millar as, for example, a learner may carry out practical task demonstrations at home or in the field studying aspects of biology (Millar, 2004). Still, the literature shows that some primary school teachers are often quite reluctant to use the outdoors as a teaching environment for science practical tasks (Lindemann-Matties, et al. 2009). According to Lindemann-Matties et al. (2009), this behaviour is reinforced by a lack of confidence in doing science.

In the US, the DoE (2009) values the importance of using resources during practical work in teaching and learning. However, Hattingh et al. (2007) disagree that the undertaking of practical tasks depends solely on the availability of physical resources like scientific apparatus, and a laboratory. In short, they do not value resources as absolutely essential. To cement their argument, Hattingh et al. (2007) argue that the availability of resources without other supportive interventions produces minimal outcomes. Simply put, this means that even if the resources are available, if the

teacher is not capable of using them, the learners may not develop skills. I strongly agree with this taking into account the study conducted by Rogan and Aldous in Mpumalanga. Rogan and Aldous (2005) discovered that almost all the schools which participated in their study had some scientific apparatus and other schools even had well-equipped laboratories, yet, they found that in some cases, the apparatus had not yet been unpacked or used since being received at certain schools. Surprisingly, some of the interviewed teachers often blamed a lack of apparatus and laboratories as a stumbling block towards doing more practical tasks. This raises the question whether the lack of resources really is a stumbling block.

Furthermore, the literature shows that learners develop scientific skills much better when they are actively involved in an activity (Michael, 2007). In fact, learners need to be fully engaged in activities that involve their minds and hands in a real-world setting (Maree & Fraser, 2008; du Toit, et al. 2008). The responsibility of the teacher is to provide guidance by showing the learners how to handle equipment, how to interpret data as well as how to reach conclusions based on the activities done (Millar, 2004; Van der Valk & de Jong, 2009). Fisher (2003) warns that the guidance the teacher gives should not lead to obvious solutions or expectations.

There are serious challenges faced by teachers in the implementation of practical tasks in general apart from a lack of resources. One challenge is that most teachers are forced through uncontrollable circumstances to teach science even though they are not science specialists themselves (Akerson & Hanuscin, 2007). Sometimes, such science teachers never had any kind of hands-on experience in science teaching when they were still at teacher training or when they were at school themselves (Rogan & Aldous, 2005). In most cases, when non-science specialist teachers or teachers inexperienced in terms of hands-on science teaching attempt to teach science practical tasks, they end up perpetuating the kind of science teaching they themselves experienced at school and during their teacher training (Rogan & Aldous, 2005).

Insufficient time devoted to practical task implementation surfaces as another challenge alongside inexperience (Lindemann-Matties, et al. 2009). Realistically, some practical activities demand more time for execution (Barber, et al. 2011).

Therefore, the allocation of a short period of time for doing such practical activities may prevent some activities from happening or may cause activities to happen at a faster rate, which makes it difficult for the learners to get enough practice (Frost, 2010). Again, teachers opt for time-saving short cuts to learning once they realise that the time to do a particular practical exercise is limited (Barber, et al. 2011), for example, the findings of an investigation conducted by Olitsky (2007) indicate that teachers could not visit every group of learners during practical activities due to time constraints. Consequently, learners end up being restricted from learning more important skills (Lindemann-Matties, et al. 2009). Barber et al. (2011) consider time planning as an important aspect for the effective implementation of practical tasks.

In contrast, the performance in schools which offer adequate time for science teaching and learning is better than those who did not. A good example is Russia, which devotes a lot of time to science work ranging from sixteen to fifty-four hours per week in different semesters (Rybakova, 2008). The learners, therefore, have ample opportunities to practise different essential skills necessary for independent research (Rybakova, 2008).

Above all, the development of strategies to ensure perennial quality and the effective implementation of practical tasks is a necessity (Frost, 2010). However, Barber et al. (2011) warn that development of effective strategies for the smooth implementation of practical tasks, as one way to ensure full implementation of the NS curriculum, may often be encountered as a challenge by different schools. Frost (2010) suggests some appropriate strategies for skills development in learners, which include the teacher presenting with confidence; assurance of safety for both the teacher and learners; awareness of the possible distraction caused by the equipment; engagement of learners in dialogue about what is happening and finally, taking the class beyond what they can see (Frost, 2010).

Apart from the aforementioned strategies, the literature reveals other very important and complementary strategies, such as the division of learners into small and manageable groups of four to five members per group (Millar, 2004; Shaha, 2011). Here, each group or group member is given an opportunity to participate actively (Kotze, 2008). Olitsky (2007:35) argues that if the learners are not given a chance to

participate during the practical work process, they end up not feeling “a sense of membership associated with Science”. Ultimately, science will not become a component of their identity and, therefore, the learners will in the future be unlikely to seek out interactions that relate to science (Olitsky, 2007).

Another effective strategy is addressing a limited number of learning objectives rather than multiple objectives at a time (Barber, et al. 2011; Ingram, 2010). However, addressing learning objectives may be problematic if teachers experience difficulties in identifying them (objectives). Usually, when teachers experience difficulties or are unclear about what the learning outcomes for a particular practical activity might be, instead of bothering to find out, they rather opt to substitute a practical lesson with theory (Barber, et al. 2011). The fact is that learners learn better when they know, understand the objectives and also “have a clear vision of the programme they are involved in” (Bantwini, 2009:179).

Finally, the literature shows that the use of concrete tasks or real problems is very important (DoE [US], 2009; Shaha, 2011; Donkor, 2011). However, real problems have to be accompanied by precise instructions about what the learners are supposed to do (Donkor, 2011). To communicate or explain to the learners what they have to do may help them to think objectively and understand real problems much better (Le Grange, 2008; Shaha, 2011). In other words, the teacher has to explain to learners why a particular activity is going to be done, what it is that learners are expected to discover and also the techniques needed to look deeper into the phenomenon. According to Millar (2004:13), explanation not only makes the learners feel that they understand the question and how the equipment they have to use operates, but more importantly, it makes the learners more effectively “minds-on” as well as “hands-on”. This means that learners completely attend to the task mentally and physically.

The literature indicates instances where practical work is avoided altogether (Cheung & Yip, 2004; Millar, 2004; Rogan, 2004). In Hong Kong, a report from the Teacher Assessment Scheme (TAS) supervisors for the ‘Advance Level Chemistry’ indicates that “a number of teachers stopped organising practical work for students well before the academic year ended”, whereas some teachers went to the extent

that they did not even organise any preparative experiments throughout the two year course (Cheung & Yip, 2004:154). Similarly, in South Africa, the results of a study conducted by Rogan (2004) in nine secondary schools in Mpumalanga show, in terms of practical tasks, that most of the schools did not even engage in the lowest level of practice. Also, in the Eastern Cape Province, a survey was conducted in 1998 in rural Grade 7-12 schools and the results indicate that teachers did not bother to do science practical tasks given that there was a deficiency of scientific apparatus (Muwanga-Zake, 2009). Apart from a lack of apparatus, once teachers realise that they are unclear about the learning outcomes for a particular practical activity, they are easily tempted to quickly search for “time-saving short cuts” which often culminate in the substitution of practical lessons with theory lessons (Barber, et al. 2011:27). Interestingly, not all schools avoid practical task implementation. The literature reveals that certain schools throughout the world attempt to do it, despite the fact that some schools seem to operate under severe circumstances such as a lack of appropriate resources.

In South Africa, for example, a study that Rogan (2004:174) conducted in twelve Mpumalanga primary and secondary schools during 2002 showed that the “doing of science”, that is practical tasks were attempted, but were often low in standard and did not even go beyond observation and simple measurement. Also, Hattingh et al. (2005) confirm what Rogan finds regarding practical activities in schools in the Mpumalanga Province not being administered the way in which meaningful hands-on practical work is anticipated to be carried out. Lastly, Fraser and Maguvhe (2008) conducted a study of blind and visually impaired learners in South African at eleven special schools to find out how science developmental process skills in outcomes-based classrooms take place. The results of that study show that the kind of practical activities done were confined to very simple and elementary exercises that provided little intellectual challenge and did not call for advanced problem-solving skills (Fraser & Maguvhe, 2008). These cases show that indeed some schools attempt to implement science practical tasks despite challenging conditions.

According to Hattingh et al. (2005), learners are rarely involved in meaningful hands-on practical work. Basically, the findings of part of the Mpumalanga Secondary Science Initiative (MSSI) project show that the only type of practical work which

might be taking place is teacher demonstrations while the learners just observe what they (teachers) do (Hattingh, et al. 2005; Hattingh, et al. 2007; Rogan & Aldous, 2005). In summary, the literature shows that many South African so called science classrooms, particularly in rural areas, are characterised by the “conservative teaching method” (Maree, et al. 2006:239), often referred to as the “chalk –and –talk” approach to teaching (Aldridge, Laugksch, Seopa & Fraser, 2006:59). The disadvantage of this type of practice is often a lack of learner performance improvement resulting from poor alignment between the intended and the implemented curriculum (Lelliot, et al. 2009).

South Africa is not the only country experiencing this type of a problem. In the Netherlands it has also been found that teachers sometimes apply “a cookbook” approach to teaching science practical tasks (Van der Valk & de Jong, 2009:831). Normally an approach of this nature allows learners to follow instructions, sometimes without even understanding or using the chance to rethink the purpose of the skills they have been taught previously (Van der Valk & de Jong, 2009). Akerson and Hanuscin (2007) discourage the use of cookbook activities since they do not promote effective science teaching and learning.

In some countries, practical tasks play a pivotal role in the teaching and learning of science (Abrahams & Saglam, 2010), England is a good example. A study conducted in secondary schools in England and Wales on the views of teachers towards the use of practical tasks reveals performance improvement in science and especially in practical work (Abrahams & Saglam, 2010). According to the research findings, an improvement in learners’ practical work performance was influenced by teachers’ development of a positive attitude towards science (Abrahams & Saglam, 2010). In addition to contributions made by positive attitude development, considerable time and money is spent on teaching science through practical work (Abrahams & Saglam, 2010).

Additionally, in the UK there is the programme called the Triple Science Support Programme (TSSP) which is delivered by the Learning Skills Network (LSN) on behalf of the government’s Department of Education (Barber, et al. 2011). The purpose of the programme is to help schools, managers and teachers to improve the

effectiveness of the practical science that they offer. What I noticed as very important about this programme is the fact that the UK science teachers have the opportunity to comment on the way they teach practical work, which could possibly allow positive intervention strategies to take place. According to Barber et al. (2011), ever since the programme started in 2007 there is an improvement in terms of practical tasks teaching and skills development in learners. Again, there is development of positive attitudes towards practical tasks teaching and learning.

Although practical work integration takes place in some countries, the literature reveals certain fallibilities accompanying its implementation. Noticeable aspects in this regard include teachers' memorisation of science content or cookbook activities engagement (Akerson & Hanuscin 2007; Maree, et al. 2006; Van der Valk & de Jong, 2009). Practice of this type led Hume and Coll (2008:1202) to suggest that "practical work in school science bears little resemblance to inquiry as practised by scientists".

Ismailov (2010:4) suggests that the quality of the NS teaching has to be improved on all levels in order to address serious problems like "global warming and the shortage of energy resources". Therefore, practical tasks, being an essential component, should be improved to raise the quality of science education. To improve practical tasks, the professional development of teachers is essential.

## **2.6 Professional development**

Educational transformation in South Africa caused the nature of the introduced curriculum and contexts in which teaching and learning operate to demand "shaping and reshaping of teacher roles, functions and responsibilities" (Lelliott, et al. 2009:55). These roles include practical tasks and should therefore be scrutinized to understand the demands on science teachers. A review of practical tasks integration is driven by the fact that traditional educational approaches usually fail to recognise the characteristics of 21<sup>st</sup> century learners, let alone addressing the educational needs of the new society in which they live (Can Sahin, 2009). Therefore, it is proper to review the activities of teachers because they are the implementers of the curriculum (Hattingh, et al. 2005).

Professional development of science teachers is indispensable (Akerson & Hanuscin, 2007). According to Van der Valk and de Jong (2009), the route to abandoning or minimising the traditional practice of teaching science is to equip teachers with sufficient knowledge of new curriculum contents and methods. In the Netherlands “a school-based professional development trajectory (PDT)” was developed with the intention of helping teachers to learn how to give “students space as well as structure” (Van der Valk & de Jong 2009:830), the same applies to England. In 2010, England introduced a science programme called About Getting Practical-Improving practical work, which offers free local Continuing Professional Development (CPD), particularly to science teachers based at both primary and secondary schools so that they “deliver a wider range of high-quality practical work that they teach” (Barber, et al. 2011:27).

Later the effectiveness of the programme was checked through conducting a study in schools from the London boroughs of Tower Hamlets and Greenwich (Barber, et al. 2011). The results were positive: teachers were “very reflective and were able to see how, by focusing on improving the clarity of the learning outcomes when doing practical work, they could enhance” the way the learners learn science (Barber, et al. 2011:32). Possibly, the behaviour of teachers changes once they (teachers) are exposed to professional developmental programmes (Walczyk, Ramsey & Zha, 2007). According to Walczyk et al. (2007) teachers then begin to consult sources of instructional innovation and that may help to improve the quality of NS teaching.

In South Africa, professional development programmes have been initiated, such as the Continuing Professional Teachers Development (CPTD) programme, which is managed by the South African Council for Educators (SACE) through the mandate of the National Policy Framework on Teacher Education and Development (NPFTED) of 2007, and the National Planning Commission’s (NPC) National Development Plan released in August 2012. The aim of this programme, *inter alia*, is to ensure that all professional development programmes contribute more effectively and directly to the improvement of teaching and learning. Although many of the programmes introduced by the South African government are not meant specifically to develop science practical work teaching like the one in England, they however contribute significantly in promoting science teaching. The creation of the Ministry of Science, Technology

and Culture, which declared 1998 and 2000 as years of science and technology, serves as a good example (Muwanga-Zake, 2009). Furthermore, the government established science centres, for example the Giyani Science Centre in the Limpopo Province, and the Johannesburg Science Centre in the Gauteng Province, which allow schools to visit and access science services free of charge.

Indeed, in as far as science practical work is concerned in South Africa, there are enormous gaps to be filled (Rogan, 2004). However, the filling of gaps is done in conjunction with assessment.

## **2.7 Practical tasks assessment**

In general, assessment is a vehicle or mechanism for the realisation of educational improvement (Van Aswegen & Dreyer, 2007). In this study, practical task assessment is considered as a process of gathering information about the development of scientific skills in learners (DoE, 2007a). Therefore, assessment is closely related to the scientific skills taught and learned (Van Aswegen & Dreyer, 2007). Consequently, assessment should become a continuous activity that forms an essential component of science teaching and learning (DoE, 2007a; du Toit et al., 2008; Le Grange, 2008). Being continuous simply means that practical task assessment is not “an end in itself” (Van Aswegen & Dreyer, 2007:26) or an “add-on” activity (Blom, 2008:14). Rather, assessment is meant to be an “on-going” activity (Ornstein & Hunkins, 2004:354).

The main purpose of practical tasks assessment is assurance that learners are well prepared to demonstrate scientific skills (Clough & Olson, 2008). To demonstrate scientific skills properly, first and foremost, demands improvement of the teaching of science practical skills which teachers are expected to teach and assess during the academic year (Van Aswegen & Dreyer, 2007). Improvement of science practical skills teaching contributes greatly towards preparing learners to participate in a society in which science and technology play a significant role (Clough & Olson, 2008). Importantly, assessment helps a teacher to realise the strengths and weaknesses of the teaching approaches that they use (Cheung & Yip, 2004). Simultaneously, assessment helps to convey a legitimate message to learners about

their strengths and weaknesses in the subject matter so that they in turn focus attention on the ability in which they did not do well (Van Aswegen & Dreyer, 2007).

Assessment of practical tasks serves as a catalyst for the enrichment of the science curriculum offered in schools (Cheung & Yip, 2004). Therefore, it is extremely important for science teachers to develop valid and reliable practical task assessment instruments capable of disclosing information about the level of skills development (Michael, 2007). Without doubt, practical task assessment needs careful planning (DoE, 2010b). The task of planning assessment is the responsibility of the teacher (DoE, 2007b; Towndrow, 2008). However, the work of planning can involve the learners as well (Van Aswegen & Dreyer, 2007). On this note, Van Aswegen and Dreyer (2007) argue that learners should have a say in as far as the whole assessment planning process is concerned. According to Woolfolk (2007), the practice of allowing the learners to participate actively in the practical assessment process increases effective learning. The reality is that learners are often excluded in the assessment planning aspect. The results of a study conducted by Van Aswegen and Dreyer (2007), which was aimed to analyse English Second Language (ESL) teacher educators' current assessment, revealed that learners did not have any say or choice in the formulation of assessment criteria and also the types of the anticipated products.

Significantly, the design of practical task assessments should be learner-centred (Fraser & Maguvhe, 2008; Matthews & McKenna, 2005). The implication of this is that when designing an assessment, teachers should take into account the age, sex, and level of language and knowledge of the learners who are supposed to do the task (Matthews & McKenna, 2005). Van Aswegen and Dreyer (2007) support the idea of taking into account the knowledge gained and the skills developed by the learners, that is, the outputs.

The key issue is to take into account the particular goal or objective to be achieved and the techniques that are to be used when planning practical task assessment (Abraham & Saglam, 2010). Consideration of the objective and techniques gives the teacher an advantage to indicate to the learners the skills to be assessed, the resources needed, whether the activity needs group or individual scoring and the

scoring procedure, or the criteria that will be used to evaluate achievement of the skill or final product (DoE, 2007b; Kotze, 2008). However, practical task assessment has disadvantages as well. Matthews and McKenna (2005) point out many loopholes in practical work assessment, including bias and unfairness.

Fundamentally, there are five different types of assessment (DoE, 2007b), however, this study is limited to only two types since they are often used to provide information based on the teaching and learning process. These types, namely formative and summative assessment are discussed separately to avoid confusion and at the same time to help the reader to understand how each operates. Undeniably a relationship exists between formative and summative assessment (Eubanks, 2009), however, more attention is devoted to formative assessment because of the pivotal role it plays throughout the academic year.

### **2.7.1 Formative assessment of practical tasks**

Formative assessment of practical tasks is an activity through which a teacher gathers information about the development of learners' scientific skills on a regular basis (DoE, 2007b). What this means is that formative assessment has the potential to reveal the success of the approaches used and how learners acquire knowledge and skills during the teaching and learning process (Van Aswegen & Dreyer, 2007). Ruiz-Primo and Furtak (2007) affirm that formative assessment is capable of directly enhancing learning because it occurs during practical activities. In support of this, Towndrow (2008) states that formative assessment involves daily tasks whereby learners conduct experiments in support of formal instruction. However, in my understanding, assessment becomes formative when the information collected during the process is in turn utilised to adapt the teaching and learning of scientific skills to meet the needs of the learners. Certainly formative assessment is a source of useful information for teachers to develop scientific skills in learners and to guide learners' future actions and thinking.

Furthermore, formative assessment is divided into two sections namely, informal formative and formal formative assessment (DoE, 2007b). Informal formative assessment provides information concerning how the learners understand and develop skills on a continuous basis (DoE, 2007b; Towndrow, 2008). Usually,

informal formative assessment occurs when the teacher creates an opportunity for the learners to answer questions orally or to demonstrate abilities consistently and in a way that makes information available immediately (Ruiz-Primo & Furtak, 2007).

Apart from oral questions, skills developmental information is instantly gathered through classwork, homework, investigations and small assignment that learners do. Informal formative assessment takes the form of teacher-learners interaction or teacher-small group interaction, or even teacher-learner interaction (Ruiz-Primo & Furtak, 2007). Although informal assessments are not recorded, the responses which the learners provide enable the teacher to interpret and act immediately on the information to support the learning process without interrupting it (DoE, 2007b; Ruiz-Primo & Furtak, 2007). The advantage is that the teacher is able to make judgements instantly as to whether learning takes place as planned or not. As a result, a teacher is able to teach the skills which were not well captured again using a different teaching approach (Clough & Olson, 2008).

In contrast, formal formative assessment commences usually when the learners are actively engaged in doing an activity planned previously in order to gather information about learning and teaching in a simple way (Van Aswegen & Dreyer, 2007; Ruiz-Primo & Furtak, 2007). Simply put, an assessment instrument is planned in the form of tests, rubrics or projects. Normally, an assessment of this nature is directed at all the learners or a group of learners at a planned time. The intention is to assess specified skills throughout the teaching and learning process rather than waiting for a specific assessment period, especially the end of year examination period (Le Grange, 2008). Fundamentally, formal formative assessments give the teacher time to step back to analyse and interpret the information at hand (Ruiz-Primo & Furtak, 2007).

Importantly, formal formative assessment is recorded (DoE, 2007b; Maree & Fraser, 2008). Records provide teachers with reliable information to use, especially when determining the competencies or abilities and progress of each learner per school term (DoE, 2007b). Again, records help teachers to identify learning problems. Lastly, when teachers decide on the progression or promotion of learners at the end of the year, they use performance records as a point of reference (DoE, 2007b).

### **2.7.2 Summative practical tasks assessment**

Usually, summative assessment is used for accountability purposes (Eubanks, 2009). In terms of the assessment policy for NS, teachers are supposed to account to diverse stakeholders, for example a school management team, parents, the Department of Education and to the learners regarding performance (DoE, 2007a). However, in as far as practical tasks assessment is concerned, the teachers account to the school management team and to the learners. Basically, summative assessment is administered to determine the progression of learners, for example, from one grade to another or retention of the learners in a grade (DoE, 2007a). However, in countries like Hong Kong (HK) and the United Kingdom (UK), school-based assessment of practical tasks is used to supplement and complement written examinations (Van Aswegen & Dreyer; 2007; Cheung & Yip, 2004). Therefore, it is imperative to conduct a summative assessment. Usually this type of assessment takes place after a long period of time, for example, during the middle of the last school term or quarter, or at the end of a programme almost yearly (DoE, 2007b; Le Grange, 2008).

## **2.8 Practical tasks assessment internationally**

This section presents a discussion of how practical tasks are assessed in diverse countries.

### **2.8.1 Practical tasks assessment in South Africa**

Du Toit et al. (2008), as well as Maree and Fraser (2008) report that the assessment of scientific knowledge and skills development were conducted in similar ways after the introduction of OBE in South Africa. This statement suggests that there was no distinction between assessment of scientific knowledge acquisition and assessment of scientific skills development in learners, which is plausible when compared with what the literature indicates about practical task assessment, especially during the Pre-1994 education system in South Africa. The literature shows that practical tasks learning was assessed mainly through pencil-and paper classroom tests and examinations or standardised tests and examinations (Blom, 2008; du Toit, et al. 2008; Le Grange, 2007).

Emphasis was given to scientific knowledge mastery rather than the ability to demonstrate skills (Hattingh, et al. 2005). The teachers expected learners to demonstrate evidence of knowledge mastery by way of recalling or regurgitating scientific concepts in tests and examinations (Hattingh, et al. 2005). The statistical evidence was used for selection, ranking, grading, sorting and certification of learners rather than to support teaching and learning (Maree & Fraser, 2008; Wa Kivilu, 2004).

With the introduction of C2005, which was outcomes driven, the focus shifted from what it used to be to what learners can do with their acquired scientific knowledge and skills (Clough & Olson, 2008). The emphasis shifted from content mastery to demonstration of potentials or abilities in a real-life situation. The shifting of focus necessitated the transformation of assessment policy. Although C2005 was later changed to the RNCS, which shortly became known as the NCS, the focus on ability to apply the developed scientific skills in a real-life context remained unchanged. Even after an amendment of the NCS into CAPS, scientific skills development and application remained a focal point.

The assessment policy for NS regarded assessment as an integral component of teaching and learning (DoE, 2007b; du Toit, et al. 2008; Van Aswegen & Dreyer, 2007). Additionally, the policy expected the NS teachers to assess and evaluate scientific skills in the learners on a regular basis (du Toit, et al. 2008; Le Grange, 2008), demanding at least one formal practical task assessment per quarter during the academic year (DoE, 2007b).

Practical skills development should be assessed differently from the way knowledge acquisition is assessed. According to the DoE (2007b) and Le Grange (2008), development of practical skills is better assessed while a learner(s) is freely creating, producing and doing something, for instance an experiment by himself or herself in a real context, rather than when recalling information (DoE, 2007b; Le Grange, 2008). On this note, Le Grange (2008:172) highlights that teachers should conduct a “direct observation of learners’ practical abilities”. The indication is that teachers have to observe and rate or allocate a score(s) while a learner(s) is busy performing or demonstrating a particular skill in a real-life context. In addition to this, teachers were

expected to assess the end products which the learners were capable of achieving during the academic year (DoE, 2007b).

The literature shows that some NS teachers in South Africa seem to have opted to carry out “business as usual” (Wa Kivilu, 2004:3) whereby tests and examinations which dominated traditional assessment practices still occupy the central stage after the curriculum changes (du Toit, et al. 2008; Maree & Fraser, 2008). Indeed, the use of pencil and paper assessments may still be practiced, but it has been highly criticised (Clough & Olson, 2008). Measuring skills in this manner leads to questions such as the following: Do assessment instruments designed by teachers diagnose the problems learners often encounter when doing science? Do such assessment instruments promote the development of 21<sup>st</sup> century skills?

Nevertheless, teachers are expected to use a variety of appropriate assessment techniques when assessing the development of learners’ skills (DoE, 2007b). These expectations invite several questions, such as: Are Natural Sciences teachers applying different techniques when assessing the development of learners’ skills? Are teachers able to apply a variety of assessment techniques?

### **2.8.2 Practical tasks assessment in other countries**

In the Republic of Ireland, schools’ development of scientific practical skills was assessed through written papers in the Learning Certificate examination in the past (Bennett, 2001; Matthews & McKenna, 2005). There were many challenges, for example, failure to yield high quality results, dropping numbers of learners choosing to learn physics and chemistry, as well as teachers turning their attention to minimum skills and techniques that are often repeated in the practical examinations. Consequently, a feasibility study based on practical skills assessment was introduced in the Republic of Ireland (Bennett, 2001; Matthews & McKenna, 2005). The feasibility study entails two systems of practical task assessment, namely, the Chemistry Group and the Physics Group of teachers (Matthews & McKenna, 2005). The responsibility of the Chemistry Group is to assess development of skills related to the doing of chemistry activities, whereas the Physics Group assesses learners based on physics related skills.

In the first place, a practical task assessment is divided into three phases, namely, assessment of practical notebooks, understanding of experimental procedures and generic practical skills (Matthews & McKenna, 2005). To discourage teachers from focusing on minimum skills, which were commonly repeated in the examinations; to promote fairness and the development of high quality skills in learners, the Republic of Ireland introduced a system that involves visiting or external examiners (Matthews & McKenna, 2005). The visiting examiners and the moderators compare and discuss the marks allocated to individual learners to finally reach a consensus. Marks for each activity are recorded separately.

The system of school-based practical task assessment which is used in Hong Kong is more or less similar to the one used in the Republic of Ireland. Hong Kong uses the Teacher Assessment Scheme (TAS) for assessing practical skills on a continuous basis (Cheung & Yip, 2004). Just like in the Republic of Ireland, chemistry teachers are responsible for assessing the development of chemistry related skills at school level during the academic year (Cheung & Yip, 2004). Furthermore, a statistical moderation procedure is used mainly to adjust “internal practical marks against the A level Chemistry theory” which each learner achieved from the external examination conducted (Cheung & Yip, 2004). The findings of the study conducted by Cheung & Yip (2004) indicate that science teachers viewed school-based assessment of learners’ practical skills as much better compared to the external, time-limited practical examinations that learners used to write.

Consequently, a team of consultants from Britain, Australia and Hong Kong, commissioned in 1998 by the Hong Kong Examination and Assessment Authority (HKEAA) to review the operation of TAS in Hong Kong, recommended that TAS should be expanded to the Hong Kong Certification of Education (CE) Examination (Cheung & Yip, 2004). The commission further suggested the inclusion of other internal assessment activities like in-class tests and problem-solving investigations in TAS. Confirming that TAS was performing well, the IBM Corporation, which was tasked afterwards to inquire about the operation of TAS, recommended that it (TAS) has to be extended to cover even non-practical assessment tasks.

Finally, Singapore uses the Science Practical Assessment (SPA), which is school-based (Towndrow, 2008). This strategy is designed to promote understanding of scientific concepts, encourage learners to actively participate in the scientific skills teaching and learning process and also to develop potential skills related to laboratory work (Towndrow, 2008). Therefore, learners are assessed on a daily basis during practical task performance. Singapore introduced the SPA system after realising that the method of measuring the development of scientific skills in learners through “a centralised and externally set, one-time practical assessment”, which normally promotes rote memorisation of actions and procedures, was not yielding the expected fruitful outcomes (Towndrow, 2008:904).

### **2.8.3 Challenges to practical tasks assessment**

The South African national assessment policy for the Natural Sciences addresses issues related to assessment of knowledge and skills in general. It seems there is no policy dealing specifically with how practical tasks should be assessed. Unlike in South Africa, in other countries there are educational policies responsible for the enhancement of scientific skills development by way of learning hands-on activities and important skills related to laboratory investigations (Towndrow, 2008), for example, there is SPA in Singapore and TAS in Hong Kong.

However, this does not mean that in these countries tests and examinations have no role to play in practical tasks assessment, tests and examinations still play an essential role. Similarly, tests and examinations still have a role to play in the Post-1994 NS curriculum, that is, in the C2005, RNCS and CAPS. Although they are important, Joffe (1993, as cited in du Toit, et al. 2008) warns that it is not advisable to use them beyond what they are intended for. Can Sahin (2009) argues that 21<sup>st</sup> century assessments have to be used to measure 21<sup>st</sup> century skills.

According to Woolfolk (2007:54), the traditional tests and examinations assess skills that have “no equivalent in the real-world”. The greatest challenge is that written practical tests and examinations show an inability to assess or cover all the essential scientific skills (Blom, 2008; Cheung & Yip, 2004). For instance, Cheung and Yip (2004) argue that written practical tests and examinations are unable to validly assess whether a learner can handle and use scientific equipment in a safe manner,

can observe the colour changes during a titration or can measure accurately by using real apparatus. Such shortcomings support views that tests and examinations sometimes test few skills or competences (Smith, Wood, Coupland, Stephenson, Crawford & Ball, 2010). Conversely, Hattingh et al. (2005) and Torgeson, MacSuzan, Beare and Tanr (2009) criticise the assessment of practical work, especially when it is done through the use of multiple-choice tests and examinations. Therefore, Taylor et al. (2007:1068) hold the belief that centring science education on test scores will eventually cause “more harm than good, as creative and insightful teachers are robbed of their individuality for the sake of schedules, conformity and those dreaded test scores”.

A limitation of the variety of practical tasks is another factor that necessitates written practical tests and examinations criticism (Cheung & Yip, 2004). The literature reveals that teachers tend to confine their practical teaching in schools to a limited number of practical activities, especially those that are usually repeated in tests and examinations (Barber, et al. 2011; Cheung & Yip, 2004; Matthews & McKenna, 2005; Towndrow, 2008). Hong Kong, the Republic of Ireland and Singapore have addressed this problem, but in some parts of South Africa it is still happening irrespective of the fact that the pace-setter clearly prescribes practical tasks. Curriculum coverage is adversely affected since only a few selected practical activities receive attention. A practice of this nature deprives learners of the opportunity to practise and acquire sufficient scientific skills (DoE, 2011). According to Fu-Yun, Yu-Hsin and Tak-Wai (2005), the practising of scientific skills consistently is one of the essential conditions which, when present, almost always facilitates effective learning.

The literature indicates that the best way to assess practical tasks is to use a scoring rubric or a checklist (DoE, 2007b; Kotze, 2008; Moskal, 2003; Van Aswegen & Dreyer, 2007). A rubric is described as a scoring tool for qualitative rating of practical tasks (DoE, 2007b; Jönsson, 2008; Van Aswegen & Dreyer, 2007). Van Aswegen and Dreyer (2007) further compare a rubric with road signs simply because of its capability to make the learners aware of what they already know, what they aspire to know and how to know what they want to know. Additionally, rubrics give the learners an opportunity to assess and correct themselves, assess the work of other

learners and to develop self-confidence (Van Aswegen & Dreyer, 2007). An important question is: Do teachers really use rubrics when assessing development of skills in learners and how often?

A rubric is developed by a teacher or a teacher together with the learners (Moskal, 2003; Van Aswegen & Dreyer, 2007). Moskal (2003) emphasises the discussion of scoring a rubric between the teacher and the learners prior to the administration thereof. The key issue is that the teacher has to indicate in advance whether he or she intends to use holistic or analytical scoring (Jönsson, 2008). In holistic scoring, the teacher uses a single scale to evaluate and make a general judgement of the quality of performance or the product as a whole (Jönsson, 2008). All the dimensions in a given task are assessed collectively or simultaneously. In as far as analytical scoring is concerned, the teacher ascribes a score to each of the dimensions, for instance, cognitive, psychomotor, and effective which are assessed in the activity (Jönsson, 2008).

However, good care is needed when holistic scoring is engaged. Le Grange (2008:172) warns that it is important to balance between direct observation of learners' practical skills and the final product, as a weak correlation in terms of assessments based on products of practical work and assessments based on direct observation of learners' practical abilities often results (Le Grange, 2008). However, assessment based on products of practical work is the most favoured method simply because it saves time. Finally, the results of an assessment need to be produced and given to the individual learner.

## **2.9 Assessment feedback**

Assessment feedback is information received from an administered assessment (Clough & Olson, 2008; DoE, 2010a). During the year, formative assessment is used to yield information about learner performance and the results are communicated to the parents and people in authority (DoE, 2010a). Assessment outcomes reveal to both the teacher and learners part of the work performed well (by learners) and that which still needs further attention (Mwanzia & Miano, 2004). Again, teachers should use assessment outcomes for the further planning of teaching and learning.

Furthermore, Mwanzia and Miano (2004) explain that feedback enhances effective learning and teaching. The implication is that a teacher uses the results and prioritises the next instruction by way of building on what the learners have mastered while simultaneously attempting to close the existing knowledge and skills gaps (Van Aswegen & Dreyer, 2007). Again, a teacher has the responsibility of communicating feedback to the learners who are expected to use the outcomes as a mirror to reflect on their performance (Van Aswegen & Dreyer, 2007). What this means is that feedback on outcomes enables learners to realise any gaps that exist between the knowledge and skills they have currently acquired and what has been set for them to achieve. Furthermore, learners should use feedback to guide them when exploring actions appropriate to achieve set goals.

Therefore, critical feedback is a necessity (Van der Valk & de Jong, 2009). Critical feedback implies that a teacher gives feedback based on the specific areas in which a learner did not perform well. A teacher has to provide specific comments based on the mistakes made and also specific suggestions towards performance improvement. Ideally, positive feedback encourages both the teacher and the learner to move to the next level of learning.

The literature shows that feedback can enhance effective learning if it is accompanied by quick, fair and constructive comments and not just numerical figures (DoE, 2010b; Ruiz-Primo & Furtak, 2007). Usually, teachers use comments which do not give clear directions as to what to do next. For example, teachers often use comments like “Good job” or “well done” (Clymer & Wiliam, 2007:41). Such comments do not improve the performance and understanding of learners (Clymer & Wiliam, 2007) as they are uninformative and not user friendly.

Additionally, the traditional feedback, which is characterised by grades, marks and scores only, is perceived as ineffective because other teachers, including other stakeholders in education, cannot work out exactly what skills learners still need to improve by mere judging of the marks or scores (Clymer & Wiliam, 2007). Even the learners themselves may not guess the skills which are lacking and how to improve the situation by judging numerical figures and closed comments. Explicit explanation of what the results entail, rather than reporting only, is important.

Significantly, feedback can be both constructive and destructive depending on how teachers use it (Clymer & Wiliam, 2007; Ruiz-Primo & Furtak, 2007). The findings of a study conducted by Klyger and Dellisi (1996, cited in Clymer and Wiliam, 2007) found that the type of feedback that focuses on task rather than on the person contributed greatly towards the performance of learners. In a study conducted by Clymer and Wiliam (2007) in which teachers made constructive comments on the feedback, there was high performance improvement.

Feedback is a fundamental tool and it can be more effective if supplemented by constructive comments (Clymer & Wiliam, 2007). Furthermore, feedback is accompanied by recording as learner performance should be recorded or documented for use when necessary.

## **2.10 Theoretical framework**

A theoretical framework is the lens through which a researcher can see, understand, analyse and interpret a situation according to a predetermined scheme of linked constructs (McMillan & Schumacher, 2006). Similarly, Smyth (2004) explains a theoretical framework as a research lens which helps the researcher to better develop an awareness and understanding of the situation under scrutiny and further communicate this to others. To develop an awareness and clear understanding of practical task integration at school level, I then based this study on the theory of curriculum implementation developed by Rogan and Grayson (2003). The theory of curriculum implementation consists of a large number of aspects which collectively contribute towards the NS curriculum implementation, of which practical work forms part of the profile of implementation (Rogan & Aldous, 2005). Although this study is based on the theory of implementation, however, attention is directed much on the profile of implementation. The structure of the framework of Curriculum Implementation is presented in figure 2.2

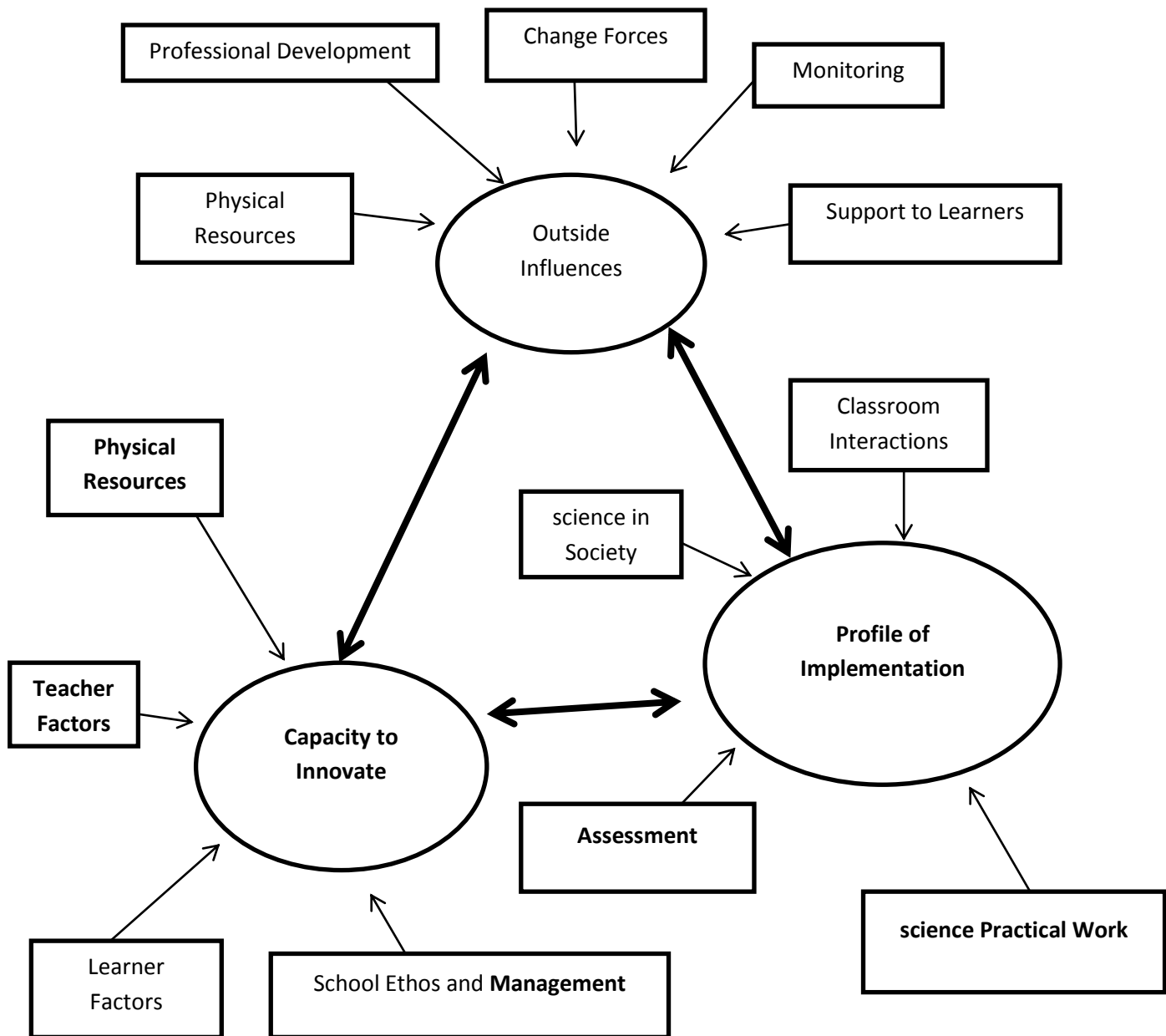


**Figure 2.2: Framework of Curriculum Implementation (Rogan & Grayson, 2003)**

Figure 2.2 shows the constructs of the Curriculum Implementation framework developed by Rogan and Grayson (2003). The Curriculum Implementation theory comprises three major constructs, namely a profile of implementation, capacity to innovate, and outside influences, that is, support from outside agencies. The framework has been successfully used in different studies (Lelliott, et al. 2009; Rogan, 2004; Rogan & Aldous, 2005; Scholtz, Watson & Amosun, 2004). Each one of the three constructs can be used independently to assist in understanding,

analysing and communicating the degree to which the national policy for the Natural Sciences is realistically implemented in South Africa (Rogan, 2004; Rogan & Aldous, 2005; Rogan & Grayson, 2003). Even though the three constructs seem different, in reality they are very much interrelated, and as a result they support each other (Rogan, 2004; Rogan, & Aldous, 2005).

However, two constructs, namely, the profile of implementation and the capacity to innovate are bolded because these constructs relate to what the current study is analysing. To enable the reader to quickly locate, amongst others, the two constructs and the sub-constructs which this study is based on, I decided to put them in bold letters. This action does not mean that the other sub-constructs of the selected constructs are not important in this study; they are very important and not completely separate from the identified sub-constructs. This is because this study is concerned with what they teach and how teachers act when they try to develop learners' scientific skills.

The profile of implementation constitutes the nucleus of this study. The profile of implementation comprises four sub-constructs, namely, the nature of classroom interaction (which is about what teachers and learners do in relation to one another during practical activity demonstrations), science in society (which relates to the application of science in society), science practical work (nature of science practical work) and lastly, assessment practices which are utilised to evaluate the functionality of science (Rogan, 2004; Rogan & Grayson, 2003; Hattingh, et al. 2007). In the current study, the focus is on practical work and assessment because they relate to the main concern of this study, namely to understand how teachers integrate practical tasks when teaching NS.

Fundamentally, the four sub-constructs *per se* are closely related and they support each other (Hattingh, et al. 2007), for example, practical tasks at school level involves activities that are related to everyday life in society; take place in a real life context that usually involves the teacher and learners; and finally, these activities need regular assessment to measure the development level of the skills (Rogan & Aldous, 2005).

The capacity to innovate as well forms an integral component of this study. This construct comprises four sub-constructs, namely physical resources, teacher factors, learner factors and school ethos and management (Rogan, 2004). Since the focus of the study is directed on investigating the integration of practical tasks, the sub-constructs, namely, learner factors and school ethos and management receive less attention in this study. Finally, the construct 'outside influences' is not addressed because the major concern was not to understand how outside factors influence the development of learners' skills. The construct outside influences comprises five sub-constructs: professional development, provision of resources required for innovation, change forces (which in essence relates to types of pressure and support experienced), direct support to the learners within the particular situation, and possible monitoring strategies (Rogan, 2004). However, aspects like physical resources and professional development also contribute to the capacity to innovate.

To maintain and sustain the ultimate aim of understanding the manner in which teachers integrate practical tasks when teaching NS in Grade 7, I decided to artificially separate and discuss the sub-constructs which bear relevant information. Therefore, I put aside the construct of outside influences and other sub-constructs that are not related to this study. This enabled me to confine my study to the sub-construct called science practical work (Rogan & Grayson, 2003; Rogan & Aldous, 2005). To show how practical tasks integration occurs in reality, I coupled the sub-construct with other sub-constructs like assessment, professional development, physical resources, and management borrowed from the sub-construct school ethos and management. Furthermore, each of the four sub-constructs operates at levels of complexity ranging from one to four (Rogan and Grayson, 2003). The levels of science practical work and assessment, shown in table 2.1, played a major role in the data analysis and interpretation.

| Level | Types of science practical work                                                                                                                                                                                                                                                                                                                                                             | Types of assessment                                                                                                                                                                                                                                                  |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | <ul style="list-style-type: none"> <li>➤ Teacher uses classroom demonstration to help develop concepts.</li> <li>➤ Teacher uses specimens found in the local environment to illustrate lessons.</li> </ul>                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>➤ Written tests are given that cover the topic adequately.</li> <li>➤ Tests are marked and returned promptly.</li> </ul>                                                                                                      |
| 2     | <ul style="list-style-type: none"> <li>➤ Teacher uses demonstrations to promote a limited form of inquiry.</li> <li>➤ Some learners assist in planning and performing the demonstrations.</li> <li>➤ Learners communicate data using graphs and tables.</li> </ul>                                                                                                                          | <ul style="list-style-type: none"> <li>➤ Questions are based on practical work.</li> </ul>                                                                                                                                                                           |
| 3     | <ul style="list-style-type: none"> <li>➤ Teacher designs practical work in such a way as to encourage learner discovery of information.</li> <li>➤ Learners perform guided discovery type practical work in small groups, engaging in hands-on activities.</li> <li>➤ Learners write a scientific report in which they justify their conclusions in terms of the data collected.</li> </ul> | <ul style="list-style-type: none"> <li>➤ Assessment is based on more than one written test. Other forms of assessment might include: reports on activities undertaken, creation of charts and improvised apparatus; reports on extra reading assignments.</li> </ul> |
| 4     | <ul style="list-style-type: none"> <li>➤ Learners design and do their own open investigations. They reflect on the quality of the design and collected data, and make improvements.</li> <li>➤ Learners can interpret data in support of competing theories or explanations.</li> </ul>                                                                                                     | <ul style="list-style-type: none"> <li>➤ Performance on open investigations and community-based projects are included in the final assessment.</li> <li>➤ Learners create portfolios to represent their best work.</li> </ul>                                        |

**Table 2.1: Four levels of complexity in science practical work and assessment: A classification framework (Rogan & Grayson, 2003).**

The key issue is that the levels are linked to each other (Rogan & Aldous, 2005). However, they gradually introduce an increasing emphasis from level one towards learner-centred approaches (Rogan, 2007). The increasing emphasis clearly indicates the way in which the learning responsibility gradually shifts from teacher-directed to learner-centred, as envisaged in the reformed curricula (DoE, 2011; Hattingh, et al. 2007; Le Grange, 2008; Fraser & Maguvhe, 2008). However, the

levels are not linear or prescriptive (Rogan, 2004; Rogan & Grayson, 2003). What this means is that none of the levels instruct a teacher to do any activity at any given point in time (Rogan, 2007).

All the levels in this table are equally important. They only differ in their degrees of complexity, for example, level 4 practices are more sophisticated than the practices in level one up to three (Hattingh, et al. 2007; Rogan, 2004). A noticeable factor is that level four appears to occupy the highest position in terms of learner involvement in science practical work. The assumption is that the learners who have reached level four are capable of doing practical work independently (Rogan, 2004). Perhaps, this is why Hattingh et al. (2007) consider practices in this level as learner-centred.

Fundamentally, the levels three and four correspond well with the activities and the expected outcomes outlined in the Natural Sciences policy documents, mainly for the Grade 7 learners to perform (DoE, 2007b; 2011). Due to the correspondence of the levels and the outlined practical activities, I therefore applied the levels three and four mostly as guidelines during data analysis.

## **2.11 Summary**

Science practical skills form a critical component of NS teaching and learning (DoE, 2007; 2011; Abrahams & Saglam, 2010; Shaha, 2011). The literature highlights that effective scientific skills development in learners is possible on the condition that lesson planning is taken care of; and that learners are fully engaged in activities requiring manipulation of apparatus and advance problem-solving in a real-life situation (Barber, et al. 2011; du Toit, et al. 2008; Fisher, 2003; Fraser & Maguvhe, 2008; Maree & Fraser, 2008; Taylor, et al. 2008).

Additionally, presentation of practical tasks demands that enough time be devoted to it (Frost, 2010; Barber, et al. 2011)). Frost (2010) argues that the allocation of short periods of time for doing such practical activities may prevent some activities from happening or may cause activities to happen at a faster speed whereby it becomes difficult for the learners to get enough practice (Frost, 2010). According to Barber et al. (2011), teachers opt for time-saving short cuts to learning once they realise that the time to do a particular practical exercise is limited.

The literature reveals that practical skills development in learners demands regular assessment and quick constructive feedback (Clough & Olson, 2008; DoE, 2007b; 2010a; du Toit, et al. 2008; Le Grange, 2008; Van Aswegen & Dreyer, 2007). To achieve the potential of administering effective implementation of science practical tasks, assessment and feedback, teachers have to be consistently exposed to capacity building programmes (Van der Valk & de Jong, 2009). The issue of capacity building is reflected in the profile of implementation which underpins the study (Rogan & Grayson, 2003).

It should be noted that the implementation of the new curriculum is not what one may consider as an “all-or-nothing” proposition (Rogan, 2007:99). The implication is that it is not always possible to correctly implement all the changes or any at all. According to Fullan (1991, cited in Rogan 2007) practicability of curriculum implementation depends on the presence of the next step. The indication is that success in practical tasks implementation depends on outside influences and also capacity to innovate. This belief of dependence on the next step is clearly illustrated in the theoretical framework which underpins the study. Finally, the subsequent research methodology chapter indicates the procedures that were followed when collecting data about practical task integration in the teaching of the NS.

## CHAPTER 3

### THE RESEARCH DESIGN AND METHODOLOGY

#### 3.1 Introduction

In Section 3.2 of this chapter, I provide a full explanation of the meta-theoretical and methodological paradigm, the application of which I found suitable to conduct a successful investigation. Not only do I provide the paradigm upon which the study rests, but the research design used in this study is also provided under Section 3.3. Furthermore, Section 3.4 provides the strategy of inquiry. I also provide a description of the sampling procedures that were followed when selecting the research sites and the participants in the study. Section 3.5 provides the data collection methods appropriate for carrying out the investigation, as well as an indication of the strengths and weaknesses of each research method. In Section 3.6, I describe the procedures followed when analysing the collected data. In Section 3.7, I present the methodological norms which were used to justify the trustworthiness of the study, while in Section 3.8 the reflexivity of this study is presented. In support of the methodological norms, I provide the ethical considerations in Section 3.9, after which I then close the chapter with the limitations of the study followed by the summary in Sections 3.10 and 3.11 respectively.

#### 3.2 Meta-theoretical paradigm: Interpretivism

Since this study is based on the integration of practical tasks, I therefore needed to understand what teachers actually do in reality and how they do what they do to ensure quality development of practical skills in their learners. For this reason, I chose to conduct the investigation from an interpretive perspective. The interpretive paradigm is viewed as a tradition that seeks to “understand the meaning of human experiences” (Vivar, McQueen, Whyte & Armayor, 2007:65). Cohen, Manion and Morrison (2007) argue that the meaning of human experiences is better understood when the words and actions of the participants are taken into account. The integration of practical tasks involves actions (doing) and words (both written and verbal). Moreover, the participants used words when responding to the questions

about integration. Therefore, I found the interpretive paradigm fit to use in this study simply because it allowed me to observe the actions and also to listen to what the participants had to say about practical task integration. It is undeniable that to successfully trace and find out what the participants actually did or have done to integrate practical tasks when teaching Natural Science (NS) demanded an understanding of the words and actions that were involved in the process. Without understanding these words and observing the teachers' actions as they unfolded, perhaps it would have been difficult or impossible to interpret how the development of process skills in the learners of the chosen Grade 7 classes was accomplished.

The participants used written words when implementing the curriculum. In fact, the documents passed down from the national Department of Education to school level are in a written form. In this case, the lesson plans served as good examples of such school-based documents, meanwhile the Natural Science (NS) curriculum policies and the pace-setters served as good examples of the national and the provincial documents that were provided to schools in a written form. Again, the participants used words to give instructions and guidance to the learners during the integration process and also to respond to the interview questions, for example. Additionally, the demonstration of practical tasks involves actions; naturally, there is no way in which practical tasks could be demonstrated without involving actions of some sort. The combination of words and actions therefore results in the development of process skills in learners. Therefore, observing the actions performed during the demonstration processes, analysing the available documents and interviewing the teachers gave me a better understanding of how integration happens in reality in the classroom.

After comparing the argument raised in the first paragraph with the aim of this study, I became convinced that the route to understanding how process skills are developed in learners is through taking the words into account and at the same time observing the actions that occurred throughout the integration process. Therefore, I chose the interpretive paradigm as the lens through which to understand how integration unfolds in general. However, meaningful understanding of words and actions depends on what the researcher identifies as the focal point towards which he will direct all of his efforts. This is feasible when a single issue is targeted in order

to unearth its reality. Since the aim in this study was to find out and understand how process skills were developed in learners, I therefore focused more on what actually transpired in the integration of science practical tasks. In general, the intention was to establish reality through interpreting the process skills practices.

The accessibility of words and actions was indispensable in this study and required the use of proper strategies. In this study, I used limitation as my first strategy to reduce the number of the participants as this enabled me to focus on the richness and depth of the data. Then I organised the investigation into a small and manageable number of four participants (three participants withdrew their participation). Limitation was used as a strategy so that I would have ample time to regularly interact and also manage the interaction process with the participants. This helped me to obtain trustworthy responses to the research questions. Constructing a quality picture that truly reflected process skills development in the first level of the senior phase while taking into account the complex questions which the study aimed to address (Bassey, 1999) was a challenge.

The second strategy, interaction, was informed by the limitation strategy discussed above. The interaction strategy enabled me to get close to the participants and access the words and actions that I might not have been able to access from a remote position. McMillan and Schumacher (2006) explain that the interaction strategy gives the researcher an advantage to interact with each of the sampled participants at close range. However, when opting for the interaction strategy, I took into account the interpretivist argument that emphasises symbolic interactions (Shacklock & Smyth, 1998). In support, Cohen et al. (2007:21) consider interaction of this nature as to see “inside the person and to understand from within”. To understand the participants from within, I opted to work as closely to the participants as possible. At the same time, I had to do whatever was required to enable the participants to freely present whatever related to the development of process skills in their learners as the idea was to create a productive situation. By creating a functional situation, I wanted to capture the rich data provided by the participants and then work through the collected data.

Furthermore, the interaction strategy resulted in the establishment of a powerful relationship between myself as the researcher and the participants. Cohen et al. (2007) explain that the interaction between the researcher and the participants results in the creation and promotion of social life on a continuous basis. Significantly, the meetings that I held with the participants enabled us to get together, get to know each other, socialise and share views on the NS process skills integration on a continuing basis. Fundamentally, the interaction yielded fruitful outcomes in the sense that I succeeded in gathering the data that I was looking for. Additionally, I managed to explore, diagnose, understand and generate answers out of the words and actions used during the integration process.

However, the crucial role which time played in the study cannot be undermined. A lot of time was needed, especially when collecting data and finally building actions and words into a reliable picture. This could have been the case due to the fact that the interpretive paradigm is non-statistical (Venter, Higgs, Jeevanantham, Letseka & Mays, 2007). On that note, I prepared myself from the beginning to spend an adequate amount of time reading through the documents, observing and listening closely to what the participants said or actions they performed to integrate practical tasks into a real life situation. To succeed in doing this, I had to frequent the research site more than once, and again, I had to spend a reasonable amount of time dealing with data collection, transcription of recorded voices into texts, triangulating as well as analysing and interpreting the research findings. I spent time attempting to paint a picture in a written form.

### **3.3 Methodological paradigm**

In this section, I present the discussion on how I investigated the manner in which teachers integrated practical tasks into their strategy to teach NS to Grade 7 learners. I based my study on a qualitative paradigm.

#### **3.3.1 Qualitative research**

In this study, I used a qualitative approach. A qualitative approach allows the researcher to focus on the actions performed, as well as to read and listen to the words in all of their complexity as they occur in a natural setting or in a real-life

context (Leedy & Ormrod, 2001). Therefore, a qualitative approach gave me an opportunity to be in close proximity and have direct contact with the participants, particularly during lesson observations and interviews. In relation to the interpretivism paradigm, qualitative research emphasises the dynamic, holistic and individual aspects of human experiences and endeavours to capture the very same aspects in their entirety, taking into account the environment of the participants (Silverman, 2000).

Both the interpretive paradigm and the qualitative approach highly value the importance of words and actions in research. As the researcher, in order to analyse whether the participants properly designed practical task lessons, and implemented and assessed accordingly, I had to take into account their words and closely observe the actions applied during the process. Understanding the words and actions as the core component of this study enabled me to provide a concrete answer to the research questions.

Essentially, I deeply inquired into the research setting and obtained an “in-depth understanding” of the way integration is done and why the participants opted to implement it in a certain way (Gay & Airasian, 2003:13). Of course, the principal notion was not just to listen to their articulation of words and to observe the actions of the participants and that of the learners; rather, my responsibility was to conduct the inquiry “in a subjective biased manner”, and to analyse and interpret the words and actions so that I could establish a trustworthy picture based on the findings (Creswell, 2005:39). Ideally, the intention was to establish how the participants prepared the foundation for science teaching and learning in the Further Education and Training band through the integration of practical tasks as an important component of the curriculum. The picture painted in this study is a true reflection of how the participants integrated process skills in a real-life context.

However, this final research product was driven by a variety of methods such as observations; semi-structured interviews; document analysis and the use of a research diary to gather the data. Unfortunately, it is highly impossible to apply all of the preceding methods simultaneously, therefore, I had to visit the research site on several occasions, using different methods, to collect data, which would bear a

detailed description of what the participants said and practiced where integration is concerned. Thereafter, I transcribed the data. Finally, as a qualitative researcher, I applied inductive reasoning when working with the collected data (McMillan & Schumacher, 2006). This means that I worked through what transpired at the research site, analysed, interpreted and finally painted an absolute picture from developing and reconstructing the data collected through diverse methods.

In summary, the interpretive paradigm and qualitative approach are concerned with words and actions. Both the paradigm and the approach used in this study provided double advantages to this study: the first advantage was that it gave the researcher an opportunity to access words and observe actions at a very close range. The final product, which was established from a combination of the findings from the observations, document analysis and the interviews, provided the second advantage. Reading and listening to words, supplemented by the observation of demonstrative actions enabled me to provide a concrete solution as to how the participants realistically integrated practical tasks when implementing the NS curriculum in the first level of the senior phase.

### **3.4 Strategy of inquiry**

There are different kinds of qualitative research designs choose from when conducting an investigation, these include: case study, phenomenological, narrative, ethnography and grounded theory (Leedy & Ormrod, 2001). In this study, I opted to use a case study research design because it relates to the meta-theoretical paradigm and qualitative approach used in this study.

#### **3.4.1 A case study approach**

In this study, I used an evaluative case study. An evaluative case study permits a researcher to focus on a single event in-depth (Bassegy, 1999) and gain insight into the practices carried out (Ghauri, Gronhaug & Kristianslund, 1995). Vivar et al. (2007:65) support the above statement as they view case study research as an “in-depth exploration of a single case or multiple cases”. The decision to give preference to an evaluative case study was influenced by the multiple advantages, namely, the opportunity for the researcher to explore a single event, understand it and describe

the existing reality. In this case, I was able to focus and gain adequate data exclusively on how the participants integrated practical tasks into their strategy for teaching NS to learners in Grade 7.

An evaluative case study requires a reasonable period of time to carry out, in fact, Leedy and Ormrod (2001) argue that researchers use a case study approach because of the abundant time available. Onwuegbuzie and Leech (2007:239) support this argument as they speak of “prolonged engagement”. This simply means that the researcher has enough time to frequent the research environment and consistently interact with the participants. Due to the sufficient time available, I managed to interact frequently with the participants at their respective schools collecting as much data as possible. I planned from the beginning to conduct more than just a “hit and run” visit to the research sites (Cheung & Yip, 2004:167). Thus, I was able to invest a reasonable amount of time investigating and compiling a report on how the participants engaged in practical activities when teaching NS.

Cohen et al. (2007:21) view the presence of a researcher at the research site as an advantage because the researcher is able to construct an explicit understanding of the “subjective world of human experiences”. To get to know and understand the situations and conditions under which the participants practised the integration of practical abilities, I observed their actions as they unfolded in real time, and listened as well as read the official documents the participants used. However, I conducted all the observations as a non-participant observer (Motshegoa, 2006). In other words, I did what Leedy and Ormrod (2001:158) consider as remaining relatively “quiet and inconspicuous” throughout the interactions with the participants, but at the same time I was friendly and approachable. Not only did this strategy require me to stay silent, at the same time it enabled me to avoid interfering in what was happening in the classroom or during the demonstrations and to rather observe and record facts (Cohen et al., 2007). To conduct an in-depth study (Bassey, 1999), I used the direct-observation method, which allows the researcher to collect first-hand information in a natural setting (Leedy & Ormrod, 2001; Ghauri et al. 1995). This was done to realise and understand what the NS documents and the participants said about integration and what the participants actually did to ensure that the curriculum was implemented accordingly.

Another advantage of using an evaluative case study is its openness. An evaluative case study allows the researcher to use diverse data collection methods, which will be disclosed and described in full in section 3.3.3 below. An evaluative case study allowed me to use diverse data collection methods that supplement each other in this study. Through the application of the multiple research methods and through using the (sufficient) time available, I managed to guard against missing essential events and information that collectively contributed towards a better understanding of how practical task integration really unfolds.

Besides the variety of methods, the context in which the events unfolded, that is, the physical environment and social factors that have bearing on the environment added information to an extent that a fully fleshed picture emerged (Leedy & Ormrod, 2001). Bassey (1999) indicates that the case study design is not only used favourably today, but was used by researchers during the 20<sup>th</sup> Century because of its uniqueness and its capacity to help the researcher understand complexity in a particular context.

Even though the case study design is user friendly, it has its shortcomings. Bassey (1999), and Leedy and Ormrod (2001) share a common agreement that the major weakness of the case study design is the difficulty in generalising the results to other similar situations, especially when only a single case is involved. With respect to this precaution, the results in this study are therefore particularised.

### **3.4.2 Sample and sampling procedures**

In this sub-section of the chapter, I present a discussion based on the two samples established and the procedures followed in this investigation. Firstly, I present the school sample, followed by the participant sample.

#### **3.4.2.1 The sampling of schools**

The schools used in this study were purposively sampled. Initially, seven public primary schools were purposefully sampled, although I ended up with only four schools participating due to reasons beyond my control. Before some of the participants (two male and one female) withdrew their participation, the sample

comprised of one previously disadvantaged primary school located in a deep rural settlement, two primary schools situated in one township, one farm primary school very close to a town and three multi-racial urban primary schools located in two different towns. Due to the withdrawal of three of the participants, the sample covered one previously disadvantaged rural primary school, one township primary school, one farm primary school and one multi-racial urban primary school. The sampled schools operated under diverse economical conditions and environments, however, the need to investigate how 21<sup>st</sup> century science process skills were integrated at particular schools remained strong.

I had to constitute the sample considering the common features or characteristics which the schools possibly shared. Silverman (2000) highlights that it is possible to take into account the available features when sampling schools for participation in a research project. Before embarking on the actual task of sampling the participating schools, I carried out a dual- purpose visit of each of the three identified circuits. Firstly, the purpose was to seek permission from the circuit manager to conduct the research within the circuit. The second purpose was to ask the circuit manager to recommend schools within his or her jurisdiction that qualified to participate in the project. After I had explicitly explained the reasons behind the investigation and also the type of schools that I had earmarked for participation, without hesitation, the circuit manager recommended certain schools considering the characteristics or qualities stipulated below. Based on the information from each circuit, I then visited each of the ten schools on the list that I compiled after consultation with the circuit manager. Immediately after I completed visiting the schools and taking notes, I carefully selected the qualifying schools, taking into account the availability of the characteristics which together suggest that the national curriculum implementation occurs in schools accordingly. Eventually, I ended up with the seven best schools out of the list of ten. Three schools were dropped because of sharing or falling within one category, which may be small, medium or big school for instance.

The features or characteristics considered when establishing the sample included:

- **The geographical location.** The geographical factor played a significant role in establishing the sample for this study, the reason being that the financial support given to public schools in South Africa by the post-1994 education

system differs drastically with the manner in which the pre-1994 education system funding took place. Currently, the democratic South African government allocates norms and standards funds on a sliding scale to public schools, irrespective of the geographical situation unlike during the pre-1994 government whereby most of the schools for black people, of which schools in rural areas constituted a great number, were financially poor. A possible lack of resources such as finance and physical facilities may influence teaching and learning at a school in one way or another.

On this note, I tried as much as possible to avoid dominating the study with only one sector, for instance, previously disadvantaged rural schools or urban schools. The intention of this study was to conduct an inclusive research study whereby schools from diverse backgrounds equally stood a chance to participate in this project. This was developed from the realisation that South African public schools have legitimate rights to spend the norms and standards funds on learner support materials available, for example. Therefore, I sampled the diverse schools taking into account that the geographical location no longer served as an absolute barrier to curriculum implementation.

- **The school organisation.** In research, a well organised school is regarded as a symbol of the functionality of management and leadership (Hattingh, et al. 2005). There are, of course, various factors which may be considered when determining the organisation of a school. To ensure that the sampling process was easy and feasible, I considered the cleanliness of the surroundings of the school, control at the main school entrance, the availability of sports grounds, fences, classroom infrastructures, toilets structures, sanitation, directive signs or boards, running or tap water, electricity and a school uniform as my determining factors. The availability of most of the listed items signified the functionality of the school management and leadership and therefore, I had no doubt that the NS curriculum implementation, of which teaching and learning of the scientific process skills constitute the backbone, was taking place effectively.

- **The size of the school.** The learner enrolment for 2013 was used as the determining factor for the selection of the participating schools. Ultimately, big, medium and small schools all qualified for participation in this study. The school size was used to avoid focusing only on schools with high or low enrolment, for example.
- **The school's accessibility.** Furthermore, selection was determined by the school's accessibility. I as the researcher reside far away from some of the schools within the province, therefore I considered this factor bearing in mind that sometimes, as a researcher, I might have been forced to frequent more than one participating school within a limited period of time to conduct field work. I did not want lack of travelling expenses and time constraint to be a barrier to the investigation.

These features serve as the cornerstone of sample selection. The availability of the features or the characteristics discussed above made it seem to me as the researcher that the school management and leadership functioned well. The availability of many of the above mentioned features convinced me that the NS Curriculum implementation was effective.

#### **3.4.2.2 The sampling of teachers**

When selecting the participants, I used purposeful sampling. Purposeful sampling allows a researcher to focus on particular identified aspects. By opting for purposeful sampling, I managed to channel my focus towards selecting the NS teachers in Grade 7 classes only. However, the selection was informed by the availability of certain earmarked characteristics that should have been embodied by each selected teacher. First, the qualifying teacher should have taught NS for more than two years, this implies that teachers from different race groups, gender, school environments and with different teaching qualifications, but who have at least two years teaching experience in NS, were considered for this study (see chapters 3 and 4; and tables 3.1 and 4.1).

In addition to this, a reputational-case was used to construct a more relevant sample. McMillan and Schumacher (2006:319) describe reputational-case as a way of selecting aspects of a particular phenomenon that are “knowledgeable and informative”. However, the reputational-case design was seldom used as some prevailing conditions did not warrant the application of a reputational-case design, for example, at schools D, E and G it was not necessary to consider selecting the participants by reputation since only one teacher was responsible for teaching NS in each school. Rather, the reputational-case design was more effectively implemented when sampling the participants at schools A, B, C and F. Each of the principals at these schools recommended the participants. The principal at School B recommended a teacher who was on sick leave, whereas at School C, the principal recommended the head of the department of science (commonly referred to as the HoD), Teacher C in this regard, to participate. At that time, Teacher C substituted for the class teacher for the sampled class. In fact, there was more than one class and a number of teachers responsible for teaching NS at schools B, C and F. However, the principals opted not to recommend the other available teachers.

Again, a reputational-case design was applied when sampling the participating classes, although only schools A, B, C and F were affected. Sometimes the principals or the participants themselves recommended the classes which qualified for participation, for example, only the classes in which NS is taught in English were recommended, with specific reference to schools B, C and F. In this way, the reputational-case design made important contributions to this study as it made it easy to identify informative participants in a situation such as the one at schools A, B, C and F. Nevertheless, I checked and analysed the performance track record in NS of each individual participant.

Finally, I managed to establish an inclusive sample. In other words, the constructed sample embraced small, medium and big schools. Additionally, the sample had one black female and two white male teachers based in the multi-racial urban schools, two black male teachers from the township schools, one black male teacher from a farm school situated near a town and one black male teacher from a rural school. However, the female participant could not continue participating due to poor health,

whereas two male participants, one from the multi-racial school and another from the township school, decided to withdraw their participation. The table below presents the participants' information.

| Pseudonym for Teacher | Gender | Academic Qualifications                                                                                                                          | Teaching experience | NS Teaching experience in grade 7 | Attended NS workshop |
|-----------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------|----------------------|
| Teacher A             | Male   | SPTD (Specialised in Science Teaching), ACE Diploma, B. Ed (Hons).                                                                               | 11 yrs              | 6 yrs                             | Yes                  |
| Teacher B             | Female | N/A                                                                                                                                              | N/A                 | N/A                               | N/A                  |
| Teacher C             | Male   | A four year Diploma in Education. No science teaching qualification.                                                                             | 23 yrs              | 23 yrs                            | Yes                  |
| Teacher D             | Male   | SPTD, FDE, ACE Diploma in Mathematics Intermediate and Senior Phase, Certificate in FET Mathematics Literacy. No science teaching qualification. | 28 yrs              | 2 yrs                             | Yes                  |
| Teacher E             | Male   | SPTD,(Specialised in Science Teaching) Advance Teacher's Diploma (Educational Guidance), B. Ed (Hons)                                            | 20 yrs              | 3 yrs                             | Yes                  |
| Teacher F             | Male   | N/A                                                                                                                                              | N/A                 | N/A                               | N/A                  |
| Teacher G             | Male   | N/A                                                                                                                                              | N/A                 | N/A                               | N/A                  |

**Table 3.1: Participants' credentials**

Table 3.1 illustrates the pseudonym, gender, qualifications, number of years in the teaching industry, experience in teaching NS to Grade 7 classes and workshop attendance. One important element which deserves mentioning in the table is the unbalanced list of participants: the list is dominated by male teachers. This is not that surprising as the majority of female teachers, particularly in primary schools within the three circuits of education identified for this study, offer educational lessons in the foundation phase, and only a limited number of female teachers who teach Grade 7 teach NS.

In as far as training for the implementation of the National Curriculum Statement (NCS)(new curriculum in South Africa) is concerned, all the selected participants attended short training courses scheduled for 120 minutes per day or sometimes

they attended two day weekend workshops which aimed to alleviate the challenges encountered by teachers when attempting to implement the policy (DoE, 2002).

All the teachers that I approached expressed their interest to participate in the study. None of the participants were forced to sign for membership in this project. After the initial meeting with the selected participants, I visited the schools regularly to establish and strengthen my relationship with the participants as well as the headmasters. Not only did I succeed in building and strengthening these relationships, I familiarised myself with how each school operated.

### **3.5 Data collection methods**

As a qualitative researcher, I opted to apply a variety of research methods and tools in this study (Silverman, 2000). The principal aim was to obtain as much credible and justifiable data as possible about practical task integration. To justify the aim, I used research tools and distinctive data collection methods. The research methods utilised included documents analysis, lesson observations and interviews. In addition to these, I used a research diary to supplement the three data collection methods. In short, to obtain relevant and sufficient data on practical task integration, I used semistructured interviews, lesson observations and document analysis as the principal data collection methods, supported by the research diary, which was used minimally. The decision to apply a variety of methods is influenced by the researcher's beliefs. Venter et al. (2007) hold the belief that proper use of scientific methods is the only path to knowledge acquisition.

The application of a variety of research methods further gave me an advantage to utilise triangulation as my main technique to detect patterns (McMillan & Schumacher, 2006). They also argue that triangulation is one principle of qualitative research which allows a researcher to examine the data in many ways through moving backwards and forwards among codes.

Additionally, I used different research instruments for the smooth application of the three research methods. I used an interview schedule (see appendix D.1), observation schedule (see appendix C, Section A and B) and document analysis

schedule (see appendix A). The digital recorder and video tape were used to capture as much data from the events as possible during the observations and the interviews sessions. Data was collected in a sequential order. Firstly, data was collected from the appropriate documents which the teachers used for teaching NS to their Grade 7 classes. Secondly, data was collected through lesson observations followed by semistructured interviews. Lastly, the research diary was used throughout to capture information which was sometimes not possible to capture through the other three methods mentioned in the preceding paragraphs.

### **3.5.1 Document analysis**

This section presents a discussion on document analysis. Document analysis was the method used in corroboration with lesson observations and semistructured interviews during the data collection. These methods equally contributed towards the findings. By selecting this method, I was well aware that every implementer of the NS Curriculum was bound to have supportive documents such as the policies and lesson plans, as well as the performance recording documents which actually provided evidence about practical task implementation.

Therefore, I categorised the primary sources necessary for the implementation of the curriculum into two groups (see Chapter 4, Tables 4.2 and 4.4). However, the two groups of documents are intertwined and support each other. I reviewed, critically analysed and compared the contents of the documents to yield the anticipated trustworthy information for this study (Ornstein & Hunkins, 2004). The official documents in Table 4.2 were supplied to public schools in South Africa by the Department of Education. McMillan and Schumacher (2006) indicate that documents such as these are abundant in organisations and they are used for external communication. The documents collectively indicated the process skills identified for Grade 7 learners, the time for implementation and the assessment procedures. Table 4.4 includes supplementary documents which the participants had designed taking into account the guideline provided by the departmental documents in Table 4.2. In principle, the participants developed school-based documents, for example, lesson plans, taking into account the NS Curriculum Policies.

However, the data collected from all the documents played a pivotal role throughout the entire study. The intention of focusing attention on the documents in Table 4.4 this time around was simply to gather as much information as possible concerning what the participants actually did to ensure effective process skills development in the Grade 7 learners. Moreover, this strategy of concentrating on the documents in Table 4.4 was fruitful in the sense that it enabled me as the researcher to establish whether the participants kept to the National Curriculum Statement Policy and principles in their integration of practical skills or not.

The data gathered from the collection of the documents contributed significantly to making me aware of, and helping me to understand the practice of process skills development in reality. Even though the documents were recognised as contributory resources in terms of data provision, however, they sometimes bore weaknesses just like other data collection methods. One notable weakness of document analysis is that it may be incomplete, or it may share the researcher's bias (Creswell, 1994). Despite the weaknesses of this method, I found document analysis contributory in the sense that information regarding the specified process skills for the Grade 7 learners, designing of the practical task lesson and assessment of process skills development surfaced. This exercise would have been difficult to execute without documents of this nature. Therefore, the contributions made by document analysis in this study are highly recommended.

The files of the participants ensured that the documents appeared in both the tables as an assurance that the NS Curriculum, the process skills included, received the necessary attention. The documents were necessary for implementing the NS curriculum effectively for the benefit of the Grade 7 learners, and many of the participants kept these essential documents in their files.

### **3.5.2 Lesson observations**

Because I was very much interested in observing what the participants actually did during practical task presentations, I developed an observation schedule (see appendix C). An observation schedule helps to provide a number of categories which a researcher uses to record what he or she observes in reality (Brown & Dowling, 2001). Then I developed an observation schedule which was used in the study

following the guidelines or observation schedule for science practical work as designed by Frost (2010). Through the help of the observation schedule and the video tape, I therefore managed to conduct two practical lesson observations with each participant.

As a researcher, I used a direct observation method to collect data during the demonstration (Leedy & Ormrod, 2001). The principal reason behind the use of the direct observation method was to collect first hand information about practical task integration in a real setting (Ghauri, et al. 1995). However, a qualitative researcher is flexible, which implies that as the researcher, I had the freedom to choose any technique or option available, that is, either to be a non-participant or an active participant. Again, a researcher can act “either as a relative outsider or, as a participant observer” (Leedy & Ormrod, 2001:158). Although I had a variety of options available to use, I found that a non-participatory technique was more suitable for this study (Motshegoa, 2006). This technique enabled me to remain relatively “quiet and inconspicuous” throughout the interactions with the participants, but at the same time I was friendly and approachable (Leedy & Ormrod, 2001:158). This means that I was not actively involved in what the participants and the learners were actually doing, although I was present in the setting. The idea was to allow events to unfold smoothly without any interference and to have an adequate chance to observe and record facts (Cohen, et al. 2007). In short, the idea was to fully observe the classroom procedures and thus was able to gather the data presented in this research study.

### **3.5.3 Semistructured interviews**

I was not only interested in observing what the participants were doing, rather, I was also interested in asking them what they thought about practical tasks integration. Therefore, interviews were conducted to find out what these teachers thought about practical tasks integration (Patton, 1990). Interviews serve a multi-functional purpose, for example, they enable the researcher to actually investigate complex issues thoroughly, they facilitate the personal involvement of the researcher during data gathering and further grant an opportunity to probe, prompt and clarify issues (Brown & Dowling, 2001).

In order to find out what these teachers really thought, I conducted two semistructured interview sessions with each participant (Bassey, 1999; Charles & Mertler, 2002; McMillan & Schumacher, 2006; Silverman, 2000). The semistructured interviews included the orientation and post observation conducted with each of the participants. The orientation interviews lasted approximately 10 minutes with each of the participants. The reason why I conducted the orientation interview for this amount of time was to orientate the participants and myself, explain the nature and purpose of the research as well as ethical considerations of the research process.

However, to accumulate accurate data during the semistructured interviews I therefore placed the entire process squarely under the control of the guideline provided by predetermined interview questions (Ghauri, et al. 1995; Leedy & Ormrod, 2001; McMillan & Schumacher, 2006; Merriam, 2002). This guideline is commonly known as an interview schedule (see appendix D.1 and D.2). Conversely, Creswell (2005:10) views such a guideline as an “interview protocol”. The implication is that one common route has to be followed when interviewing the participants. Simply, I prepared the questions which I intended to use with the participants before interviewing them (Charles & Mertler, 2002). By so doing, I created a guideline for the interviews that prevented participants from veering away from the topic, or simply chatting. The leading questions in this study consisted of seventeen items which all four participants responded to (Appendix D.2). However, this guideline did not prevent me from asking probing questions for more clarity and elaboration, rather, it simultaneously assisted me to minimize bias while collecting data (Ghauri, et al. 1995). Perhaps this is why Bassey (1999) views semistructured interviews as a flexible and productive tool.

A digital-recorder was used as the main instrument for capturing data in the form of responses to semistructured interview questions in each case. The instrument played a pivotal role because through it I managed to capture information immediately and analyse it at a slower pace in my own time without pressure or fear of missing important information or events as they occurred. It was not always possible to use a digital-recorder to capture certain information, for instance, the number of learners who could not attend the lesson. The responses were recorded and were later transcribed and analysed. The aim was to provide a detailed

supplementary description based on (1) the design for practical lessons, (2) the presentation of practical skills in a real-life situation (3) and lastly the assessment of practical skills development in learners.

Consequently, the necessity of sufficient time cannot be overemphasised as a lot of time is needed to collect, transcribe, analyse, construct, reconstruct and finally generate a body of valuable and reliable data that corresponds well with data collected through other research methods. The rationale is that post-observation semistructured interviews are mainly scheduled to obtain accurate data that make significant contributions to answering the research questions (Bassey, 1999; Creswell, 2005; Devlin & Gray, 2007; Vivar, et al. 2007). For that reason, I had to spend approximately one to one and a half hours (60 to 90 minutes) interviewing each participant.

The semistructured interviews were conducted at a convenient time and date for both the participants and myself. A collective agreement was also reached by both the participants and myself before conducting the interviews in the venues which were used. I interviewed Teachers A and E in my car, which was then parked within the premises of the school, Teacher C in his office and Teacher D in the classroom. The classroom was the same one that was used during the lesson observations.

#### **3.5.4 Research diary**

As a qualitative researcher, I used a research diary to record data which contributed to this study, however, it was used minimally in this study. The diary was used to record any information which was impossible to capture through the digital recorder, for example. Here, I refer to pieces of information that kept cropping up unexpectedly from the interviews. The diary was used especially during the first day of my visit to the individual schools. At that point, I succeeded in recording the appearance of each school, the description of each setting, the behaviour of each school principal and participant, as well as what I saw or overheard, particularly during my stay or visit at each diverse school. As I continued to visit each school, unexpected events kept on occurring and the information that was important enough to be recorded in

the diary received attention. I also included my thoughts and feelings about the schools and persons I had contact with in the diary.

### **3.6 Data analysis procedure**

This section presents an analysis of the findings gathered through conducting the semistructured interviews, lesson observations, documents analysis and diary completion. I therefore used a content analysis technique when analysing the collected data (Merriam, 2002). The objective was to obtain descriptive information surrounding practical task integration with specific reference to the few chosen Grade 7 teachers, and further than that, to gain a deeper insight into the subject under inquiry. McMillan and Schumacher (2006) contend that content analysis allows a researcher to actually divide data in each transcript into smaller pieces called segments, incidents or units containing some descriptive meaning.

The data division followed a specific guideline. When analysing the data, I was guided by the sub-constructs of the profile of implementation, which was one construct of the Theory of Curriculum Implementation developed by Rogan and Grayson (2003), as explained explicitly under the theoretical framework section in chapter two of this study. Nevertheless, Leedy and Ormrod (2001:95) argue that data are not “absolute reality” of the phenomenon under investigation, but rather evidence of that reality. In line with this assertion, I therefore analysed the evidence that I collected in order to understand it and to draw a picture of how practical task integration occurs in the NS classroom.

I did not wait until a specific time before commencing with the data analysis (Creswell, 2008). This meant that I actually began analysing the data during data collection. Gay and Airasian (2003:9) view qualitative research data analysis as an on-going process whereby a researcher analyses “data interpretively by synthesizing, categorizing, and organizing data into patterns that produce a descriptive, narrative synthesis”. In this case, the data analysis process continued while at the same time providing me ample opportunity to search for the underlying truth by means of establishing categories, themes and differences from the gathered data (Creswell, 2008).

When analysing data I actually followed the following steps:

**Step 1:** As soon as possible after the observations, I transcribed the data (see appendix C, Section B) (Bassey, 1999; Silverman, 2000). Niewenhuis (2007) supports this as he views the transcription process as conversation analysis. At this stage, I played the video tape while listening and watching the events unfold. Each event recorded during the lesson observations of the participants received equal attention or treatment. When I was satisfied that I understood the tapes and the events, I started to transcribe the events in my notebook. The same process was used soon after the interviews. I played the digital recorder while listening the voices and transcribing (see appendix D.2). This was not easy, especially as I was a novice researcher, however, I succeeded in transcribing the events into text by constantly playing, stopping and rewinding the video tape and the digital recorder in order to capture the recorded events accurately. During this process, I often had breakthroughs that I could add to what I had transcribed.

**Step 2:** I replayed the digital recorder and then the video tape to check whether the events corresponded with the transcribed words. Above all, I wanted to find out whether the data in the transcripts answered the research questions.

**Step 3:** I read each of the transcripts word by word while listening to the digital recorder and again watching the video tape. I did this to ensure the accuracy of the transcripts of the semistructured interviews and the observations. To further ensure the quality of the transcripts, I then handed them to each participant for checking and commenting. Bassey (1999) views this action as member checking. Through the transcribed text, I was able to read the data on several occasions in order to gain a deeper understanding of the data. Notably, I independently analysed the transcribed interview and observations data of each individual participant. The transcribed data from the interviews and the observations were then compared.

**Step 5:** The segments or codes were matched with the developed themes in the profile of implementation. I checked the data backwards and forwards, making comparisons of the data collected through the triangulated methods and then observing the formulation of patterns.

**Step 6:** I coded the entire body of the transcribed text to obtain meaning from the data. At this stage, I used the emergent codes to examine the data deeply while priori coding was used to identify codes from different data sources (Miles & Huberman, 1994).

The coding process gave me an opportunity to compare the data collected through observations, interviews, document analysis and the research diary. I compared the data in order to understand data consistencies and inconsistencies. Creswell (2005), and McMillan and Schumacher (2006) highlight that all data collected needs to be scanned to constitute a general sense of the views of teacher participants, as well as to capture recurring ideas or meanings that may build themes.

Finally, an interpretation of the findings was derived using thematic or narrative analysis style. I interpreted the data within the framework of practical task application, that is, lesson preparation, enactment and assessment. I then translated the data into thick descriptive written form under the title findings in the forthcoming chapter. The conclusion used words to paint a realistic, rich picture of the context, the perspectives and how the teachers integrated practical works (Creswell, 2005; Gay & Airasian, 2003) into their classroom practice. In carrying out this exercise I made it a point that “prejudices and preconceived notions” did not gain ground to the extent that they improperly influenced the perceptions and interpretations of the analysed data (Charles & Mertler, 2002:184). My intention was to realise and integrate themes and concepts into a framework that would provide an accurate and thick interpretation of key issues that identified how teachers developed their application of practical skills in the classroom.

### **3.7 Methodological norms**

Quality assurance is indispensable when conducting research. In other words, the researcher is compelled to report the steps taken to ensure that the work done is of good quality. There are numerous strategies that can be applied to assess the quality of the research conducted. In this study I used four criteria, namely, credibility, dependability, conformability and transferability to ensure that the findings in this research were academically trustworthy (Lincoln & Guba, 1985; Shenton, 2004).

### **3.7.1 Credibility**

Credibility refers to the “authenticity of the data” used in this research (Vivar, et al. 2007: 68). Credibility can be considered in a number of ways, however, Graneheim and Lundman (2003) state that credibility is used mainly to check whether the data collected and the processes followed when analysing data are accurate. To maintain credibility in this research, I kept the transcribed data safe for reference and consistently showed the data to the participants. By doing so, I invited corrections and additions to the transcriptions from the participants. Researchers, such as Shenton (2004) and Harrison, McGibbon and Morton (2001), refer to this action as member checking. Member checking allows the participants to see, read, comment, add and/or omit some of the existing data before the data is considered as a final product. In short, I consistently took the transcribed work, observations and document analysis back to the participants for auditing. Only comments that I found extremely important and useful as part of this research study were published.

### **3.7.2 Dependability**

Lincoln and Guba (1985), and Merriam (2002) share an agreement that dependability or consistency in qualitative research is considered in terms of the findings not changing. This means that the findings remain the same even though different methods are used to obtain the data. To achieve this, I practised what Shenton (2003:71) views as “overlapping methods”. In other words, the different methods supported each other and finally yielded data that showed connectivity.

Additionally, I used an audit trail as the main strategy to intensify dependability (Merriam, 2002). An audit trail allowed me to describe the manner in which the data was gathered, how categorisation was done and how I arrived at the final conclusions. The audit trail contributed to the intensification of dependability of this study.

### **3.7.3 Confirmability**

The concept confirmability is described by Lincoln and Guba (1985) as the extent to which the collected data and the interpretation of the findings are grounded in events

instead of the researcher's personal constructions. To ensure this point, I kept the raw data collected through the interviews, observation, document analysis and diary in a safe place. In addition to this, confirmability in qualitative research highlights a crucial element that a study that has been properly carried out enjoys confirmation and support, not only from the researcher, but largely from other researchers who may undertake similar studies (Vivar, et al. 2007).

#### **3.7.4 Transferability**

Transferability refers to the extent to which the research findings and conclusions in this study can be transferred and generalised to other situations and populations (Graneheim & Lundman, 2003; Vivar, et al. 2007). However, Shenton (2003) argues that qualitative research findings are specific to a small number of particular environments and individuals rather than general ones. In honour of the above argument, I did not generalise or transfer this study's findings to other situations, rather, I attempted to give a clear and thick description of how NS practical works were integrated in the four schools that participated in this study. This was done to provide the researchers an opportunity to gain an in-depth understanding of the data, which would make it easy for them to compare the findings with what they have experienced or observed in other similar situations (Shenton, 2003).

#### **3.7.5 Triangulation**

All the selected data collection methods were used successfully. The data collected through the lesson observations, semi-structured interviews, document analysis and the diary were first checked and compared to identify similar events (Leedy & Ormrod, 2001). Furthermore, the data or findings were transcribed, analysed, compared, categorised and coded to ensure triangulation. The use of triangulation in a qualitative investigation entails the involvement and validation of multiple data collection sources and research sites (McMillan & Schumacher, 2006). Triangulation was used as my main strategy whereby I moved forward and backward through the codes that emerged from the data. In summary, I compared the data from the various data sources, situations and the methods to find out if similar patterns recurred (Creswell, 2005).

### **3.8 Reflexivity**

I entered the research sites expecting to see various curriculum events or activities taking place. The events included, but were not limited to, using the curriculum policy documents as references, the availability of practical task lesson designs, the involvement of learners in practical activities, the use of apparatus, and participants integrating practical tasks. I was obliged to remain subjective during the data collection and analysis processes, that is, not to be biased. Furthermore, I guarded against the dominance of preconceived notions regarding the various contexts, the individual participants and the expected data. I took such an initiative because I was aware that the dominance of preconceived notions could mislead the entire research process.

### **3.9 Ethical considerations**

The ethical considerations section deals with ethical clearance, informed consent, right to privacy and honesty with professional colleagues, which every researcher has to comply with when conducting research (Leedy & Ormrod, 2001; Shacklock & Smyth, 1998). Moreover, adherence to ethical issues also contributed to the establishment of a qualitative research product (Rabojane, 2005).

#### **3.9.1 Permission to conduct research**

Permission was sought from the Ethical Committee of the Faculty of Education at the University of Pretoria, the Limpopo Province Department of Education, the District Senior Manager and the individual school principals to conduct research in the selected schools prior to the commencement of data collection (See appendices S and T). After receiving a clearance certificate from the University of Pretoria, I started with data collection in April and May 2013.

#### **3.9.2 Informed consent**

I did my best to comply with all the ethical and legal requirements that were compulsory for this research. As an assurance of research requirements compliance, I disclosed all the information governing the entire research process. First and foremost, I informed the participants verbally and in writing that their participation in

the research was on voluntary basis and therefore there would be no reward. Above all, I made each participant aware of his or her legal right to discontinue with the proceedings should they wish to withdraw. However, if the participants decided to withdraw, there would be no penalty of any sort.

Furthermore, the participants were made aware of the objectives, including a full description of how the data collection would unfold and how the application of the digital recorder would work so that they had complete comprehension concerning their voluntarily participation in this study. I also made the participants aware that the transcripts and the final research product would remain available for them to check and correct. For that reason, I emphasised that the data would serve no other purpose except to be used in my Master's Dissertation.

Having reached consensus with each individual participant, a consent form was issued for signature and the participants were given a copy of this. During the interviews, I again reminded the participants of the content of the consent form before starting.

### **3.9.3 Confidentiality**

I openly informed the participants that confidentiality would be consistently kept throughout the process. This referred to keeping the information about their identity as well as that of their schools confidential through the application of pseudonyms. As a matter of fact, I was as flexible as possible with the participants in order to encourage maximum participation and revelation of whatever relevant information they could provide.

### **3.10 Limitations of the study**

This study was strictly restricted to teachers who had more than two years experience teaching NS to Grade 7 classes, specifically at public schools within the Limpopo Province, however, participants from different geographical locations, gender or race were not discriminated against. Although this study involves four participants who form one case or unit, I had no intention whatsoever to generalise the results (Bassey, 1999).

### **3.11 Summary**

The research design and methodology relevant to the investigation received full attention in this chapter. The interpretive paradigm was applied to ensure that the results reflected reality. To disclose this reality, I decided to approach the investigation from a qualitative perspective. The rationale for applying an interpretive paradigm and qualitative approach together was because both consider understanding words and actions as key in research; words and actions constituted a core component in this study. Additionally, I used an evaluative-case study design because it allows a researcher to focus on a single event in-depth (Bassey, 1999). Proper sampling procedures were followed when selecting the participants for the study. Finally, I explained in detail the data collection methods and tools, the data analysis, the methodological norms and the ethical considerations of this study.

## CHAPTER 4

### THE RESULTS AND INTERPRETATIONS

#### 4.1 Introduction

This chapter presents the results of the investigation carried out in this study. The results were generated through the application of a variety of specific research methods, which included document analysis, lesson observations, post-observation interviews and the use of a research diary. The intention was to collect as much significant data related to understanding practical task implementation in the classroom as possible. Finally, the collected data was used collectively to paint a reliable picture about practical task implementation at school level. Simply put, the data contributed greatly in bringing to light normal practices based on what the teachers actually did to enhance process skills development in the observed Grade 7 learners during the NS teaching process.

The research findings are presented in the following order: Section 4.2 presents the background of the sampled schools. Section 4.3 provides a snapshot of the behaviour of the principals of the selected schools. Sections 4.4 to 4.6 discuss the findings in a sequential order. Finally, Section 4.7 summarises the findings discussed in this chapter.

#### 4.2 General information about the sampled schools

In this section, I give a brief overview of the schools sampled for participation in this research study. In supplementation to the general overview, the profile of the schools is provided in a tabular form (see Table 4.1 below). I provide detailed information about each of the sampled schools in the subsequent paragraphs under each teacher's case, within the description of the practical task environment subheading, which is discussed before the presentation of the lesson observation data for each teacher. Detailed data about each sampled school is given separately under the teacher's case to assist the reader in obtaining a clear picture of the school in which the practical task demonstrations unfolded.

Seven schools were selected according to the criteria in chapter 3 for participation in this study. The sampled schools were from diverse geographical locations, had different financial statuses (this refers to the norms and standards funds allocated to the South African public schools by the government), and were different in terms of learner enrolment and laboratory facilities (see Table 4.1). In other words, the participation list comprised big, medium and small; rural, urban, farm and township schools.

Three of the sampled schools, with specific reference to schools B, C and F, shared one exceptional phenomenon: they were exceptional as compared to other participating schools in the sense that they were parallel medium schools offering separate classes in English and Afrikaans. Perhaps, this was due to the fact that these schools were situated in multi-racial, urban areas. The learners from the Black and Indian communities were taught in English. In contrast, schools A, D, E and G were dominated by learners from the Black community, however, the schools used English as the medium of instruction. The table below presents information about each of the participating schools.

| School's Pseudonym | Geographical Location | Norms and Standards Status/ Category | School Enrolment | Laboratory facilities |
|--------------------|-----------------------|--------------------------------------|------------------|-----------------------|
| School A           | Rural                 | Quintile 1                           | 926              | No                    |
| School B           | Urban                 | Quintile 2                           | 546              | Yes                   |
| School C           | Urban                 | Quintile 2                           | 1100             | Yes                   |
| School D           | Township              | Quintile 1                           | 99               | No                    |
| School E           | Farm                  | Quintile 1                           | 400              | No                    |
| School F           | Urban                 | Quintile 2                           | 801              | Yes                   |
| School G           | Township              | Quintile 1                           | 1350             | No                    |

**Table 4.1: The profile of the participating schools**

Table 4.1 shows the code of the participating schools, the location of the schools, their status in terms of the norms and standards funds, the current learner enrolment and availability of laboratory facilities. Although schools A-G differ in terms of the place of operation, the organisation of each school is commendable. School organisation played a key role in the selection of the schools that qualified for

participation in this study. The participating schools had classrooms, toilets, security fences, running water, electricity, sports grounds and direction signs. The surroundings of each individual school were clean and ensured safety and security. Discipline seemed to have been maintained at each school as the learners were dressed in school uniforms and behaved in an orderly manner, although, schools D and E did not have administration blocks. Worse than this, school E had dilapidated classroom structures and old security fences. In conclusion, schools A, D, E and G lacked laboratory structures even though they were in possession of some scientific equipment.

#### **4.3 General behaviour of the sampled school principals**

Before presenting the general findings from the documents supplied by each teacher, I strongly considered including a skeletal picture of the behaviour of the principals of each school. As the researcher, I approached seven school principals to hear their views on participating in the proposed research study. Moreover, the plan was to request these principals to recommend knowledgeable participants. I disclosed my intention to use a reputational-case study design, which required each school principal to recommend appropriate participants for the study (McMillan & Schumacher, 2006).

I was fortunate to meet the principals of all the schools, except school B during my first visit. My meetings with the six principals were successful and I was warmly welcomed by the principals of the identified schools. They each gave me a chance to explain the purpose of the visit, which I did as plainly as possible. The principals were impressed by my presentations and they willingly permitted me to conduct research at their schools. Furthermore, each principal satisfactorily introduced me to the recommended NS teacher(s). Eventually, three of the schools dropped out of the study.

As indicated in the preceding paragraph, the principal of school B was not present during my first and second visits, on these visits I was hosted by the deputy principal. Fortunately, on my third day visit to the school, I found the principal. The principal confirmed that he was aware of my pending visits to his school, apologised for his absence and, significantly, asked me why I decided to engage his school in my

research project. After I shared with him the genuine reasons why the school under his jurisdiction was chosen and also the criteria included in chapter 3 (see Table 4.1 as well), he was convinced that the school indeed qualified to participate. Without hesitation, the principal of the School B accepted and recommended one female teacher, teacher B in the study, for participation.

However, the principal openly mentioned that the recommended teacher was actually on sick leave and had been for quite some time. From this I assumed that School B's principal trusted the sick teacher very much otherwise he would have recommended a substitute teacher for participation. Normally when a teacher is absent from duty for a reasonable period of time, as a result of ailment for instance, the School Management Team (SMT) recommends another teacher within the staff to teach the affected subject. To be specific, I gathered that the ailment kept the teacher in question from her duties for more than three consecutive months. Nevertheless, the headmaster encouraged me to exercise patience while she recovered from her sickness. During the fourth visit I discovered that she had just resumed work and the headmaster introduced me to her. Eventually, teacher B withdrew her participation from the research project, but only after she had given me the documents she used when teaching NS.

In the second instance, the headmaster at School G indicated his intention to remove the teacher who was then responsible for teaching NS in the Grade 7 classes. According to the headmaster, the performance of the teacher was dissatisfactory. Eventually, teacher G was removed from the Grade 7 class terminating the school's participation in the project. Importantly, teacher G had already provided me with some of the documents listed in the Tables 4.2 and 4.4 before discontinuing in the study. In addition to this, Teacher F also dropped out and the participation of the school discontinued bringing the total number of withdrawals from the study to three. Therefore, four teachers remained as participants in the study.

In conclusion, all of the principals openly welcomed and introduced me to the NS teachers. Of course there was no choice in the case where only one teacher was responsible for the subject in question, and I had to approach that particular teacher.

Henceforth, I started to engage the participants telephonically and to meet with them regularly regarding matters concerning the study. Before each meeting, I made it my habit to first visit the principal to make him or her aware of my presence. Through that practice, I managed to strengthen the relationship between the principals and myself as the researcher.

#### **4.4 Document analysis**

I provide document analysis since documents played a pivotal role in this study. According to Merriam (2002), documents may include personal documents, public records or documents, as well as physical materials. Based on this information, I therefore selected specific documents relevant to the teaching and learning of NS from the participating teachers. Afterwards, I categorised the documents into two groups, namely the official documents (referring to the documents which the Department of Basic Education was entitled to supply to each public school) and those that were designed by teachers (see Tables 4.2 and 4.4 below). The findings from the documents in each category are discussed together. The discussion covers all the official documents accessed from various NS teachers in this study. The decision to analyse all the documents together was influenced by the awareness that both the Provincial and the National Department of Basic Education (NDBE) provided public schools in South Africa with common documents. In other words, the documents shared similar characteristics.

##### **4.4.1 Official documents**

The investigation revealed that the teachers kept official documents in their files. The official documents found in the files included the National Curriculum Statement (NCS) for the Natural Sciences Policy, National Curriculum Statement (NCS) for the Natural Sciences Assessment Policy and the pace-setter. Imperatively, every NS teacher was expected to be in possession of those particular documents and were expected to use them accordingly during the teaching and learning process. The table below shows the official documents found in the files of the teachers.

| Pseudonym | CAPS Available | NCS for the NS Policy Available | NCS: Assessment Policy for the Natural Sciences Available | Pace-Setter Available |
|-----------|----------------|---------------------------------|-----------------------------------------------------------|-----------------------|
| Teacher A | N/A            | Yes                             | Yes                                                       | Yes                   |
| Teacher B | N/A            | Yes                             | Yes                                                       | Yes                   |
| Teacher C | N/A            | Yes                             | Yes                                                       | Yes                   |
| Teacher D | N/A            | Yes                             | Yes                                                       | Yes                   |
| Teacher E | N/A            | Yes                             | Yes                                                       | Yes                   |
| Teacher F | N/A            | Yes                             | Yes                                                       | N/A                   |
| Teacher G | N/A            | Yes                             | Yes                                                       | Yes                   |

**Table 4.2: Official documents available in the files of the participant teachers**

These indispensable documents included the National Curriculum Statement for the Natural Sciences Policy, National Curriculum Statement: Assessment Policy for the Natural Sciences and the Pace-Setter, or Syllabus. Table 4.2 shows that the CAPS documents did not appear in the files of the selected teachers. Perhaps the reason for this was that CAPS implementation was scheduled for 2014 particularly at Grade 7 level. By the time the study was conducted, CAPS was not yet in practice in Grade 7, although, I accessed the CAPS document through the internet in the year 2012. It was imperative for me to access CAPS document well in advance to carrying out this study to check and be aware if the changes covered in the CAPS document affect the study negatively. If it had negatively affected this study, I would have made the proper adjustments before the actual implementation of CAPS at Grade 7 level.

After checking this, I realised that the content was similar to the NCS except that there are very few changes which distinguished CAPS from NCS. For instance, instead of Learning Outcomes, the CAPS document uses the concept 'Specific Aims' (see chapter 1, Table 1.1). Specific Aim 2, which concerns investigating phenomena in Natural Sciences, addresses scientific skills for development in learners. In other words, Specific Aim 2 specifies what the learners in Grade 7 had to develop, namely the ability to follow instructions, handle equipment or apparatus, make observations, record information or data, measure, interpret, and design/plan investigations or experiments (DoE, 2011). All of the skills listed, with the exception of the design investigations or experiments, were compulsory for the Grade 7 learners (DoE, 2011). These skills constituted a core and indispensable element in as far as CAPS is concerned.

Comparatively, the NCS specified the outcomes which were supposed to be achieved during the teaching and learning of Natural Sciences (DoE, 2002). The practical skills to be achieved included problems of making; observing, surveying and measuring; comparing, and determining the effect of certain factors (DoE, 2002). All these practical skills were addressed under the Learning Outcome 1 (LO) which was “Scientific Investigation” (DoE, 2002:8). Table 4.3 clearly indicates the NCS outcomes which were still in operation when the study was in process.

|                                                              |                                                                                                                                                                               |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Learning Outcome 1 (LO1)<br>Scientific investigation         | The learners act confidently on curiosity about natural phenomena; they investigate relationships and solve problems in scientific, technological and environmental contexts. |
| Learning Outcome 2 (LO2)<br>Constructing knowledge           | The learner knows, interprets and applies scientific, technological and environmental knowledge.                                                                              |
| Learning Outcome 3 (LO3)<br>Science, society and environment | The learners demonstrate understanding of the interrelationships between science and technology, society and the environment.                                                 |

**Table 4.3: The three Natural Science outcomes covered by the South African Curriculum 2005 (DoE, 2002)**

Table 4.3 shows the three learning outcomes, which learners were expected to achieve during the teaching and learning of NS. Finally, and most importantly, I accessed assessment policy documents from the files of the teachers. The Natural Sciences Assessment Policy informed me on the forms of assessment possible for use by teachers (DoE, 2007a). According to the assessment policy, at least four formal practical assessment tasks needed to be done per year. That means one practical task per school term. The files also contained pace-setters; which are presented in the last column in Table 4.2, which shows the availability of the pace-setter. The pace-setter document is arranged in a way that clearly describes the skills which the learners were expected to achieve per school term. Furthermore, the document showed strand and content, or rather the activity, the term, dates, learning outcomes, assessment standards, resources, assessment tasks and time allocation. In terms of the information in Table 4.2, the file of teacher F did not have a pace-setter for the year 2013. However, the listed official documents alone were not sufficient to implement scientific skills smoothly, thus they needed other supportive documents as well.

#### 4.4.2 Planning documents

There were various documents which the individual teachers were responsible for designing in order to implement the NS practical tasks into their teaching. The documents included, *inter alia*, lesson plans, assessment instruments, personal and assessment time tables for the smooth implementation of the curriculum (see Table 4.4 below). Although the structure of the documents varied in how they looked, the crux of the matter is that they shared common objectives. In this case, similar documents were classified or grouped together. For example, lesson plans were grouped on one side and assessment instruments were grouped together to form another category and so on.

| Pseudonym | Lesson plan | Personal Timetable | Assessment timetable | Assessment instruments |
|-----------|-------------|--------------------|----------------------|------------------------|
| Teacher A | Yes         | Yes                | Yes                  | Yes                    |
| Teacher B | N/A         | Yes                | Yes                  | Yes                    |
| Teacher C | Yes         | Yes                | Yes                  | Yes                    |
| Teacher D | Yes         | Yes                | N/A                  | Yes                    |
| Teacher E | Yes         | Yes                | Yes                  | Yes                    |
| Teacher F | N/A         | Yes                | N/A                  | N/A                    |
| Teacher G | N/A         | Yes                | N/A                  | Yes                    |

**Table 4.4: Documents prepared by the teachers**

Table 4.4 illustrates the lesson plan, assessment instruments, and personal and assessment timetables which were designed by the participants to smoothly run the teaching and learning of NS. In Table 4.4, the lesson plan column presents the lesson documents which I accessed from the teachers during the observation sessions. There were additional lesson plans which I accessed from some of the teachers as part of the documents collected prior to the observations.

I observed two lessons that were taught by Teacher A. The two lesson plans seemed to be photocopied from a textbook or other source related to NS teaching and learning. The lesson plans were electronically written and each lesson plan received comprised different sub-headings. The sub-headings included the subject, theme, learning outcomes, assessment standards, week number (for example week 26-28), content knowledge, teaching methods/approaches, integration, type and

form of assessment, reinforcement, and expanded opportunities (see appendix E). In addition to this, the lesson plans specified the duration for implementing the specified activities, for example, the lesson about the transfer of heat energy was scheduled for 10.5 hours. Furthermore, the transfer of heat energy lesson plan illustrated a long list of apparatus such as: 2 tin lids; 2 coins; test tubes; a stop watch. Noticeably, the lesson plans did not mention a specific date for demonstrating the activities, except for the week numbers; they also did not specify the roles and responsibilities of both the teacher and the learners during the demonstrations.

Teacher C used the lesson plan template designed at the school and the lesson plans which I accessed were prepared in Afrikaans (one of the eleven official South African languages). The lesson plans covered many aspects which reflected in the lesson plans of Teacher A, for example, which included the subject, theme, the assessment standards and other aspects. The difference was that Teacher C's lesson plan indicated the skill to be developed, attitudes, assessment purpose, methods, tools, techniques and the teaching approach (see appendix E). Moreover, the lesson plan indicated the activities the learners were expected to do.

In contrast, Teacher D used an exercise college book for writing lesson preparations rather than a ready-made template which refers to a template designed by someone other than himself. However, the lesson plans missed some of the important information expected to appear on every lesson plan; for example, they lacked dates, duration, roles of the teacher and the learners (see appendix E). The lesson plan explained the theme of the day in detail and further described the concepts related to it, although, lesson plans do not always follow the same pattern. In one lesson plan, the apparatus for the activity were indicated as well as what the learners had to do during the demonstration process, whereas another participant's lesson plan, with specific reference to mixtures, did not include the roles of the teacher and student.

Teacher E either used a template or designed his own lesson plan. Although Teacher E did not use one way to prepare practical task lessons, the headings or items covered were more or less the same. The common aspects like the subject, theme, date, duration, and assessment standards were included in the lesson plans.

The important thing was that the lesson plans clearly indicated the role of the teacher and the learners. However, the lesson plans did not specify the apparatus to be used for the development of abilities in the learners (see appendix E).

Apart from the observation lesson plans, I also accessed previous lesson plans from the teachers. Initially I thought of accessing four (4) practical task lesson plans per teacher, that is, a maximum of twenty eight (28) practical task lesson plans which teachers used prior to the observation sessions, nevertheless, I ended up with only nineteen (19). Remarkably, all the lesson plans received from Teachers A and B in this category were ready-made lesson plans which usually form a component of the NS teacher's resource pack delivered to schools by the textbook publishers' agents. This suggested that the two teachers might have applied them without alterations. Teachers E and G used lesson plan templates, which were often supplied to them during the NS workshops. The lesson plans were exceptional in the sense that they had being completed by the teachers. Furthermore, the lesson plans accessed from Teacher D were prepared exactly the same as those that I observed. In general, the lesson preparations were more or less the same in terms of lacking sufficient outlines of the activities in their detailing.

Not all the teachers were able to provide me with the compulsory planning document that I requested. Teacher C and F served as good examples as Teacher C only gave me one uncompleted lesson plan template, and Teacher F could not provide me with any lesson plan. I arranged with him telephonically to prepare certain documents for me, but only after searching through several cabinets was he able to collect some of the required documents; this came across as disorganised.

In addition to the lesson plans, I checked the personal timetables of each teacher. The personal timetables of the teachers who participated in the project reflected only the NS period number and time (see appendix F). The timetables also missed details on the specified practical tasks to be carried out on each particular day. This could have been due to the fact that the work schedules or pace setters specified when, in terms of weeks, to perform a particular activity. The files of the teachers did not keep assessment timetables as required by the policy (DoE, 2007b). This important official

document only appeared in the file of Teacher E and it was signed by the HoD (see appendix G).

Furthermore, I checked the formal assessment instruments the teachers used to measure the skills development of the learners. The overall reason was to find out what the teachers did or had done to assess the ability or the level of process skills developed by the learners so far. After checking, I realised that most of the formal assessment instruments which the learners responded to were supplied by the provincial Department of Education. The instruments were commonly known as common assessment tasks. The most dominant strategy noticeable in this type of assessment was the classroom pencil and paper tests and examinations (DoE, 2007b).

The common assessment task which the learners wrote during the first quarter of the academic year comprised of 7 questions, of which questions 3 to 7 dealt with practical work. In addition to this, the teachers designed their own formal assessment instruments in the form of a test. Teacher A designed a formal assessment instrument which covered three questions, that is, questions 2 to 4, which addressed practical activities. Questions 3 and 6 of the formal assessment instrument designed by Teacher B dealt with practical tasks. Finally, Teacher D designed a formal assessment task in the form of a test, of which questions 3 to 8 were based on practical skills development.

The key issue is that the formal assessment tasks were marked and the scores were allocated according to the available memoranda. Moreover, there is evidence that Teachers C and E sometimes used rubrics to assess practical skills development of the learners (see appendix J), for example, the learners in School C kept small and electronically written papers in their files, which were rubrics of ten items each. Jönsson (2008) defines a rubric as an instrument which is used for qualitative rating of performance of the work done. The availability of rubrics suggests that the learners were sometimes assessed and allocated scores while demonstrating a particular scientific skill.

Alongside the assessment instruments there were memoranda in the files of the teachers, I therefore checked the memoranda received from teachers A, B, D, E and G. The memoranda corresponded with the formal instruments the teachers used to assess the learners. Each item on the memorandum was allocated a corresponding score. Conversely, the rubric template indicated the rating scales ranging from 1 to 4 rather than marks. Apart from the documents mentioned under the sub-heading 'planning documents' there were other important documents that were checked.

#### 4.4.3 Supportive documents

The accessed supportive documents included the mark or record sheets and workbooks that the learners used to write the NS informal assessments. The following table presents these supportive documents.

| Pseudonym | Mark/Record sheet received<br>Yes/No | Number of practical tasks recorded in the mark sheet | Number of informal practical tasks in the learners' workbooks. |
|-----------|--------------------------------------|------------------------------------------------------|----------------------------------------------------------------|
| Teacher A | Yes                                  | Not specified                                        | 10.                                                            |
| Teacher B | Yes                                  | Not specified                                        | I did not get the workbooks from the teacher.                  |
| Teacher C | No                                   | N/A                                                  | 16.                                                            |
| Teacher D | Yes                                  | Not specified                                        | 3.                                                             |
| Teacher E | Yes                                  | Not specified                                        | 13.                                                            |
| Teacher F | Yes                                  | Not specified                                        | I did not get the workbooks from the teacher.                  |
| Teacher G | Yes                                  | Not specified                                        | I did not get the workbooks from the teacher.                  |

**Table 4.5: Supportive documents indicating learner performances**

Table 4.5 presents the mark/record sheets for the learner performance scores and the total number of practical tasks recorded in the workbooks of the learners. The teachers used the mark or record sheets to keep the performance scores that the learners obtained (see appendix K). The mark or record sheets that I saw were supplied by the Department of Basic Education, although in some cases, the teachers designed it themselves. The record sheets had spaces for recording practical task performance scores. Notably, the mark or record sheets pertaining to Teachers A, B, D, F and G did not separate practical performance scores from

knowledge acquisition or the total scores of the entire assessment instrument, in fact, the specific practical task performance scores were not indicated. The mark or record sheet of Teacher E kept the practical skills scores each learner obtained separately from the general scores. The implication is that the mark sheet received from Teacher E was the only one that plainly separated the marks allocated to a learner during a practical activity demonstration and marks that were obtained through demonstration of knowledge acquisition. In short, the mark sheet had a specific column dedicated to practical task scores. The practical scores form an essential part of the total percentage for the quarter ending as well as progression at the end of the year.

I could not access the record sheet of Teacher C as the NS teacher in possession of the record for the sampled class was on leave. I was, however, able to obtain exceptional supportive documents from Teacher C. The documents are worth mentioning as they were important in as far as integration of practical tasks was concerned. There was a year plan which Teacher C used for the teaching and learning of NS (see appendix H). Teacher C divided the year plan into two parts, namely a “Science” part of NS and a “Biology” part. In addition to this, Teacher C included a document about safety precautions in the laboratory (see appendix M); scientific methods (see appendix N); a document about expectations from the learners (see appendix O); a communiqué to the parents (see appendix P); household information (see appendix Q); a NS observation book (see appendix R) and the Natural Sciences policy (see appendix I).

In addition to the documents the teachers used, I analysed the workbooks that the learners often used to write informal tasks. Usually, the learners used college exercise books to complete NS class and home activities. This kind of work is referred to as an informal task in the sense that it is not counted in the final examination mark. In my view, such activities serve a dual-purpose: they prepare the learners, and also assess their performance on a continual basis. However, Teachers B, F and G could not give me the learners’ workbooks.

Overall, I checked a total number of sixteen learners’ books, which I received from schools A, C, D and E that equates to four learner books per participant. Some of the

activities in the books of the learners were marked with a red pen and very short comments such as good, well done, proud of you and poor accompanied the total scores allocated to the overall performance of the learners.

On top of the practical work, which was reflected in the exercise books as class or homework, there were a few papers which showed pictures which had a stronger relation to practical work, for example, amongst the documents which Teachers A and E provided me, there were pictures which were directly photocopied from the textbook. The learners were assigned the task of matching pictures that reflected types of energy transfer with the corresponding type of energy. Lastly, and interestingly, all the exceptional support documents which I received from Teacher C were pasted on the first pages of the exercise books which the learners used to write informal tasks.

In conclusion, I analysed the official and the teacher prepared documents as well as the workbooks that the learners used to complete activities. Sufficient evidence surfaced showing the extent to which the process skills were attended to. However, it appeared that some of the process skills did not to receive the attention they deserved. Some of the teachers' documents lacked a lot of information about process skills implementation. The data collected from the document analysis was not the only evidence which could provide a fully fleshed picture of how the process skills were integrated in the teaching of NS in the Grade 7 classes. The document analysis is used in conjunction with the other research methods discussed in Chapter 3.

#### **4.5 Lesson observations**

This section presents the cases of four teachers and a combination of two lesson observations for teachers A, C, D and E. The observation cases are arranged alphabetically according to the names of the teachers who participated in this study, however, the findings obtained from each lesson observation are presented separately. Before presenting the lesson observation findings, I decided to explain the steps that I took to make the observation sessions a success.

Before conducting the lesson observations, I met with each teacher on the date and at the time as arranged for the demonstration. I observed at least two practical task lessons per school. Each of the lessons I observed were conducted in a formal manner (Bassey, 1999). During the observations, I used a video tape as my main instrument supplemented by observation schedules to capture events (see appendix C). Each case commenced with a description of the field in which the demonstrations took place, then the teacher's background, followed by the two practical lessons that I observed.

#### **4.5.1 Teacher A's case**

Under this subheading I describe the environment in which the practical task lessons for Teacher A were observed, followed by a brief description of the teacher. Next, I provide the findings from the lesson observations starting with the first lesson.

##### **4.5.1.1 Description of the practical task environment**

School A was one of the previously disadvantaged schools situated in a rural settlement. However, the school had resources and infrastructures, although many of these infrastructures were new. It had a combination of adequate classrooms and toilet facilities. The school was electrified, well fenced, paved at the entrance level and had running water and a garden near the main school gate. On average, the school satisfied most of the specified requirements shown in Table 4.1 in Chapter 4. The school was classified as a quintile 1 category school. This could be because many of the parent community members are unemployed since the school is situated in one of the previously disadvantaged communities. At the time of investigation, the learner enrolment count was 926.

Both the first and second observations were classroom-based, although the second one ended outside the classroom. The classroom itself had paint missing, a built-in cupboard, a steel cabinet without doors, a hand-drawn timetable and one rectangular chalkboard which the teacher used to write up some of the information he was teaching the learners. Apart from these items, there was no evidence of NS, such as scientific pictures, posters or objects which could have suggested that practical tasks

were ever demonstrated there. Initially, the classroom was allocated to the Grade 7 D learners, but later, Grade 7 D and B were merged.

The arrangement of learners' desks was from the back of the classroom facing the teacher towards the front of the classroom in four rows. An arrangement of this kind often suggests that grouping of learners into small units is not entertained. Two learners shared a desk. The boys sat together and the same applied to the girls. It was rare to find a boy and a girl sharing the same desk.

#### **4.5.1.2 Teacher A**

In this study, the participant in School A was known as Teacher A. The participant was a male teacher who became a teacher in 2002. He was open, welcoming and presentable. Academically, he held several qualifications and he also qualified to teach science (see Table 3.1 in Chapter 3). Teacher A taught NS in Grade 7 for approximately six years. He taught other subjects to other grades as well.

#### **4.5.1.3 Practical task observation 1**

NS period number three commenced at 09h03 and ended at 09h33, before break time. The teacher allocated me a table and chair on the side of the classroom against the wall where I faced the entrance door and was able to see the learners and the teacher quite well. The teacher happily welcomed and introduced me to the learners. After the introduction, the teacher reminded the learners that I was the one who had requested them to complete the consent form for my research project.

The sampled class had an enrolment of 32 learners, seventeen boys and fifteen girls. Three boys were absent during the first practical task demonstration. Before the teacher could start with the practical task presentation, he sent one learner to collect tap water outside the classroom. He then approached me to find out if I was ready, which I was as I had prepared all the materials I was going to use in advance. However, I pointed out that I would stand up or move if necessary in order to capture the event(s) that were unclear from the position I was sitting. Moreover, I indicated that my intention was not to disrupt the proceedings.

The lesson commenced at 09h10. The NS topic was heat transfer. Teacher A started his lesson by revising the three methods of heat transfer which he had taught the learners the previous day. The methods were radiation, convection and conduction. Some of the learners were asked to name these methods. Any learner who knew the answer had to show that by means of putting up his or her hand. The first and second learners who the teacher pointed to answered correctly. For the third method of heat transfer the teacher commanded all the learners to name it, which they did correctly. Thereafter the entire class was instructed to repeat the answers radiation, convection and conduction en masse. Every time a learner mentioned a new concept, the teacher wrote it on the chalkboard. Soon after he had completed this revision, the teacher disclosed the objective. The main objective was to find out which substances were the best conductors of heat. The teacher wrote “Which materials are the best conductors of heat?” on the chalkboard. I assumed that the teacher did this to emphasise what he was saying.

Teacher A used apparatus to achieve this objective, which included a glass beaker containing tap water, a tripod, a spirit burner, a box of matches, a wire mesh and three spoons made of plastic, metal and wood. The apparatus were set up on a small table in front of the learners before the commencement of the lesson. Teacher A introduced pieces of apparatus to the learners by handling and lifting up one item after another and each time he wrote the name of the item on the chalkboard under the heading ‘apparatus’. All the learners repeated the names of the materials after him in en masse. Sometimes items were introduced to the learners in vernacular, for example, a wire mesh was introduced as “kesefo”. According to the teacher, the available apparatus were supposed to be used throughout the lesson.

Secondly, Teacher A demonstrated how heat is transferred by using the spirit burner filled with methylated spirit and a matchstick. The teacher attempted to light a matchstick and while it was on fire he connected it to the rope of the spirit burner. The teacher then placed a tripod on top of the spirit burner followed by a wire mesh, after which he placed a glass beaker with tap water on top of the wire mesh. Learners that were unable to see what was being demonstrated moved between their seats at the back of the classroom to the stand at the front where they had a better view of the experiment being conducted.

Thirdly, Teacher A explained each step taken as well as the expected outcomes of the experiment, for example, he articulated that the spirit burner would continue burning while the heat generated moved upwards and heated the water inside the beaker. By doing so, the heat would travel from the main source, which was the flame, through the beaker into the water. As a result, the water near the source was the first to be affected. Based on this explanation, the teacher promised the learners that the currents would become visible inside the water and that would be evidence that, convection as one method of heat transfer, was taking place. When such explanations were delivered, all of the learners looked and listened to the teacher attentively.

Next, the teacher introduced radiation as the second method of heat transfer. He demonstrated how radiation occurs by putting his hands around the bottom part of the glass beaker without touching it. The teacher articulated that should learners put their hands around it in the same way, they would also feel the heat emanating from it as the heat was transferred through the air in the form of waves.

Fourthly, the teacher placed three spoons made of different materials inside the glass beaker immediately as the water was beginning to boil, but only the front portion was immersed into the water for a few minutes. When bubbles began to show, the teacher informed the class excitedly that the molecules were beginning to move up. Suddenly, he was surrounded by learners who wanted to observe the process. The teacher highlighted that, as water at the bottom of the beaker rose as a result of receiving more heat, the cool water molecules on top sank down. He pointed out that convection operated in liquid substances in the same way. Immediately the teacher remembered and asked a learner whom he saw in possession of a piece of wire to bring it to the front. The teacher placed one end of the wire into the flame so that it received some heat. The teacher was able to utilise or relate the experiment to real life situations.

Fifthly, the teacher warned the learners of the dangers and risks that could arise during experiments of that kind, for example, he warned the learners not to practise the experiments conducted in the class at home as that may put their lives in

jeopardy. To prevent health risks, the teacher carefully touched each one of the spoons before the learners were requested to touch them.

Sixthly, some of the learners were given the chance to touch and report on what they felt to the entire class. At first different learners reported contradictory experiences regarding the temperature of the three spoons. The spoons were immersed again for a while then the touch and report action was repeated. The same results were reported about the wooden and the plastic spoons whereas the metal spoon results indicated that it had gotten warm. Eventually, one girl quickly withdrew and shook her hand after touching the spoon and commented that it was hot. That reaction forced the learners and the teacher to laugh.

In conclusion, the teacher explained that heat moves from a hot place to a cold place with ease. He further highlighted that the metal spoon was warm or hot simply because it allowed heated particles to move through it at a fast speed. Furthermore, teacher A explained that heat moves from “a higher concentration or hot place to a lower concentration or cold place”.

Again, the teacher placed all three spoons inside the beaker and asked the learners to tell him which spoon was a good conductor and which one was a poor conductor of heat. The learners correctly answered the questions and the teacher wrote three statements on the chalkboard which read as follows:

1. Metal is a good conductor of heat.
2. A wooden material is a non-conductor of heat.
3. Plastic is non-conductor of heat.

By this time the water in the glass beaker was boiling. Teacher A then redirected the learners' attention to the boiling water and explained that the molecules moved up and down faster simply because of heat current. At the end of the lesson, the teacher wrote five informal assessment items on the chalkboard for the learners to write in their workbooks. The workbook in this study refers to either a college exercise or hardcover book that a learner uses to write the work in during class time or at home. The assessment items were:

1. Write down all the apparatus used to when performing the experiment

2. Which material is a good conductor of heat?
3. Which materials are non-conductor of heat?

While the learners were busy attempting to respond to the assessment questions, the teacher approached me and informed me that he ended each lesson this way.

#### **4.5.1.4 Practical task observation 2**

Although it was NS period number five, the lesson presentation commenced during period number four at 09h13 and ended at 10h14 after break time. Teacher A welcomed and directed me to the table and chair that I had used during the first day of observations. He indicated that he had negotiated and gotten permission from his colleagues to use period number four and five for my advantage. In other words, Teacher A combined two Grades 7 classes on that day. The class comprised of a total number of forty two learners, twenty-two boys and twenty girls. In fact, Grade 7 B, with an enrolment of 32 learners, and Grade 7 D with ten learners were combined into one class. All the learners were present. The teacher commenced his lesson by revising the work done during the course of the week. The work involved forms of energy, for example, electrical energy, and chemical energy. I noticed that the teacher moved up and down the classroom in an attempt to be close to the learners, although he never reached the learners at the back of the classroom.

Shortly after the revision, the teacher introduced energy change as the theme of the day. He explained that the main objective was to investigate or find out whether one form of energy can really change into another form of energy. The idea was to identify and verify the different forms of energy which result when chemical energy is transferred. Chemical energy was centralised because it served as a source of other kinds of energy.

Firstly, the apparatus were introduced. The apparatus included a spirit burner containing methylated spirits, a box of matches, a battery cell normally used to light a torch, plus or minus sixty centimetres worth of thin electric cable and a small globe for a torch. This time the apparatus were introduced differently than in the first observation session. The teacher picked up one item after another and requested

the learners to name each object. The learners called the spirit burner “Khetshubampara”, which is a vernacular name.

Secondly, the teacher gave an explanation of how the experiment was going to unfold followed by demonstrations. A demonstration of the experiment was done thirdly whereby the teacher connected one end of the electric cable to the ring of the globe. Then he connected the tip of the globe, which is close to the rings, to the positive side of the battery cell, and the loose end of the electric cable was connected to the negative side of the battery. Consequently, light became visible. When observing this positive response, the teacher explained that it was chemical energy that had changed into light energy. The learners were instructed to clap their hands as appreciation of the success of the experiment.

Fourthly, the teacher picked up the spirit burner and a matchstick. Before starting the activity, he explained that the chemical energy inside the spirit burner would change into light energy once a flame was visible on the rope. After opening the lid and moisturising the rope, the spirit burner responded positively and a light resulted. The teacher explained to the learners that chemical energy had again changed to light energy. The learners were instructed to repeat after the teacher that chemical energy changed to light energy.

Furthermore, the teacher instructed the learners to put their hands on their cheeks as he wanted the learners to feel the difference after putting their hands around the flame. One girl was summoned to the front in order to experiment and experience the diverse temperatures. At first, the flame in the spirit burner went out, however, the teacher continued explaining that if a person puts their hands around the flame produced by the spirit burner for a while, they would feel the warmth on their hands and if they immediately put their hands to their cheeks, they would feel the warmth on their cheeks. The teacher apologised and acknowledged the disappointment created by the spirit burner’s flame going out.

Fifthly, the teacher requested me to join him and the learners to conduct another experiment outside. Outside the classroom near the classrooms block there was a vehicle parked, the teacher opened the bonnet of the sedan and allowed the learners to gather around it and look inside. Only the learners close to the car were able to

see the engine and other accessories. The teacher asked the learners to show him the battery and also to name the substance inside it, which was a chemical substance. Furthermore, the teacher promised the learners that they would see chemical energy changing into light, movement energy or kinetic energy, heat energy and sound energy when the car engine was turned on. Before turning the engine on, the teacher explained to the learners in vernacular that there is yet no light or even sound that can be heard. Moreover, he requested the learners to test if the engine was hot by putting their hands on it. After starting the car, the teacher moved to the front of the vehicle and asked whether the learners could hear any sound coming from the engine, the lights of the car were switched on so that the learners could see the chemical energy changed into light energy.

The teacher then pointed to the fan belt which was turning fast, and explained that chemical energy changed to kinetic energy. Apart from that, the teacher gave an explanation that the engine had become hot because chemical energy had changed to heat energy. Finally, the teacher wanted to know if the learners had any questions, they did not so they were sent back to the classroom.

The lesson was concluded by giving the learners an assessment task. In this case, the teacher distributed a paper showing six different pictures related to scientific activities to each learner. The pictures included a drill machine, a person holding a torch which shows the light emanating from it, a person close to a heater, children playing soccer and the sun shining over plants on earth (which signifies photosynthesis). The learners were expected to identify and write the energy change involved in each picture in their workbooks.

#### **4.5.1.5 Teacher C's case**

Under this subheading, I describe the environment in which the practical task lessons for Teacher C were observed followed by a brief description of the participant. Next, I provide the findings from the lesson observations in their order.

#### **4.5.1.6 Description of the practical task environment**

School C was a public institution and was one of the multiracial urban schools in its area. The learners at this school originated from different race groups including

White, Black and Indian. At the time, School C registered 1100 learners counting from Grades R to 7. The school was classified as a quintile 2 category school. This could be the case as most of the parent community were employed and, as such, the school had a good financial backbone.

School C was well developed. Evidence of the school's development was visible in various aspects, for example, adequate infrastructure which included classrooms, a laboratory, a hall, a well resourced administration block, sporting grounds and many other resources such as computers, photo copiers, and school vehicles. Again, School C had sufficient human resources including teaching and diverse non-teaching staff. In addition to this, School C had a display of awards in the form of assorted trophies. On average, School C possessed a great number of the facilities which any former model C school is expected to possess.

Many practical tasks were conducted in the laboratory, which was well equipped with different items, for example, scientific pictures, posters, mixed objects in a wooden cabinet, an aquarium, an impala and elephant's skull, a human skeleton and other materials that contributed to making science teaching and learning easier. Apart from that, the laboratory had electricity, adequate modern wooden shelves around the inside walls and two zincs on top of the shelves. The central portion of the laboratory was where the learners sat to do practical activities. There were four chairs and two types of tables which were arranged in such a way that they accommodated two learners on the one side and the other two on the opposite side per group. The learners were evenly mixed and every group consisted of boys and girls. The central table in each group was used for scientific apparatus. Significantly, each central table had laboratory rules pasted on it.

Lastly, close to the chalkboard there stood a counter with shelves for the teacher. This was the laboratory wherein I conducted my two practical task observations.

#### **4.5.1.7 Teacher C**

Teacher C was a white male. Some of his noticeable characteristics included hospitality, vigour and commitment to what he did. He was the head of the

department (commonly known as an HoD) of science at School C. Teacher C had taught science in Grade 7 for twenty-three years.

I observed him teaching the sampled class of learners NS practical activities. In fact, the sampled class belonged to another female white teacher. However, Teacher C recommended in absentia that she was a good teacher. Unfortunately, the teacher was on *acchouchement* leave by the time I visited the school for this project. I was desperately looking for at least one female teacher to take part in this study, which would have given me an advantage in observing and listening to how she managed to teach NS in the senior phase since some female teachers enjoy teaching in the foundation phase.

#### **4.5.1.8 Practical task observation 1**

I arrived at the school's reception at 08h35 and waited. Later at 08h49 I informed Teacher C telephonically of my presence. Teacher C promised to send a learner to lead me to the laboratory room as soon as the siren sounded. Indeed, not long after I heard the siren sound and a learner took me to Teacher C's classroom. Arriving at the door step of the laboratory, I found Teacher C waiting for me and the last group of learners entering through the door. When entering the laboratory, there were some learners still busy putting their school bags on top of the shelves while others were finding their seats. In fact, the learners moved from their classroom to the laboratory during practical activities lessons. As soon as the learners entered the laboratory they arranged themselves accordingly. Wa Kivilu (2004:3) views a practice of this nature as "business as usual", simply meaning that the learners did what they usually do once they arrive in the laboratory. They do not wait for the teacher to tell them what to do as they already knew what to do.

The sampled class had a register of thirty six learners, twenty two girls and fourteen boys during that academic year of which only one girl was absent during my visit. The Grade 7 class was constituted of many Black learners, and very few Indian learners. The sampled class was the only class that offered NS in English. In the other Grade 7 classes, Afrikaans was the instructional language for NS.

I was allocated a small table and a chair in the corner directly opposite the laboratory entrance door. From that position, I was able to use my research instruments and was also able to see the learners and the teacher very well.

It was NS period number three and it started at 09h03 and ended at 09h33. Very importantly, before the lesson could start, Teacher C apologetically highlighted that the practical task presentation would be short due to the long amount of time spent at assembly receiving announcements. He welcomed and introduced me to the learners who welcomed me with applause.

Teacher C ordered the learners to sit down in their respective groups. He advised the learners to be quick, particularly as they had to work with apparatus. Afterwards, he introduced the NS theme on the chalkboard. The topic was the reaction of bases and acid substances, and the theme was a continuation of the previous lesson, which received a review before continuing with the current lesson. Furthermore, he warned the group leaders to be very careful and to master the kind of substance they poured into each test tube. Each group leader was expected to collect the different bases and acid substances from the teacher's counter and ensure that each test tube was filled up.

There was a test tube stand with seven empty test tubes on the central table in each group. That meant that each test tube had to be filled with one type of substance. Apart from the test tube stand, there were also one big towel, plastic dish wash of 10 litres in capacity and a syringe on the central table. A number of apparatus including glass beakers, test tubes, a small towel, 5 litres of vinegar, 500 millilitres of distilled water, 1 litre of methylated spirit, 500 millilitres of bromothymol blue, 500 millilitres of handy andy, 1 kilogram of soda and 1 kilogram of tartaric acid were lined up on the teacher's counter. Teacher C introduced all the apparatus to the learners before the start of the practical activities.

Furthermore, Teacher C explained the purpose of conducting such an experiment, which was to see whether bases and acid substances react when they are in contact with each other. Basically, the reaction of bases and acid substances was supposed to be measured or gauged in terms of colour change once the different substances were mixed together. Teacher C asked the question: "How many different colours

will result in the test tube?” For that matter, the practical lesson demonstration was arranged into two phases. Phase one was for adding bases to acid substances, whereas phase two was for adding bromothymol blue to the substances. Additionally, Teacher C mentioned that he had gone to one of the shops in town to buy himself alkaline and an acid indicator and could not find the substances. Teacher C intended to test acid in soil through alkaline and acid indicators, which are commendable for use when testing acid in food or in human blood.

Before Teacher C opened the platform for the practical activity to commence, he fully explained the procedure to be followed and the expected outcomes. Firstly, the group leaders had to queue at the counter and pour the different substances, with the exception of bromothymol blue, into their glass beakers. Then each group member had to go to his or her leader to fill in the test tube. In the first test tube, they had to fill vinegar followed by distilled water into the second test tube and so on. The level of the measurement required was illustrated.

Teacher C kept moving from one group to another talking to the learners and trying to assist the learners in overcoming any challenges they experienced. Later, when all the learners had completed their task, Teacher C picked up two test tubes with different colours from one group and demonstrated how to mix the content, that is, base and acid substances. Then, the learners demonstrated the experiment on their own under the supervision of the teacher. Consequently, the substance in each test tube into which a base substance was added reacted. Five different colours were identified within the test tube, which the learners named.

After a brief discussion of the experimental results, Teacher C proceeded and introduced phase two of the lesson. Phase two involved the use of bromothymol blue, the use of which Teacher C explained satisfactorily to the learners. Subsequently, the learners were strongly warned not to touch or swallow the substance as it is very harmful to humans. The learners were advised to wash their hands thoroughly after contact with the substance.

To make the lesson a success in phase two, Teacher C filled a glass beaker with bromothymol blue, which looked brown, yellow and orange in colour. Finally, he ordered the group leaders to bring their syringes, which he filled with bromothymol

blue himself. Lastly, Teacher C demonstrated how the syringe operates, that is, how the learners were expected to hold and use it when adding bromothymol blue into the test tubes. The learners immediately embarked on their activity. The learners injected bromothymol blue into each already filled test tube and soon after the substances contacted, they shook the test tube. This step, the injection and shaking, was allocated two minutes and it was finished within the limited time. Time played an important role as Teacher C continuously reminded the learners of the remaining minutes for completion of what they were doing.

After the bases and acid substances contacted, the bromothymol blue changed colour, for example,

- |                                       |                    |
|---------------------------------------|--------------------|
| 1. Vinegar + bromothymol blue         | = blue colour      |
| 2. Distilled water + bromothymol blue | = green colour     |
| 3. Tartaric acid + bromothymol blue   | = yellow colour    |
| 4. Soda + bromothymol blue            | = dark blue colour |
| 5. Citric acid + bromothymol blue     | = yellow colour    |
| 6. Handy Andy + bromothymol blue      | = blue colour      |

Learner involvement was consistent from the beginning to the end of the practical demonstrations. Each learner had an ample opportunity to see and demonstrate the practical activity using the apparatus. Even when the learners demonstrated an activity, they worked co-operatively together in all the groups. Each learner in a group performed something contributory to the completion of the activity within the specified time. Anything the learners laid their hands on was done with confidence. The presentation was successfully completed and the objectives set out for the lesson were accomplished.

After the completion of the lesson, Teacher C asked if I had something to say to the learners; I thanked them for their cooperation. In turn Teacher C asked the learners if ever they wanted to say something to me, and in response the whole class clapped hands ten times as a gesture of good wishes.

Finally, Teacher C informed me to feel free to contact him if I needed to do so. The learners were released to continue with sporting activities.

Teacher C left to meet his rugby team waiting for him at the grounds. I remained in the laboratory with six group leaders who were busy cleaning the apparatus and ensuring that the room was tidy. I was informed that policy demands the learners to clean up before evacuating the laboratory.

#### **4.5.1.9 Practical task observation 2**

I arrived at the school's reception at 11h10 and waited. Again, I made Teacher C aware of my arrival telephonically.

When period number seven started at 11h30, I went straight to the laboratory wherein the practical activities were planned to take place. The laboratory looked the same as it had during the first practical task observation. There was nothing new that could have drawn my attention. When I entered the laboratory I found Teacher C standing next to the counter and the learners busy arranging themselves into their respective groups. I was welcomed and offered the same seat I had occupied during the first practical observation. No learners in the sampled class was absent on that day. The learners in the sampled class were being taught NS in English.

On the teacher's counter there was an electric kettle, candle, electric lamp, overhead projector, gas stove and a box containing chemical energy substances. These were apparatus organised for use during the demonstration of the practical activity. The lesson started at 11h35 and ended at 12h00. Before the start of the practical activity planned for the day, Teacher C ordered the learners to take out an exercise book, a demarcated piece of paper for examinations, homework book and pencil case within one minute. Teacher C took about ten minutes to explain to the learners about the forth coming test, examination and homework in the form of a project scheduled for the following Monday. The learners were expected to collect 13 specified pictures and paste them into their exercise books.

Teacher C started the practical task presentation by talking to the learners about the papers bearing different pictures. The pictures were also indicated on the chalkboard

through an overhead projector. The learners had to say what each picture was about. The first picture showed how kinetic energy occurs, which Teacher C explained as a moving energy. In addition to this, the learners demonstrated how kinetic or moving energy occurs by playing a game called rap battle in the laboratory. Rap battle was played by flying a specific object from point A to point B. Two girls played with a hand ball and as the ball moved from one girl to another, Teacher C explained the situation as a true reflection of how kinetic energy takes place. Teacher C then asked the learners to name examples of things that show movement in the laboratory. The learners mentioned the fans and the curtains to which Teacher C added that blood and the heart were also examples of moving elements in our bodies.

Furthermore, Teacher C explained that the second picture presented potential energy. Potential energy was explained as stored energy and also something that has the ability to do something. Potential energy is realised because of the position and state of the object. 'Cars' and 'curtains' were mentioned as good examples of potential energy. Moreover, Teacher C placed a piece of paper on top of the shelf and from there allowed it to fall. In the second example of his demonstration of potential energy, he used a flexible meter or measuring stick which was hanging on the wall. Teacher C demonstrated how the meter stick acquired potential energy when it was bent. The demonstration was momentarily disrupted by an announcement over the school's loud speakers. The lesson was resumed shortly. Teacher C then asked the learners to identify objects that could produce light in the laboratory. The learners identified the candles, globes and electric lamp on the counter. Teacher C quickly explained to the learners that light energy is visible once the candle, for example, starts burning or the electric lamp is turned on. After a short explanation the lesson was ended.

Teacher C then invited me to join him in his office at 12h10 to prepare for his forthcoming interview session.

#### **4.5.2.0 Teacher D's case**

Under this subheading, I describe the environment in which the practical task lessons conducted by Teacher D were observed, followed by a brief description of the participant. Next, I provide the findings from the lesson observations in their order.

#### **4.5.2.1 Description of the practical task environment**

School D was one of the township schools in this study. The school had sufficient infrastructure; the building structures were old and electrified, and there was running water as well as an old fence. At the time of my visit to the school, a developer or contractor was busy constructing the foundation for a new administrative block. On average, the school possessed many of the requirements included in Table 4.1. Furthermore, the school was classified as a quintile 1 category school because of their historically poor financial background. There were only 99 learners from Grades R to 7 enrolled at School D when the observations were conducted.

The first and second classroom observations took place in the same classroom, which appeared to be an old classroom. It had electricity, a built-in cupboard, a chalkboard and a notice board. No evidence of scientific pictures, posters or objects could be seen anywhere in the classroom. The desks of the learners were arranged in three rows from the back to the front of the classroom.

#### **4.5.2.2 Teacher D**

The participant's name in this study was Teacher D. Teacher D was a male in his 28<sup>th</sup> year of teaching at the time of data collection (2013). He had come to School D through the promotional post of Head of Department (HoD) the previous year. That meant that 2013 was his second year of teaching at that particular primary school. He was also an NS teacher. Before the promotion, Teacher D taught at different schools including a high school. Interestingly, at the high school, Teacher D taught General Sciences (which was the subject name used during the Pre-1994 Education System), NS and Physical Sciences, especially in grade 10, despite not having a science teaching qualification (see Table 3.1 in Chapter 3). He displayed a real a passion for science.

#### **4.5.2.3 Practical task observation 1**

The practical task presentation started during period number six at 10h58 and ended at 11h20. Teacher D welcomed and allocated me to a desk at the back of the class where I was able to see the learners and the teacher very well. Grade 7 had ten learners registered, four girls and six boys in the current academic year. During the observations, Grade 6 and 7 learners were combined totalling twenty three. Boys and girls shared desks.

Teacher D started by introducing the NS theme which was the separation of mixtures and he wrote it up on the chalkboard. Before starting with the presentation, the participating teacher revised a lesson he had previously taught about substances that dissolve in water. I noticed a small table placed against the classroom wall near the chalkboard which had apparatus on it for use during the demonstration. The apparatus included a plastic plate containing some bean seeds, a glass beaker, a mug, a sieve and a 500ml bottle of tap-water. The teacher only introduces each apparatus as they were used in the experiment.

Teacher D then informed the learners that mixtures were to be separated from one another. The learners quietly listened to the teacher as he taught. The teacher explained that bean seeds and sand were to be separated first as the bean seeds were going to be mixed with sand and then the learners were expected to take the beans out of the sand. Without hesitation, the teacher held a plastic plate containing some bean seeds in his hand and explained the contents. He explained that there was a method that could be used to separate bean seeds from sand, which was hand sorting.

Before the actual practical task demonstration commenced, the teacher sent one girl out of the classroom to collect sand in a glass beaker. The teacher proceeded to mix the sand with the tap-water, then he stirred with a spoon while the learners observed. Teacher D kept on saying to the learners: "Do you see that the sand does not dissolve?" And indeed the sand failed to dissolve. Realising that sand does not dissolve despite stirring, Teacher D explained that sand is insoluble. Consequently, the teacher introduced the method used as settling and decanting.

Apart from settling and decanting, Teacher D also demonstrated the sieving method. At first the teacher picked up a sieve and asked the learners to name the item. The learners said “sefo” which is its name in vernacular. Teacher D picked up a mug with a mixture or a solution and poured it into a glass beaker while standing close to chalkboard, yet far from the learners. Later, the mixture was brought close to the learners seated in the front of the class. Ultimately, the learners identified the mixture or the solution as tea as the teacher kept hinting that it was something they drank everyday at home. From there, the learners were able to name the materials used to make tea - tea bags, hot water, sugar and milk. The learners also revealed that they knew that tea bags contained leaves. Teacher D explained that if the tea leaves and hot water were mixed together they would result in a tea solution. To separate the two mixtures or solution, the teacher used sieving or sifting. Sieving or sifting is another method for separating tea leaves from water.

Lastly, the teacher explained the concept of evaporation. He indicated that evaporation is another method used to separate mixtures. Although he did not have the apparatus to demonstrate it, he explained that they would learn more about evaporation throughout their education. The teacher returned to the second method of separating mixtures by collecting the glass beaker in which the sand was mixed with water. Handling the beaker with great care, the teacher walked to the front of the classroom and stood close to the learners. He pointed to the sand settled at the bottom of the glass beaker and the water which remained visible on top and said to the learners: “Do you see that sand and water are not mixed?” The learners indicated that they did. After pointing this out, the teacher used a 5 litre bucket to pour in the tap water. This was explained as decanting, which is similar to the settling and decanting method. The teacher explained that a filter paper can be used to separate the sand from the water apart from the settling and decanting method.

In conclusion, the teacher named the five methods and the learners repeated these after him. This exercise was repeated more than twice. Finally, an assessment based on what the learners had observed was given. The learners were expected to use a chart and draw or indicate the three methods that they could use to separate a particular material from a mixture. However, the learners were not supplied with charts, rather, they were instructed to write the work in their scribblers.

#### **4.5.2.4 Practical task observation 2**

This NS practical task lesson addressed dissolving. The main objective was to identify substances that dissolve in water and also the factors that affect the rate of dissolution. During the second visit, I was welcomed and provided the seat that I had used during the first observation. The lesson started during period number six at 10h50 and ended at 11h25. Only 17 learners from both the Grade 6 and 7 classes attended the presentation.

Teacher D informed me that he was going to do the practical task lesson he had done a week ago. Before embarking on the theme he chose to revise the methods used to separate mixtures, which was the lesson taught the previous day. Ultimately, he introduced the methods as hand sorting, sieving, evaporating, filtration and distillation and the learners repeated these after him. Soon after he had finished with the revision of the previous work, the teacher instructed the learners to assemble around a small table which was at the front of the classroom. I soon realised that the learners were interested in seeing what Teacher D was about to do, the learners were eager to occupy the closest positions to the teacher.

On top of the small table there were apparatus, which included three glass beakers, a thermometer, a kettle containing hot water, salt crystals of different sizes and ice tubes supplied by a learner from home. The teacher introduced the apparatus one by one depending on the exercise that was performed at the time. When the learners gathered around the small table, the teacher started his demonstration. I observed every step very closely. Firstly, the teacher poured tap-water inside two of the glass beakers which he marked A and B respectively. Furthermore, he added a small quantity of small salt crystals into glass A and also a small amount of bigger salt crystals into glass B. Meanwhile both the teacher and the learners waited for the outcome of the experiment, the teacher then asked the learners to guess which crystals would dissolve faster between those of glass A and those of glass B. Although the learners guessed right, the teacher however encouraged them to observe the process.

Secondly, the teacher informed the learners of the factors affecting the rate of dissolution, for example, the size of the crystal was given as one factor that affects dissolution. While elaborating on the size, he noticed that the crystals in glass A had dissolved completely. Therefore, Teacher D asked the learners to explain why the crystals in glass B were still visible even though the size had decreased gradually, which one answered correctly. In support of the learner, the teacher confirmed that the smaller the crystals, the faster the process of dissolution would take place.

Stirring was subsequently introduced. To demonstrate how stirring increased the rate of dissolution, the teacher added a quantity of crystals into each of the two glasses marked A and B. After stirring for sometime, the teacher handed the spoon over to one of the learners to stir. For the first time in my observations a learner was involved in performing a practical exercise. Eventually, there was no evidence of salt crystals in the glass beaker marked A, while glass beaker B still contained salt crystals the reason being that stirring had increased the rate of dissolution.

The third factor to increase the rate of dissolution is temperature. To demonstrate this concept, the teacher started by showing a thermometer and asking if the learners had ever seen one before. Some of the learners responded that they had seen a thermometer at the local clinic. Other learners claimed that they had seen it at a hospital. Furthermore, the teacher explained that nurses and doctors use a thermometer to measure the body temperature of a patient. Apart from that, the teacher clarified what the small lines and numbers on the body of a thermometer stand for, which is to record information about the temperature of a person or a particular object.

Teacher D demonstrated the practical activity while the learners observed. He immersed the thermometer in a glass containing tap-water and then asked one learner to announce the temperature reading to the whole class. At that point the temperature reading was 20 degrees celcius. The teacher pointed out that the reading represented the classroom temperature. He further demonstrated how temperature is measured by firstly pouring tap-water into the glass marked C and adding some salt crystals, followed by immersion of the thermometer. In glass B he put some ice tubes and salt crystals followed by immersion of the thermometer. The

same practice was done in glass A, but this time hot water was applied to make the difference. The overall intention was to see which crystal were the fastest, slow and the slowest to dissolve. Moreover, the temperature readings were recorded. Although the learners struggled at first, they managed to read the temperature with the assistance of the teacher eventually. The results indicated that the temperature in glass C was 20 degrees celcius, glass B was 10 degrees celcius and finally glass A was 55 degrees celcius.

Besides this, there was a significant change in all three glasses, that is, A, B and C. The change discovered was that the crystals dissolved quickly in glass A, slowly in glass C and extremely slowly in the glass marked B. However, the crystals were still visible in all the glasses. The only noticeable difference was the change the size of the crystals in each glass. Initially, salt crystals of bigger sizes were used in each glass. The consequences of the practical activity done indicated that salt crystals dissolve much faster in hot water than in cold water or tap-water.

To summarise, the teacher explained that temperature refers to the degrees of warmth or coldness of a substance which are measured in degrees using a thermometer. That means that the unit of temperature is degrees celcius. Therefore, temperature serves as another factor that increases the rate of dissolution. Finally, the teacher warned the learners not to play with a thermometer because it contains a very dangerous substance called mercury.

In conclusion, an assessment of three items was written on the chalkboard for the learners to copy and search for the answers while at home. Basically, the assessment required the learners to recall the information taught during the practical task. The assessment was presented as:

1. What do you understand by the word temperature?
2. Which instrument or tool do we use to measure temperature?
3. Name three factors that increase the rate of dissolving.

The learners copied the assessment into their books to answer at home.

#### **4.5.2.5 Teacher E's case**

Under this subheading, I describe the environment in which the practical task lessons were observed followed by a brief description of teacher E. Next, I provide the findings from the lesson observations in their order.

#### **4.5.2.6 Description of the practical task environment**

School E was situated on a farm approximately one kilometre from the nearest town. The school was on a small hill near the main road to town and was only visible from the south. The bricks used to construct the school looked like old home-made mud bricks, which made it look dilapidated. Besides this, the classrooms looked smaller than the standardised classrooms in many public schools. Nevertheless, the school had electricity, fences and it administered the governmental primary schools nutritional programme. There was an old structure which was used for food preparation. Although the infrastructure looked old, the school reflected on average as a good organisation. In terms of the governmental schools classification, School E fell under the quintile 1 category due to a poor financial background.

The learner enrolment from Grades R to 7 at the time this study was conducted stood at 405 learners. Annually a large number of the learners at this school came from two townships which were situated on the outskirts of the town. These learners were transported by buses to and from school to take part in their daily educational activities. The learners from the neighbouring farms constituted a small number. The learners in School E spoke Sepedi and Xitsonga as their home languages.

The first and second classroom observations took place in the classroom, which was congested with desks arranged in four rows from the back of the classroom to the front. There was a built-in cupboard, a chalkboard, a notice board at the back of the classroom and a big table. The notice board had a science poster, a calendar for 2013 and different pictures pinned to it. Besides these, no evidence of scientific pictures, posters or objects could be seen anywhere in the classroom.

#### **4.5.2.7 Teacher E**

Teacher E started his teaching career in 1993. He was open, welcoming and presentable, and was also an athlete who participated in South African marathons. He had twenty years of experience in teaching NS. He had taught the subject to

Grades 4, 5 and 6 for the past seventeen years. At the time of this study, he was in his third year of teaching NS to Grade 7 learners.

#### **4.5.2.8 Practical task observation 1**

The NS practical task presentation started during period number five at 10h10 and ended at 10h25. Teacher E welcomed and allocated me to a seat next to the big table in the front of the classroom near the chalkboard. This position enabled me to face the learners head-on. The learner enrolment in Grade 7 was 56, thirty girls and twenty boys. None of the learners were absent on that day. Both boys and girls shared the same desk.

Teacher E introduced systems of energy as the theme prepared for that day. Firstly, he revised the lesson taught previously. Teacher E announced that he had taught this subject to these learners when they were in Grades 4, 5, 6 and then 7. This implied that energy sources had been dealt with for the past three years consecutively. The teacher wrote the names of the sources that learners provided on the board. The list included the sun as the main source of energy, a battery or cell, wood, coal, gas and falling water.

Afterwards, Teacher E explained to the learners what systems of energy entail. The term system refers to things that work together. In addition, the systems store and supply energy. Teacher E also spoke about the forms of energy with specific reference to kinetic energy and potential energy.

Furthermore, Teacher E indicated that a battery is one system that stores energy. I observed him picking up three battery cells tied together on a plank with a thin piece of wire which was silver in colour. While he unwrapped the batteries he apologised for not having a globe and a cable, and it also turned out that the batteries were exhausted and could not be used to perform the demonstration. Instead, Teacher E tried to explain what was expected to happen if the batteries were in working order. He held one battery in his hand and explained that if a copper wire is connected on one end of the battery and a globe on the positive end, it would make light and that would indicate that the chemical energy stored in the battery had been transferred into light energy. The implication is that the system (the battery in this case) in

possession of chemical energy, which is in the form of potential light, changed to kinetic energy and then to light energy. This is the reason why a battery can be referred to as a system.

Additionally, Teacher E collected three rubber bands on the table and handed them over to three learners, two girls and a boy. The rest of the class discussed the fact that the rubber bands stored potential energy. Later, the three learners were instructed to make the rubber bands fly. Each learner did that by first stretching the rubber bands between their hands and then releasing them. While these three were doing this, the other learners observed them.

To further prove his point regarding the workings of a system, Teacher E explained about gravitational energy. Gravitational energy is a form of energy that makes things drop and is released by the earth. He gave an example of how volcanos and earthquakes operate. Gravitational energy was demonstrated in different forms. First, Teacher E threw a piece of white chalk up followed by a textbook which all fell down to the floor. In support of this, he gave an example of papers that are carried by a cyclone. Secondly, he instructed the learners to jump and touch the ceiling. Of course, they tried it in a noisy manner. In conclusion, he explained that anything that is thrown up will eventually come down because of the force of gravity.

Finally, Teacher E explained about chemical energy. He used food as his example of a system. Food stores chemical energy that is transferable to other forms of energy like kinetic energy. In conclusion, Teacher E repeated the sources and forms of energy as well as the systems that store energy. Lastly, the learners wrote an assessment in their class workbooks. The assessment said the following:

1. Give me four forms of energy.
2. Explain what kinetic energy is.
3. Explain what potential energy is.
4. Where does gravitational force come from?
5. Which energy does elastic rubber has if put on the table?

#### **4.5.2.9 Practical task observation 2**

The second NS practical task presentation started during period number six at 10h36 and ended at 10h57. I received a warm welcome from both Teacher E and the learners. I was offered a seat at the front again, this was probably due to the small size of the classroom. The classroom looked exactly the same as in my first observation. The number of learners present day was 54. One girl and two boys were absent.

Teacher E introduced the theme energy transfer to the learners. It is important to note that Teacher E did not intend to do any practical task that week, however, he did practical tasks for my benefit mainly because in my communications with him I requested that he carry out practical tasks for my observations. On that day, Teacher E started by asking whether the learners had brought the projects he had asked them to bring to class. The learners in possession of the projects were informed to take them out while others went out to collect their projects.

Teacher E quickly revised the work done previously, that is, sources of energy. Afterwards, Teacher E requested the learners to tell him about the items he had requested them to bring. He wrote a list which included a battery, a bulb, wire, a switch, a motor, a card-box, a rubber band and a set of wheels. Teacher E then instructed the learners to form groups. Consequently, six large groups were formed. A group comprised of three boys and five girls. Each of the groups was requested to have a motor and a bulb. The motors were small in size. Surprisingly, I noticed that Teacher E did not allow the girls in the class to handle the motors.

The learners had to perform two activities: first, each group had to supply the bulb with light followed by the use of a motor to move the wire car. The group that completed the activity first had to delegate one member to demonstrate the activity in front of the classroom. Each group was allocated five minutes to arrange and connect their projects. Eventually, two learners, a girl and a boy, from the group that completed the task first came to the front. The girl connected the globe and light began to shine. The boy followed with a motor and the wire car. The wheels of the wire car were made of cooldrink caps. After being connected, the motor turned noisily and immediately the wire car started to move. Only three groups were represented.

Furthermore, Teacher E produced a dynamo which was not functional due to a dead globe. While narrating the challenge he faced, one boy approached him with a screw bulb and handed it to him. Teacher E connected the bulb to the dynamo and it started to shine light. The learners watched what the teacher was demonstrating with great interest. Because the school siren rang when the teacher was busy demonstrating how the dynamo operates, the lesson was then forced to cease immediately.

## **4.6 Semistructured interviews**

In supplementation of the lesson observations, I interviewed each teacher in a formal setting. I started the interview process with what I regard as the build up talk, which helps the interviewees to feel free to respond to the forthcoming questions. Brown and Dowling (2001) view this practice as initial stimuli-questions or activities which create a path for active engagement. An example of build up talks is the use of greetings coupled with jokes; a short explanation of how you as the researcher value both the occasion and the interviewee amongst other examples. The findings from the teachers are presented separately to provide the reader a clear understanding of the events.

### **4.6.1 Teacher A: Post-observation semistructured interviews**

The interview was arranged for 14h30 after school, but I arrived at School A 15 minutes before the scheduled time. Besides honouring the appointment, I wanted to ensure that I did not disturb other activities which the teacher might have planned to do thereafter and it was very important to guard against unnecessary disappointment, such as arriving when the teacher had just left the school premises. Arriving at the school, I went straight to the office of the principal. Since the principal was not present in his office, I then went to the deputy principal's office and found her busy with one of the teachers. The deputy principal welcomed me and directed me to Teacher A's location. I found Teacher A busy monitoring five girls who were sweeping a classroom. Teacher A requested that the interviews take place in my car, which we did.

Before starting the interview process, I reminded Teacher A of the ethical considerations binding the research project and also that the digital-recorder would be switched on to help me capture the information he provided. The interview started at 14h35.

Teacher A responded briefly to the first interview question that he consulted numerous sources when he designed a lesson plan for a practical task. He consulted a work schedule or pace-setter for NS, a learner's textbook, a teacher's guide and a booklet. Teacher A mentioned that he usually used the lesson plans in the booklet. If there was nothing in the booklet, he then prepared a practical task lesson. I noticed that his voice gradually got softer when responding to the question. This is how he responded: "I just, eh.....isn't that I gather all the information needed or the materials needed to use. And from there the learners are involved in practical. After showing them how to do this thing then I involve them. They also do".

Teacher A explained that he first gathered all the information needed before integrating a practical activity. According to him, an explanation of the lesson and expectations preceded the actual presentation. To make the lesson effective, Teacher A indicated that he made use of apparatus and involved the learners by getting them to do parts of the activity with him. However, lack of apparatus was a major systemic barrier. Teacher A complained that although he sometimes compromised and purchased some of the equipment needed to demonstrate a practical activity, the school management often took a long time to reimburse him. To prevent such a strenuous situation whereby reimbursement takes time, which made practical activities possible, Teacher A claimed that he resorted to asking the learners to bring some of the equipment that they could bring from home.

Yes, there are some challenges whereby some of these practical activities that I have to do with learners there are no other apparatus to be used. The school does not have. So, it is a challenge because I have to involve learners to bring along other things.

In addition to this, the teacher indicated what he did as an attempt to solve some of these challenges. It seemed as if the teacher did something to alleviate skills development challenges, although some of those challenges were continuous.

Ja. It is a matter of consultation with the management most of the time. And then sometimes the management do help, sometimes you find that it is also difficult for the management as you know the resources of the school, especially money issue. It is a long process. The other thing you find that you end up using your money and in order to be refunded, hei,..... it is a process also. This is how we suffer when we do these things.

The preceding statements provided evidence beyond reasonable doubt that the teacher at times encountered challenges when he had to organise apparatus. A lack of apparatus was not the only barrier, there were other serious systemic and contextual barriers towards learner skills development which Teacher A experienced.

Ja, sometimes. The time that we are given for the period is 30 minutes. This practical work needs time so that these learners can really touch, feel and can do all these other things on time. So, we don't have time because when the period is over is over. So, these 30 minutes to me I don't think it is enough for practical works. And the other challenge is when these learners..... Isn't it that sometimes we use them to go out and find one, two, three? You find that sometimes they do not come with those things.....You find that only two learners have this. And you cannot work with two learners while others are watching.

Furthermore, Teacher A reported that apparatus were introduced to the learners one by one whenever they were available. In case the apparatus needed to be assembled, he did that first during class with the learners observing the process. Where possible, the learners demonstrated the activity later. Teacher A put it this way:

Ja, learners. They first.....they watch what I am doing when I assemble or maybe I introduce the apparatus. They just listen and watch. You see. So, from there I want them also, if possible, to participate by means of maybe assembling the apparatus, touching the apparatus, touching the results, the conclusion and so on. So, thus how I....

The teacher openly indicated that he had not yet done much in as far as practical activities were and gave no reason for this. Unfortunately, I only realised later that I

should have asked him why. In response to my question regarding assessment of the process skills, Teacher A pointed out that assessment followed each task immediately after completion. He usually provided assessment in the form of written work which was either done in class or at home. As for using a rubric, Teacher A openly indicated that he did not quite know how to use a rubric. This created the impression that Teacher A never used a rubric to assess the development of abilities in the learners. However, Teacher A reported that he designed formal assessment instruments and the head of the department (HoD) moderated these. Additionally, Teacher A was responsible for controlling the written assessment, recording the performance scores and giving the learners feedback.

Finally, I requested the participating teacher to ask any question or make comments based on the interview process. He commented that he enjoyed the interview. This is what he had to say:

You know, I enjoyed this because it is about my work. It makes me wake up on other things. So, I really like it like this. It is your work, but I have adopted it. I see it is my work because I know some of the questions when you ask me, some of the things when you need from me, I turn up and stand up and go and look at. When I know it, I become happy. You helped me also. In short, what I can say is that I am happy.

I thanked Teacher A for spending some of his profitable time sharing his practical task experience with me. From there, I switched off the digital-recorder and we remained in my car for few minutes to discuss general issues.

#### **4.6.2 Teacher C: Post-observation semistructured interviews**

I interviewed Teacher C in his office, which was small in size and was situated in a corner close to the administrative block. The semistructured interview session was conducted during school hours as per agreement between the two of us. Teacher C welcomed me into his office.

Before the start of the interview process, I reminded Teacher C of the ethical considerations binding the research project and also that the digital-recorder would be switched on to help me capture the information he provided. The interview started

at 12h15 and at first there were noisy learners outside his office which forced him to close the door.

Teacher C responded well to all the questions. In response to the first interview question, Teacher C indicated clearly that he spent a lot of time thinking about what he aspired to do in the classroom. With regard to planning a practical lesson, Teacher C first paid special attention to what the module was about. The module embraced the practical activities to be taught to the learners. Thereafter, he gathered a lot of information on the theme by consulting various sources ranging from the teacher's guide to the learners' guide, the copies he had been using for many years, the internet and also the curriculum and assessment policy documents. Furthermore, he consulted with other colleagues and he even invited the opinion of his wife on specific themes.

The steps which Teacher C outlined regarding a practical lesson design portrayed time as important to whatever he did. The reason why he spent so much time thinking about each theme was to try to make the lesson as practical as possible. In his response, Teacher C emphasised that "When you plan for a lesson, especially in science...natural sciences or science, when you plan a lesson, you should look at everything as early as possible to try to teach the children".

The key issue Teacher C illustrated is commitment and aspiration to deliver a fully fleshed or detailed lesson. The greatest ambition of the teacher is to see the learners developing scientific skills. He reiterated that "...When you plan a lesson in science, it must be practical as far as possible to help them to know the work".

Teacher C's greatest secret in the integration of practical skills was to start writing a lesson plan when he was completely satisfied that he had consulted and collected all the resources. The activity of putting down information on paper was informed by the information he had at his disposal. He explained that he designed a practical task lesson in accordance with the expectations of the department of education, although he used a format compiled by the school (see appendix E).

Teacher C reported that he designed a lesson plan taking into account the old scientific methods, by this he was referring to giving preference first to the aim,

objectives, apparatus, observation and then the conclusion. This meant that he first considered what the problem was, then he considered the apparatus required to perform the demonstration. In the next stage, he would direct his attention to the delivery of the information. Lastly, he would conclude by checking whether the question was well answered by all the above efforts. Some points stated in his response are:

...It is all about planning. The aim or the problem first and the apparatus or equipments that you need to have, then the methods. How are you going to do the observation? You sit in and you work out for yourself. How is this gonna work? And then the last thing of the scientific methods is conclusion. What happened? Did I answer the question or the problem from all the stuff? All I am working a lot with is the scientific methods when I prepare a lesson...?

Teacher C considered spending much time organising and making arrangements very helpful in the sense that easy ways of putting the lesson into practice would come to light. To successfully integrate practical tasks into his teaching Teacher C, used activities that were practical and observable. Additionally, Teacher C indicated that he attached evidence to his teaching as much as possible in the form of giving the learners practical examples, especially regarding the fact that science is a living subject.

....When you plan the information that you wanna give to the children, you want the learners to know. When you are busy planning you bring in practical frame because science is a living subject. For each statement of that particular lesson, give to the children. So, it is very important while you are thinking about the stuff or information that you want them to know. Think about some practical stuff, for instance, minerals. I discussed now with them. Now I can't just tell them light being dim that it shines or bright. You must bring in examples, things to show them because learning from general statements is not enough. They must be showed the stuff.

Besides this, he took the learners into account when implementing a lesson. Teacher C stated that he considered and aligned himself with the standard and level of the learners' understanding. Teacher C considered himself as a mere communicator or facilitator. On this note, he usually started his lesson by strategically gaining the

learners' trust. To Teacher C, the overall aim was to create an environment that was conducive to teaching and learning. Teacher C's advice for making a lesson more effective was that, despite all the difficult situations that a teacher may find themselves in, a teacher must be sincere and passionate about their job. In other words, a teacher has to admire his or her work with all his or her heart. As long as a teacher admires their work, then they will find it easier to get through to the learners. Teacher C stated that getting through to the learners yielded successful results.

You have to change your heart and your mind and go to the level of the learners. You cannot speak as an arrogant. You are just a communicator, you are a facilitator. Teacher should teach or speak from his heart. So, I have to make a joke to the children. I tease them. Just to get them relax. I totally believe you have to go down to the standard or level of the children. Then, there is where your lesson is going to be successful. Even if you are at home, you stood up from bed with the wrong foot or whatever or you don't feel well. Even if you are sick, you must be a teacher from your heart 100% perfectly. You have to teach the children. You have to speak to their hearts not to their minds. You cannot stand there with sickness, disappointment or problems of your colleagues or whatever. Then it is the start of success of your lesson. If your heart is really pleased the learning atmosphere will be good. So, the success of your lesson starts there. And everything will come.

Significantly, learner involvement was indispensable to Teacher C in every successful lesson. To maintain continual learner involvement in his teaching, Teacher C developed certain effective strategies. Firstly, the learners worked in small groups of four members each. Each group had a leader, a records keeper and a time keeper. The group leader had to be someone who was knowledgeable and he or she was identified through academic performance, especially diagnostic assessment, at the beginning of the year. The leaders always sat in the same position annually. That meant that their positions were not interchangeable. Next to each leader, Teacher C would place a learner who was struggling with the subject.

The learners in each group worked together and were urged to consider themselves as one team working towards a common goal. Therefore, the sharing of information and helping each other was very important to the group. They all had access to the apparatus.

Another strategy Teacher C used to integrate practical tasks successfully was to introduce the odd apparatus were to be used throughout the academic year to the learners, particularly at the beginning of the year. When Teacher C presented a practical activity, he firstly organised and demonstrated how the apparatus operated. That helped the learners to handle and use the apparatus with confidence.

Certain apparatus are harmful to human life, so to prevent any health risks, Teacher C mentioned that he explained right from the start how the apparatus involved were supposed to be used. Explaining and demonstrating to the learners how equipment operates is considered helpful in the sense that a risk free teaching and learning environment becomes possible. When introducing bromothymol blue to the learners, Teacher C warned them not to touch or swallow the substance because of its harmfulness. Evidence of what Teacher C said during the interviews was realised when he filled the test tubes himself with the substance in question during my observations. Above all, each central table in each group had laboratory rules pasted on it. The visibility of the rules helped the learners to remain alert for the danger most of the time.

Sometimes teaching practical activities can be challenging. Teacher C reported that in case he did not have the appropriate apparatus at his disposal, he would consult with his colleagues at neighbouring high schools or on the internet. In his response he said, “There are apparatus that you can use for every lesson. ....because science is about everything, so, you can. If you really want to work hard you can find aids or apparatus from anywhere”.

Teacher C pointed out that the information that learners absorbed during demonstrations was recorded by a scribe. Moreover, the learners used a worksheet which included questions about the lesson taught. To find out how successful the presentation was, Teacher C indicated that he would ask the learners a few questions about the work done in the past. However, Teacher C emphasised that he did not assess the learners simply for reports or reporting purposes. The key issue was to understand whether the learners knew and were capable of doing what he wanted them to be able to do. Teacher C said in response to the interview question:

And if they get 80% and more, the rest of the class, then I feel good because I can see that I was teaching. My teaching was good. So, I am testing a lot. But, not always testing for marks, for the reports or reporting stuff...

The implication was that Teacher C assessed the learners several times using different styles. Teacher C explained that he assessed the learners verbally, informally and formally with the intention of seeing what the learners knew or did not know yet, rather than assessing them simply to obtain scores. Sometimes Teacher C gave the learners a card game to play where they had to match words; they would receive fake marks per group. This is what Teacher C said regarding this activity, "There are cards they have to use to match words after a lesson. This is a kind of test I give the learners. If they can match all the cards with the words, then my lesson was successful....".

Of course Teacher C acknowledged that most of the learners wrote formal common tasks. The tasks were common in the sense that they were supplied by the Department of Education for all the Grade 7 learners in public schools to use. However, Teacher C controlled the work of the learners by marking it.

At the end of the process, I thanked Teacher C for the time he had spent providing me with the information that I was looking for, starting with the observation session. Teacher C promised to assist me in future if anything required clarifying.

#### **4.6.3 Teacher D: Post-observation semistructured interviews**

The appointment was arranged for 13h00, but I arrived at 12h30. Entering the school premises, I met the principal who was ready to leave. She indicated that Teacher D was waiting for me in his office. Indeed, I found Teacher D ready for me in his office. Later, the teacher invited me to accompany him to the class arranged for the occasion. On my arrival I realised that the classroom was the one in which the two lesson observations had been conducted.

Before commencing the interview, I then took some time to remind Teacher D of the ethical considerations binding the research project and also that the digital-recorder would be switched on to help me capture the information that he would be sharing

with me. Teacher D clearly explained that he used a variety of resources, for instance, the National Curriculum Statement, the Pace Setter and also a newspaper called “The teacher”, as well as the learners’ textbooks when preparing a practical task lesson. Sometimes he accessed information regarding planning a practical task lesson for Grade 7 learners from the internet. Clearly the resources, particularly the NCS for the Natural Sciences policy document, the pace setter and the learners’ textbooks helped him to identify the practical tasks fit for Grade 7 learners.

Teacher D was convinced that it was only through these resources that he became exposed to different practical task teaching methods. The knowledge he gained from these resources further assisted him to easily address the challenges he often experienced when teaching small children like the Grade 7 learners. He cited the alignment of his teaching approaches to the level of the Grade 7 learners as a major problem. According to him, the problem resulted from having more experience teaching high school learners.

Fundamentally, Teachers D explained that he designed a practical task lesson his own way using a college exercise book. As such, he considered himself as someone who did not use a formal way of planning, “Today’s lesson tomorrow can change after realising the mistakes that I did. I don’t have a formal way of preparing a lesson plan for a practical activity...”. The key issue was that the teacher prepared in his exercise book rather than using the template supplied by the Natural Sciences subject advisor. Finally, and very importantly, Teacher D strongly emphasised that when designing a practical task lesson, he gave a lot of thought to the apparatus to be used during the presentation. Accordingly, the engaging apparatus when demonstrating a practical task was indispensable to Teacher D. Therefore, Teacher D urged that apparatus make a practical lesson more effective as the learners did not easily forget what they had learnt. Teacher D seemed to be committed when it came to the accessibility of apparatus.

Actually for practical activities, I disregard the fact that I don’t have apparatus. So, I do improvise. Before I look at what I have at my disposal. If they are not there, I go to the neighbouring schools and inquire about the particular apparatus [...] If they don’t have, for instance, instead of glass and use [...] I have realised that teaching

the practical part of the science using what you have is easier than explaining to kids theoretically. They even attach me with the apparatus that I use. One learner once saw me coming and told the other learners that Mr Thermometer is coming. Apparatus make the lesson easier for the teacher to present. It makes learners to attend. And learners don't easily forget what I have taught them.

Importantly, Teacher D indicated that he did not depend on the school to access apparatus on his behalf. Instead, he borrowed or used his own money to purchase the missing items or apparatus, for example, he explained that he bought the sieve used during the first observation lesson, he substituted a glass beaker with an ordinary glass of water and he also explained that once he borrowed a circuit board from a neighbouring former college education institute.

Another strategy Teacher D used when there was a lack of apparatus was to use any object that seemed to relate to the original apparatus. The fundamental idea was to use apparatus during the teaching and learning of practical activities.

Somewhere.....Eh..... Fortunately, we do have nutrition programme at school. They do eat beans, rice and samp. So, when you come to mixtures, take different things. Take samp, take some beans, and mix them. .... They will say a samp, beans,..... Now, do you have any way of separating the samp from the beans? They will say I just pick beans from samp. So, that is very much simple.

Analytically, Teacher D seemed to be creative when it came to the point of practical task integration. One indicator of creativity was the explanation he gave in terms of how the National Schools Nutrition programme (NSNP) can be used to benefit the learners during practical task demonstrations. The examples he gave underpinned the point that apparatus played a pivotal role in his practical task presentations and that any lack of apparatus did not present a problem.

There were, however, other challenges that Teacher D encountered when integrating practical tasks into his teaching. According to him, the most serious contextual problem he often experienced was that the learners did not always understand and use instructional language properly, which caused complications during teaching and learning. This challenge was exacerbated by poor foundations

set in the foundation phase. There were some English words which could not translated into the learners' home language (Sepedi) to help them understand, yet, the teacher was eager to use such words and help learners understand them.

The challenge is there. One is to explain an English lesson in a mother tongue. I realised that most of the learners still have a problem. They still not understand English. So, to mix mother tongue and English, may be say for few or 10 minutes, but I found that it is difficult when teaching learners practical thing. Maybe, thermometer, I do not know what I am going to say thermometer is in mother tongue. Another thing is that learners, when, maybe you presented a practical lesson, when you ask questions instead of answering what they have seen, they will just tell you the names of the apparatus you have used, to say a thermometer. Let say, you have asked them a question: Which instrument do you use to measure temperature? They will not say thermometer. They will say coldness or hotness coldness or hotness. What is that? Which instrument? Which tool? But you find that you say tool; the learner doesn't understand what you are saying.

However, Teacher D attempted to solve or minimise some of the challenges he encountered, but certain situations forced him to explain a practical task theoretically, for example, Teacher D explained that he visited a neighbouring high school and a chemist at different intervals looking for iodine solution to test starch but could not find it.

When conducting a practical task, Teacher D explained that he took into account what the learners already knew. The key issue was to use the materials with which learners were familiar. In response to how he exactly integrated a practical task in the classroom, Teacher D indicated the following:

Hm....., starting from what the learners already know. .... when they come to school some will say we ate soft porridge. And I ask them. Which ingredients did you make or did you use to make soft porridge? Some will say mealie meal, hot water. We boil that. Ja., no. Explaining the word mixture will be easy. What is taught in class is related to what you do at home. So, that gives me satisfaction of explaining what mixtures are because I already know what they know.

To make his lesson effective, Teacher D claimed that he involved the learners in executing practical tasks. The learners handled and utilised the apparatus during the practical tasks. Before any equipment was used during a demonstration, Teacher D indicated that he would show it to the learners so that they could tell him if they had ever seen it before.

You ask them. Just rise up the apparatus. Ask where they have seen it. .... just like the thermometer. Where have you seen it? Although it was a big thermometer, some said at the clinic. I said what did they do with this at the clinic? Some said, they put it under the tongue. Some said under the armpit. What are they actually doing? To check as to whether I am sick. Then you know that the child has an answer. To see..

Fundamentally, the teacher avoided centralisation of the lesson, which is imminent especially when the teacher has a habit of doing activities while the learners are mere passive observers, “The involvement. Do not allow that as teacher that the lesson must be centred only on you. Give children to do the experiments while you are busy monitoring”. Furthermore, the teacher confirmed that he explained to the learners well in advance if ever a particular equipment or object to be used posed a danger to their lives. He assumed that the lower grades, comparing primary and secondary schools, had no activities that were harmful, and in such cases, the presence of the facilitator or teacher was important.

Fortunately, in these lower grades there are no activities that are harmful. So you can just give children to do that while you are busy monitoring so that you correct their mistakes, because they don’t do activities that are harmful to their health. So, in classes where now you have to mix maybe hydrochloric acid, where you use acids, you must be very much strict. Do not allow children to do those practical things on their own.

Finally, Teacher D explained that he usually assessed the learners to check whether they had understood the lesson. Although Teacher D was aware that the development of process skills in learners could be successfully measured through a rubric, he did not rely on one due to his large workload as HoD. For that matter, he designed the assessment instrument and also used the workbooks supplied by the government. Teacher D allowed the learners to control their own performance. What he did was simply to check and give it his signature.

#### 4.6.4 Teacher E: Post-observation semistructured Interviews

I interviewed Teacher E in my car at 12h58 due to the fact that all the classrooms were being used at the time, and that it allowed him to get to his public transport sooner when it arrived. As usual, I started the interview by reminding Teacher E of the ethical considerations binding this research study and also that a digital-recorder would be switched on to help me capture the information that he would be sharing.

In response to the first question, Teacher E pointed out that he used a pace-setter or work-schedule and the Natural Sciences textbook as guidelines for designing a practical task lesson. He gathered all the materials applicable for the execution of the practical activity before presenting the lesson. In most cases, Teacher E integrated practical tasks theoretically. In other words, Teacher E would first explain the practical activity without using any apparatus and where possible, the practical demonstration would follow later. According to him, theoretical teaching gradually develops into practice. Teacher E argued that explaining a practical activity theoretically helps to equip the learners with scientific knowledge. Apart from that, the school had no science resources like apparatus or a laboratory to practise skills development effectively. In response he said:

Ja. If the apparatus are not there we just leave it. Because you will go around, if you need a methane and methane is not here, you want to go to another school and you find that there is nothing there at the neighbouring schools you just leave it. And you teach theory.

Usually, Teacher E resorted to teaching practical skills theoretically, particularly when apparatus were not available. If the apparatus were available, Teacher E indicated that he would prefer to give the learners the names of the apparatus first and where there were apparatus, he allowed the learners to touch and use them on their own. However, he did not allow the learners to contact acidic substances, rather, he warned the learners well in advance in case they had to use a harmful substance. Another strategy that Teacher E used was to divide the learners into small groups and allow them to carry out the activity while he led and assisted them.

With reference to the assessment of process skills development, Teacher E explained his knowledge of assessing learners through a rubric while performing an activity:

In most cases I am using a rubric. If a learner is able to handle particular equipment I allocate a score. And they know. First before we do that they need to know that there is a guideline, a rubric that is going to help us. He or she knows very well that if I come with the apparatus, I connect this.....I do one, two, three, the rubric will be used.

However, Teacher E explained that he had been using the same rubric from Grade 4, 5, 6 and at the time, 7. The assessment instrument, particularly the rubric he used, had not been reviewed for the past three years. Teacher E, in addition, said that he copied some of the assessment instruments from the textbook. On top of that, the school-based assessments were not moderated by the immediate senior or supervisor. What he did was to design an assessment instrument such as a test and give it to the learners to write, "It is a one man's show here. No one moderates. I just do it and give it to the learners to do a practical activity". Documentary evidence showed that Teacher E marked and commented on the work the learners wrote in their exercise books.

#### **4.7 Summary**

In this chapter, I presented the research findings. I briefly described the background of the sampled schools and the specific environment in which the practical task demonstration took place. Additionally, I described how each of the seven principals behaved after hearing that their schools were earmarked for participation in this research study. I valued the information from the schools and the principals as superior in this study. I then presented the profile of each teacher. I further defined the two types of documents which the teachers used as guidelines for NS teaching and learning. The findings which emerged from the document analysis, lesson observations and a discussion of the teachers' responses during the semistructured interviews were plainly indicated.

## CHAPTER 5

### DISCUSSIONS AND CONCLUSIONS

#### 5.1 Introduction

In this chapter, I present the conclusions of the research. Section 5.2 discusses the findings of each teacher's case. Section 5.3 presents a cross analysis of the results. Section 5.4 presents the answers to the research questions, whereas Section 5.5 addresses the answers to the main research question. Limitations of the study appear in Section 5.6. Lastly, I present the recommendations in Section 5.7.

#### 5.2 Synthesis of each teacher's case

In this section, I present a discussion of the body of findings for each teacher separately. The findings included were generated through the application of distinctive data collecting methods, as outlined in Chapter 3.

##### 5.2.1 Teacher A

All of the documents that I accessed from Teacher A appeared in Tables 4.2, 4.4 and 4.5 respectively in Chapter 4, and during the interviews, Teacher A mentioned that the same documents could be found in his file.

The literature highlights that a lesson plan is a detailed document which has to clearly outline the specific skills learners are expected to develop, the objectives, the outcomes, and strategies for achieving those objectives (Barber, et al. 2011; Fisher, 2003; Millar, 2004; Taylor, et al. 2008). In contrast, most of the practical task lesson plans which I accessed were not actually prepared by Teacher A himself (see appendix E). In fact, he provided me with photocopies of the lesson plans which the teachers received from the textbook publishers. Again, during the interview session, Teacher A clearly articulated that he used the lesson plans found in the booklet he often referred to. Actually, Teacher A referred to the package received from the publishers as this booklet.

In terms of the Curriculum Implementation theory (see Table 2.1) underpinning this study, the lesson plans used by Teacher A qualify to be classified under level 1 of the four levels of learner autonomy in science practical tasks and assessment, which are presented in Chapter 2 (Rogan & Grayson, 2003). According to Rogan and Grayson (2003), the activities befitting level 1 do not encourage learners to develop minimum inquiry skills independently. The lesson plans under scrutiny were designed in such a way that the content had to be understood by the learners. When designing such practical lessons, the designer seemed to have ignored the uniqueness of the environments and the level of understanding of the learners who were supposed to develop those specific skills. I concluded that the designer held the belief that “one size fits all” when designing such practical task lessons (du Toit, et al. 2008:42). Furthermore, Teacher A pointed out that he prepared a practical lesson himself when it was not included in the booklet, which meant that Teacher A seldom prepared practical lessons for himself. I concluded that Teacher A’s lack of lesson preparation is an example of the many teachers who do not prepare lessons before teaching them to learners (Bantwini, 2009).

Interestingly, Teacher A presented practical lessons to the learners. Notably, when Teacher A presented a lesson, he usually started by revising the lesson presented previously, followed by an introduction of the theme and the objectives. It seemed that the intention was to arouse the interest of the learners and to remind them of relevant information pertinent to the lesson being taught. In addition to this, Teacher A used the chalkboard to write important points for the learners to read.

The Department of Education (2009) in the US values the importance of using apparatus during the teaching of science. To show that apparatus play an essential role in science, Teacher A attempted to use them as often as possible. Before Teacher A demonstrated particular scientific skills, he preferred to introduce the apparatus even if it meant using the vernacular. He sometimes gave the learners an opportunity to name the apparatus which was organised to develop their skills. It seems that the idea was to familiarise the learners with the apparatus.

A lack of appropriate apparatus for performing some of the activities was still a challenge according to Teacher A. Teacher A explained that he sometimes spent his

own money to buy the resources he wanted to use, for example, methylated spirits. He also asked the learners to bring some equipment from their own homes, and sometimes a few of the learners would bring along such items to class, this indicated a lack of co-operation from the learners. Apart from a lack of apparatus, Teacher A complained about the 30 minute period. According to him, the 30 minutes allocated to teaching and learning practical tasks was too little.

When presenting a practical task lesson, Teacher A would combine explaining and demonstrating approaches. He explained each step to be taken and the possible outcomes of the demonstration. During the lesson observations, I realised that Teacher A handled and used the apparatus himself when demonstrating how a particular experiment works. The learners did not have any opportunity to handle the apparatus. Again, during the interview, Teacher A explained that the learners were only involved when they had to confirm the outcomes of a practical task demonstrated by the teacher. In contrast, the literature shows that learners develop scientific skills much better when they are actively involved in an activity (Frost, 2010; Kotze, 2008; Michael, 2007; Millar, 2004). The reality was that the learners were not afforded opportunities to develop their abilities. I think allowing the learners to do the activities by themselves is a very important step towards the development of skills. Interestingly, Teacher A allowed the learners in a group or individually to stand close to the scene and observe the unfolding events. In turn, a learner(s) who had an opportunity to observe the events at close range was/were expected to report back to the whole class during the demonstration. Simply put, the learner had to report on the events as they unfolded.

Furthermore, Teacher A demonstrated that he was able to prove that practical tasks need not to be confined to classrooms or laboratories only. He demonstrated this when he took the learners out of the classroom to the vehicle parked outside. Similarly, the literature shows that practical tasks are not restricted to a single milieu (Lindemann-Matties, et al. 2009; Millar, 2004; Van der Valk & de Jong, 2009).

Teacher A concluded the practical lessons by giving the learners short written informal assessments which promoted knowledge acquisition. During the first practical lesson observation, he wrote an informal assessment of five items on the

chalkboard and handed out papers reflecting different pictures related to the practical task so that the learners could write their answers in their exercise books.

Regarding formal practical task assessment, the learners wrote school-based as well as general common assessment tasks. The common assessment tasks were general in the sense that practical tasks form part of the entire question paper. By the time this study was conducted, Teacher A had only given the learners one written school-based practical task. The types of assessment that the learners performed support what the literature indicates, which is that the assessment of a practical task is done mainly through pencil-and-paper classroom tests and examinations (Blom, 2008; du Toit, et al. 2008; Le Grange, 2008; Ornsteins & Hunkins, 2004).

### **5.2.2 Teacher C**

All the documents that I accessed from Teacher C appear in Tables 4.2, 4.4 and 4.5 respectively in chapter 4. During the interview, Teacher C mentioned that he used different documents, for example, the teacher's guide; the learner's book; copies of the previous years to gather sufficient knowledge. Evidence appeared in the appendices section (see appendices H, I, M, N, O, P, Q and R). All of these helped to expand his knowledge. According to Millar (2004), teachers are expected to have clear knowledge about the subject matter they intend to teach learners.

A very important document which I accessed from Teacher C during the observation is a self prepared lesson plan. Teacher C used a template on which he indicated the topic prepared in both Afrikaans and English. He mentioned the template designed at the school during the interview. When checking, I realised that the practical lesson corresponded with the practical task prescribed in the pace-setter for that week. Again, the lesson plan includes information ranging from the theme to the roles of the teacher and the learners as well as assessment strategies.

Firstly, Teacher C made sure that the appropriate apparatus were organised and well arranged for the learners to use. This did not mean that he experienced no problem with regard to the accessibility of apparatus. Just like other teachers in the study, Teacher C was sometimes affected by a lack of appropriate apparatus, for

example, he reported to the learners that he could not get alkalis and acid indicators in town. Teacher C explained during the interview that he organised and introduced the apparatus to the learners at the beginning of the year. Before presenting the lesson, Teacher C would revise the work done together with the learners previously, followed by an introduction of the theme and the objectives of the intended practical task. According to Barber et al. (2011), and Ingram (2010), the explanation of the learning objectives is very important.

To protect the learners against any health risks during practical task presentations, Teacher C introduced dangerous apparatus and the necessary precautions to the learners before starting any practical tasks. Essentially, there were written rules about practical task implementation on a piece of paper pasted permanently on each table that the learners used in the laboratory.

Teacher C explained during the interview that he used different strategies to present a practical task. Indeed, I observed those strategies being applied. The literature in agreement indicates that using strategies for the smooth implementation of practical tasks is a necessity (Barber, et al. 2011; Frost, 2010; Millar, 2004). The strategy that Teacher C mentioned and practised successfully during the observation was the division of the learners into small groups of five members each. The literature strongly supports the division of learners into small and manageable groups (Kotze, 2008; Millar, 2004; Shaha, 2011). To actively involve each learner or make the individual groups function well, Teacher C gave some of the well performing learners responsibilities, such as being a group leader or a scribe.

Teacher C explained that all the learners in a group are actively involved in doing the specified practical task. Indeed, I watched the learners handling and using the apparatus under the guidance and supervision of the teacher (Van der Valk & de Jong, 2009). However, this does not necessarily mean that Teacher C never handles and uses the apparatus. He used the apparatus to demonstrate a particular skill in cases where there was only one piece of apparatus available, for example, he used a plastic measuring stick to demonstrate potential energy. According to the literature, learners should be given enough chance to actively participate in skills development

(Frost, 2010; Kotze, 2008; Michael, 2007; Millar, 2004). If the learners are not involved, they end up not feeling an association with science (Olitsky, 2007).

Furthermore, and very importantly, Teacher C gave each group an opportunity to explain the results of the activity done. This was observed during the two practical lesson processes. The Teacher C also asked oral questions during the practical task process to keep the learners on track. Finally, Teacher C rounded up the lesson by asking the learners a few oral questions and sometimes he asked the learners to do an assignment or a project at home.

In as far as practical task assessment is concerned, Teacher C indicated that he consistently assessed the skills developmental progress in the learners informally and formally by means of a rubric. He consistently asked questions to keep the learners on track. The learners also wrote school-based and common assessments required by the Limpopo Province Department of Basic Education and training.

### **5.2.3 Teacher D**

The documents that Teacher D talked about in his file concurred with the documents that I accessed (see Tables 4.2; 4.4 and 4.5 in Chapter 4). Differing from the other three teachers in this study, Teacher D used a college exercise book to prepare his lessons in detail.

In his practical lesson plans, Teacher D included the apparatus and the objectives. According to him, a lack of apparatus was not a serious problem. Teacher D strongly disagreed with the belief that a lack of scientific apparatus is a stumbling block towards decent integration of practical tasks in the science classroom. He explained how any available object could be used productively. Teacher D then cited ice-cubes that can be collected from home and again bean seeds, and samp used for the National Schools Nutrition Programme (NSNP) as examples of items that can be used when presenting practical task lessons, such as decanting and sorting, or separation of materials. In cases where the school did not possess the appropriate apparatus, Teacher D either used any relevant object available or he borrowed from neighbouring schools. Another preferable alternative was to spend money on

purchasing the apparatus, e.g. a sieve. If the apparatus were not available, he would teach the practical task in a theoretical way.

Although Teacher D explained during the interview that he organised apparatus well in advance, during the first lesson observation he sent a girl out to collect sand, however, the rest of the apparatus were readily available on a small table placed in front of the learners. He mentioned issues related to safety after the second lesson observation was completed.

Teacher D started his presentations by introducing the theme, followed by a revision of the previous work. However, he preferred to explain the practical activities before demonstrating them. Teacher D explained the possible results and wrote important points on the chalkboard as the practical activity was being carried out. The learners did not get a chance to handle and use the apparatus, they only observed at a distance while the teacher demonstrated. During the second lesson observation, the learners had an opportunity to gather around the small table and observe events at close range. With each practical task, Teacher D asked the learners to tell him the changes that took place during the process of the activity, however, the learners were involved cognitively and not physically.

Teacher D concluded each lesson by assessing the learners informally. The learners also wrote formal school-based and common assessment tasks, which in most cases include questions about practical tasks described in the question paper. The practical task assessments about which the learners wrote seemed to promote science knowledge acquisition rather than skills development.

#### **5.2.4 Teacher E**

I accessed all the documents which Teacher E used for NS teaching and learning (see Tables 4.2; 4.4 and 4.5 in Chapter 4). Again, Teacher E mentioned the same documents during the interview. When necessary, Teacher E used a template to prepare practical lessons.

A shortage of apparatus at the school often forced practical tasks teaching and learning take place in a theoretical way. Although Teacher E emphasised that he did

most of the practical tasks in a theoretical way, there was an indication during the observations that he tried to organise some apparatus, for example, rubber bands, a dynamo and exhausted batteries. Amazingly, Teacher E had no problem demonstrating a particular skill to the learners using incomplete or exhausted apparatus, for example, he attempted to demonstrate energy change by using exhausted torch batteries. Nothing related to the possible dangers during the handling and use of the apparatus was explained by Teacher E, rather, risk management was explained during the interview.

During the observations, I realised that the introduction of the theme was done first, followed by a revision of the previous work. Once Teacher E completed explaining the activities and their possible results, he would then start with the demonstration. Teacher E preferred to talk about and write important points on the chalkboard. This confirms what the literature says, which is that many South African science classrooms, of which a large number are located in the Limpopo Province, are characterised by the “conservative teaching methods” (Maree, et al. 2006:239) or often referred to as a “chalk-and-talk” approach to teaching (Aldridge et al., 2006:59). Teacher E once allowed the learners to form large groups of more than five members each in order to demonstrate the projects they had made at home, for example, a bulb connected to a motor and a wire car. Again, few learners were given an opportunity to demonstrate a skill in front of the class during the observations. I realised that many of the learners enjoyed performing an activity in front of the whole class. According to Olitsky (2007:35), learners end up not feeling “a sense of membership associated with Science” if they are not given an opportunity to participate during the practical work process. Ultimately, science will not become a component of their identity and, therefore, the learners will in the future be unlikely to seek out interactions that relate to science (Olitsky, 2007).

Lastly, Teacher E assessed the learners informally and formally. Development of skills was measured in the form of allowing the learners to write answers in their exercise books or on a piece of paper in the case of a formal task. Usually, the learners wrote school-based and common assessment tasks. Furthermore, Teacher E explained that he used a rubric to assess skills development in the learners. All of the other teachers, except Teacher A, used rubrics as well.

### 5.3 Cross analysis of the findings

When I compared and further analysed the findings, I realised that the teachers in this study shared certain practical habits with regard to practical tasks integration in more or less the same way. The practical habits include:

**Inadequate practical task lesson preparation:** A comparison and analysis of the findings based on practical task lesson design and presentation illustrated the freedom which the teachers in this study enjoyed, for example, some of the teachers in this study minimised the information so that it fitted within the small spaces available between the subheadings of the templates they had received from the NS workshops. By doing so, the teachers omitted essential information like objectives, strategies for the attainment of the objectives, risk management during the process, and assessment strategies. Freedom is good, but only if teachers utilise it appropriately. Here, the appropriate use of freedom implies that teachers freely prepare and present practical lessons in accordance with the outlined expectations. Conversely, freedom becomes disadvantageous when teachers begin to practise phenomena their own way. In fact, a lesson plan has to be designed in such a way that it provides clear direction toward the attainment of the selected objectives. There is also a tendency of relying on practical task lessons designed by publishers. Although such practical task lessons look good, they are not applicable in every environment, for example, some of these lesson plans included a series of activities accompanied by a list of sophisticated apparatus which some of the schools did not possess. The practical task lesson plans received from Teachers A and B serve as good examples of this problem.

There is a possibility that reliance on the templates and lesson plans from publishers without making adjustments to the documents in question before they are utilised can disadvantage both teachers and learners. In my view, inclusion of apparatus which are not available and the exclusion of essential information like objectives, strategies and the roles of the teacher and the learners when preparing a lesson contribute towards making practical lessons ineffective. The literature states clearly that a well designed lesson plan has to incorporate all the necessary aspects (Barber, et al. 2011; Fisher 2003; Rodrigues, et al. 2010). In fact, teachers are not

supposed to be free to an extent that they only teach their favourite topics, rather they must plan to teach whatever the pace-setter directs them to teach (Aubusson, 1994). A noticeable gap exists between the lessons which some of the teachers in this study prepared and what the literature expects a practical lesson to look like.

**Lack of learners' engagement:** In many cases, I observed lessons wherein the teachers demonstrated practical tasks by handling and using the apparatus without giving the learners an opportunity to participate. Out of eight practical task presentations, only three lesson presentations allowed the learners to actively participate throughout the process. Two of the practical task lessons where learners participated were observed in School C and one in School E. The remaining five practical lessons were predominantly teachers' demonstrations while the learners observed and answered oral questions. In contrast, the literature emphasises that learners develop particular skills effectively by actively engaging in the actual exercise of doing those activities that involve their minds and hands (Aubusson, 1994; du Toit, et al. 2008; Maree & Fraser, 2008; Schibeci & Wong, 1994). The implication is that the disengagement of learners during demonstrations prevents them from developing scientific skills.

Furthermore, I realised that the teachers opted to teach practical tasks in a theoretical way if there were no apparatus. In other words, the teachers adhered to the teaching approaches that promote knowledge acquisition. This kind of practice was observed during the observations and was again raised during the interview sessions.

**Teachers' interest in practical tasks:** All of the teachers in this study integrated practical tasks during observations when teaching NS. Although some teachers did not have science qualifications, they were highly interested in incorporating practical tasks when teaching NS. Proof of this was seen in the intensive consultation of diverse sources of information before lesson presentation reported during the interviews by Teachers C and D (see semi-structured interview items 4.6.2 and 4.6.3 in Chapter 4). Intensive consultation is done to ensure the smooth practice of scientific skills. In addition to this, three out of the four teachers interviewed indicated that they even spent their own money to purchase materials and/or apparatus, e.g. a

sieve. Furthermore, some of the teachers took initiatives to involve the learners in the search for alternative materials which the schools did not possess. This was an indication of high commitment towards the development of scientific skills. What is needed is further capacitation of teachers, which is a notion that gains support from the theoretical framework underpinning this study (see Figure 2.2 in Chapter 2).

**Lack of resources:** The great challenge faced by the teachers in implementing practical tasks in three of the schools that participated in the study is a deficiency of resources regarding well trained teachers, laboratories and apparatus. However, I must indicate that there were certain schools in possession of apparatus which remained unused for years. A study conducted by Rogan and Aldous (2005) in Mpumalanga revealed scientific apparatus sealed in boxes at schools. In addition to this, Teacher D remarked during the interview that neighbouring schools had apparatus locked in steel cabinets, “But when I went to the neighbouring schools to go and ask, some of them even though they have got apparatus that are locked in steel cabinets doing nothing, they find it reluctant to offer me”.

The real issue is that the resources, namely apparatus, humans and laboratories are interrelated. The availability of sophisticated apparatus without a suitable space and a knowledgeable teacher to apply them is useless. Some apparatus can however be substituted, for example, Teacher D used an ordinary glass of water instead of a real glass beaker to demonstrate an experiment. Besides this, Teacher D did not view a lack of apparatus as serious:

Not 100 percent. science is a practical subject. We have got a lot of tins that have been used up. You can use them as containers. We have glasses that we use..... to drink water. Although they are not marked, you can use them as beakers. So, lacking apparatus is not a major .....problem. Torches, we do have.....Energy transfer: Stoves we light at homes...Globes we use....heat energy, light energy. So, not having an apparatus, I don't think is a problem in....presenting.....Science.

I concluded that a lack of physical resources such as a laboratory, apparatus and knowledgeable human resources in science are systemic barriers which consistently deprive the learners the privilege to develop scientific skills at school. In terms of the construct capacity to innovate (see Figure 2.2 in Chapter 2), effective implementation

of practical tasks requires the application of the necessary resources (Rogan & Grayson, 2003).

**Insufficient time available:** In general, the lesson observations coupled with the views of the teachers in the study revealed time as a barrier towards the effective development of scientific skills in learners. A cross analysis of the findings indicated that the time allocated for NS teaching and learning was not enough. The literature reveals that insufficient time allocation for executing practical tasks is frowned upon (Barber, et al. 2011; Frost, 2010; Lindemann-Matties, et al. 2009; Olitsky, 2007). The stumbling block here is that policy-makers determine the amount of time for teaching NS (DoE, 2011). However, school management teams have the freedom to decide upon the length of the teaching and learning periods per day, according to the theoretical framework (Rogan & Grayson, 2003).

Although some teachers, like Teacher C, did not include information regarding practical task teaching and learning time, they were definitely affected in one way or another, for example, the movement to and from the laboratory by the learners in School C indirectly affects the time for practical tasks and the time or period (s) for the upcoming subjects. Again, the act of combining Grade 7 classes during the practical lesson observation by Teacher A suggests well planned time management. The limited time teachers spend attempting to develop the skills of the learners challenge questions such as: “Why is there no intervention to address inadequate time available for practical tasks teaching and learning?”

The contact time for teaching and learning scientific skills emerged during the lesson observations and interview processes as a challenge which all the teachers who participated in this study were faced with. The worst part was that the personal timetables of the teachers in this study indicated nothing regarding practical tasks integration.

**Inappropriate assessment of practical skills development:** The literature states that the development of skills is better assessed while a learner(s) is freely creating, producing and doing something, for instance, an experiment by himself or herself within a real context rather than merely knowing or recalling information (DoE, 2007b; Le Grange, 2008; Miminoshvili & Jibladze, 2007; Ornstein & Hunkins, 2004).

Contrarily, the findings of this study indicate that the teachers assessed the learners orally during demonstrations and after the completion of the practical lesson presentations.

Furthermore, the practical task assessments which the learners performed often intended to measure the quantity of science knowledge gathered during the presentations. The evidence included pen-and-paper tests and examinations which assessed knowledge at the expense of skills development. This finding is in agreement with the literature, which shows that practical skills were assessed by means of pen-and-paper tests and examinations during the pre-1994 education system (Blom, 2008; du Toit, et al. 2008; Hattingh, et al. 2005; 2006; Le Grange, 2008; Maree & Fraser, 2008; Wa Kivilu, 2004). Again, the teachers assessed to obtain scores to fill in the marking-sheets provided and prepare the quarterly mark schedules. Obtainment of scores is just a routine task instead of an opportunity to reflect on challenges and the improvement of practices. Clough and Olson (2008), and Taylor et al. (2008) highly criticise this act of assessing learners just to obtain scores to be used for marking-sheets and schedules completion. Rather, appropriate assessments should be used to measure the development of 21<sup>st</sup> century skills in learners (Can Sahin, 2009).

Furthermore, the study reveals that teachers C, D and E, with the exception of Teacher A, had knowledge of how to use a rubric. A number of informal practical task assessments in which a rubric was utilised effectively was reflected in the documents supplied by Teacher C. A rubric gives a teacher an opportunity to assess the development of different skills in learners, for example, teachers may be able to assess the development of cognitive, psychomotor and affective skills in learners (Jönsson, 2008). Significantly, a rubric gives learners an opportunity to assess and correct themselves, assess the work of other learners and to develop self confidence (Van Aswegen & Dreyer, 2007). Therefore, the teachers who do not use rubrics limit efficiency indirectly.

Finally, there is a possibility that some of the teachers did not give their immediate seniors (HoDs) school-based assessment instruments for moderation purposes. This is reflected in two statements articulated by Teachers D and E respectively regarding

the moderation of assessment instruments. Teacher D reported that he was the one responsible for moderating assessment instruments. Inversely, Teacher E drafted and allowed the learners to carry out a practical task, “It is one man’s show here. No one moderates. I just do it and give it to the learners to do a practical activity”.

The two statements imply that nobody moderated the assessment instruments. In conclusion, the assessment used by most of the teachers in this study do not support and assess skills development in learners.

## **5.4 Answering the three research questions**

### *5.4.1. How are practical task lessons for Grade 7 Natural Sciences learners designed?*

This question aimed to explore the procedures that NS teachers usually follow when they design practical task lessons. The study revealed four major sources which the teachers used as guidelines when designing lessons to teach NS practical tasks. The documents included the policy documents, pace-setters (syllabus) and the prescribed textbooks for NS, which were supplied to schools by the national and the local departments of Basic Education and Training. Furthermore, two teachers, namely Teacher C and Teacher D, claimed that they also used the internet as a fourth source to supplement the information they had gathered before drafting a lesson plan. However, not all of the teachers consulted all of these sources.

The act of consulting various sources of information is commendable taking into account the emphasis laid down by the literature that a properly designed practical lesson should include detailed objectives, the strategies for the realisation of the objectives, all the necessary steps to be followed during presentation and thereafter, the targeted learning outcomes and assessment strategies (Barber, et al. 2011; Fisher, 2003; Millar, 2004; Shaha, 2011; Taylor, et al. 2008). Contrariwise, the study revealed that most of the lessons that the teachers designed for teaching NS practical tasks were not detailed, although they included common aspects such as the subject, the theme, date, duration, and assessments standards. Such lesson preparations are fit to be categorised under level 1 (see Table 2.1 in Chapter 2) of the classification framework (Rogan & Grayson, 2003). The reality is that some of

the practical task lessons do not outline the objectives; do not specify the skills to be developed; do not include safety issues; do not indicate the roles of both the teacher and the learners nor how they should interact when the process unfolds. The importance of the interaction between the two stakeholders is strongly emphasised in the Profile of Implementation (Rogan & Grayson, 2003).

Another important aspect which the teachers did not include in their practical task lesson preparations was a specific timeframe. I believe that a timeframe helps both the teacher and the learners to adjust the speed they are working at, especially if it is realised that the learners may not be able to finish the task. Furthermore, a timeframe allows regulation and intervention to take place on time in order for the learners to complete the activity and achieve the set objectives.

Very few practical lesson plans matched the requirements which the literature indicates. The rest of the practical task lessons which some of the teachers prepared did not differ from the way lessons were prepared in the pre-1994 education system. In other words, such practical lessons should rather be used when teaching content, rather than skills development. This revelation corresponds with the findings of a study conducted by Rogan. Rogan (2004) observed eighteen video-taped science lessons from nine secondary schools in Mpumalanga and the findings indicated that the teaching of content rather than skills development had remained the main objective of those science lessons.

Again, the study successfully revealed that some of the teachers depended on the templates they had received from the workshops they attended, especially when attempting to design practical lessons. In my view, there is nothing wrong with the use of those templates. What I view as problematic is the manner in which the teachers use these templates. During the document analysis, I realised that the templates had very limited space or lines between the subheadings. Some of the teachers did not extend or increase the space available in order to write detailed information, rather, they made copies and used the templates without alterations, which only allowed them to fill in limited details.

Finally, the study revealed that some of the teachers did not prepare practical task lessons. Instead, they used practical lessons designed by companies which publish textbooks. This was demonstrated when Teacher A and E embarked on the practical lesson demonstrations without having prepared the lessons. Dependence on lesson plan hand-outs without reviewing them to fit the environment corresponds with a report issued by Bantwini (2009) that teachers do not prepare lessons before getting to their classrooms. The disadvantage of not adjusting practical task lesson plan hand-outs is that some of them contain information which only suits certain environments, for example, the lesson about the transfer of heat energy was scheduled for 10.5 hours and further included apparatus such as 2 tin lids, 2 coins, a test tube, and stop watch, of which Teacher A did not possess certain items. In these cases, the preparation was done by publishers without adaptation from the teachers to suit their classroom situations.

#### *5.4.2. How are lessons involving practical tasks enacted in Grade 7 classes?*

This question was successfully answered. I was present in the environments in which events unfolded and observed the teachers presenting practical lessons. In addition to this, I had an opportunity to listen to the views of the teachers regarding practical task integration in science.

Some of the teachers tried hard to make apparatus available in order to present practical task lessons. According to the Department of Education (2009) in the US, resources play an important role during practical task teaching and learning, although Hattingh et al. (2007) argue that resources need other supportive interventions in order to be effective. Some of the teachers in this study confirmed that they opted to present practical tasks theoretically only if there were no appropriate apparatus available. However, the teachers attempted to organise apparatus although some items were not available, for example, alkaline.

In as far as real usage of apparatus by the learners is concerned, the study revealed that in many cases it was poorly done or completely avoided. Handling and application of apparatus was only practised convincingly in one case. The implication is that the teachers handled the apparatus and demonstrated the skills themselves, while the learners only observed the events and responded to theoretical questions

posed by the teachers. In a situation of this nature, the learners seldom got opportunities to handle and use the apparatus themselves. A practice of this kind contributes greatly towards the inability to apply scientific skills in a real environment.

Sometimes the teachers did not hesitate to conduct practical tasks in a theoretical way, for example, Teacher A and Teacher E imparted knowledge to the learners on how something happens without actually using any apparatus. I assume that the problem leading to the theoretical teaching of NS practical tasks is caused by a lack of appropriate resources, for example, three out of four schools that participated in the study did not have a laboratory facility (see Table 4.1 in Chapter 4) and they also lacked the appropriate scientific apparatus. As a result, the NS teachers improvised apparatus or embarked on teaching practical tasks in a theoretical way.

In contrast, the literature shows that learners develop scientific skills better when they are actively involved in an activity (du Toit, et al. 2008; Frost, 2010; Maree & Fraser, 2008). In three cases, the practical task presentations appeared to be of a high level in terms of the four levels covered in the Profile of Curriculum Implementation (Rogan & Grayson, 2003). The learners themselves handled and utilised the apparatus under the supervision of their teacher. The literature emphasises that learners develop particular skills effectively by actively engaging in the actual activities that involve their minds and hands (Aubusson, 1994; du Toit, et al. 2008; Maree & Fraser, 2008; Schibeci & Wong, 1994). Surely, if the learners are not given a chance to participate during the practical task process, just as it occurred in many cases that I observed, they end up not feeling “a sense of membership associated with science” (Olitsky, 2007). The mechanism to use to guard against a situation of this nature is simply to give the learners as much time as possible to experience using apparatus on their own.

Although time plays a crucial role in practical task integration, the study revealed it as a challenge. All the lessons that I observed were affected by management and by the teachers. Most of the periods I observed were actually meant to run for a maximum of 30 minutes. The teachers often complained that the time given to practical task integration was too short. This is a genuine concern that takes into account the learners’ level of understanding, and other unforeseen circumstances

such as lesson interventions and interruptions by teachers' industrial actions, funerals, and workshop attendance. Supportive evidence emerged when Teacher A combined two classes and Teacher D combined two grades (6 and 7). The literature indicates that some practical tasks demand more time for execution (Barber, et al. 2011; Lindemann-Matties, et al. 2009; Frost, 2010).

The challenge that often accompanies allocation of short time for doing science in most cases is the prevention of some activities from happening and the promotion of other activities to happen at a faster speed than needed (Frost, 2010), for example, the second lesson which Teacher C presented was cut short and some of the activities were forced to unfold at a fast speed. This happened as a result of too much time being taken up by the morning devotion. I believe that a practice of this kind handicaps learners from developing scientific skills. Many activities based on practical tasks are not done or well attended to due to little time allocated for NS teaching and learning.

Importantly, this study revealed that the teachers had an interest and commitment in terms of NS teaching, although some did not have science qualifications (see Table 3.1 in Chapter 3). The teachers, with specific reference to Teachers C and D, explained convincingly during the interviews that they even searched for information through the internet in order to gather as much information as possible. Furthermore, I observed the practical lessons in which Teacher C successfully applied his experience in teaching practical tasks (see Table 3.1 in Chapter 3).

Interestingly, I realised that the teachers in this study started their presentations with a revision of previous work. An explanation of the tasks, the objectives and the names of the apparatus were then given. Furthermore, some of the teachers attempted to apply different strategies when presenting practical lessons, of which Teacher C is a good example. When presenting a practical lesson, he usually grouped the learners into small and manageable numbers and further allowed them to communicate the outcomes of the tasks amongst themselves. Additionally, Teacher C made sure that each table used by the learners in the laboratory had safety rules pasted on them. Similarly, Teacher E partially attempted to divide the learners into large groups during the second lesson observation. The literature

strongly supports the application of appropriate strategies in order to successfully develop skills in learners (Barber, et al. 2011; Frost, 2010; Millar, 2004; Shaha, 2011).

Overall, the teachers attempted to teach the learners scientific skills even under difficult conditions, for instance a lack of resources, but the findings indicate that some of the practical tasks were taught in ways that do not promote skills development. A good example is the traditional approaches which Teachers A, D and E used for presenting practical lessons. Just like in Rogan's (2004:174) study, which was conducted in twelve Mpumalanga primary and secondary schools in 2002, it shows that the "doing of science", that is, the practical task was attempted, but was often low in standard and did not go beyond observation and simple measurement. Similarly, the results of various studies, including a study conducted by Hattingh et al. (2005) in the same province (Mpumalanga), reveal more or less the same point that practical activities were not administered the way in which meaningful hands-on practical work is supposed to be administered. Lastly, Fraser and Maguvhe (2008) conducted a study amongst blind and visually impaired learners in South Africa at eleven special schools to find out how science developmental process skills in outcomes-based classrooms take place. The results of such a study show that the kind of practical activities done were confined to very simple and elementary exercises that provided little intellectual challenge and did not call for advanced problem –solving skills (Fraser & Maguvhe, 2008). All these cases show that when the situation seldom allows for practical skills development, learners are spectators instead of participators.

#### *5.4.3. How are learners' Natural Sciences practical skills assessed?*

This sub-question aimed to explore how these teachers measured the development of scientific skills in the learners. The study revealed that the measurement of skills development is done through assessment. According to the Department of Education (2007b), assessment is the only mechanism through which information about development of skills in the learners is collected.

The answers to this question emerge in three different phases. Firstly, I checked all the relevant documents which the teachers used exclusively for assessment purposes and realised that the teachers endeavoured to assess the development of scientific skills in the learners. I checked the informal tasks in the exercise books of the learners and the common tasks which the learners had done. When going through the work in the learners' exercise books, I realised that the teachers assessed the learners in a uniform way, except in a few cases where evidence exists in the form of a rubric. Generally, the development of scientific skills in learners is assessed in a way that promotes knowledge acquisition and also provides scores for accountability purposes. Conversely, Wiliam (2006) argues that assessment serves as a bridge between the teaching and learning process and as such it has to be designed in a way that enables a teacher to teach better. This was confirmed and supported during the practical observations and interview sessions. I observed the learners answering questions orally throughout the demonstration processes followed by written responses to informal assessment questions in real-life situations. Furthermore, the responses to the interview questions about practical task assessments confirmed that knowledge is promoted more than skills development. An analysis of the interview responses together with both the informal and formal assessments, especially the common tasks which the learners had done, shows that the teachers did not attempt to assess the learners while the process of handling and using the apparatus was being carried out. The literature considers a rubric as the best tool to use when assessing the development of skills in learners (DoE, 2007; Jönsson, 2008; Kotze, 2008; Le Grange, 2008; Moskal, 2003; Van Aswegen & Dreyer, 2007). This is because a rubric gives a teacher an ample opportunity to observe learners demonstrating skills development in a real life situation and the opportunity to allocate or credit them accordingly. The findings in this study show that one teacher often uses a rubric. Although the responses of some of the teachers indicated that they had knowledge about a rubric, the reality is that a rubric is seldom used. Apart from one rubric used by Teacher E at some point, and a number of rubrics in the work of Teacher C, there was no other supportive evidence.

There is no doubt about the scarcity of evidence in the form of rubrics. The truth is that in many cases, the teachers appear to be the ones who demonstrate while the learners observe. Rather, the learners respond mostly in the form of answering

questions either on a chalkboard or a test/examination paper after the demonstration was completed. Such questions demand learners to show the amount of knowledge they had gathered during the process. In short, the findings indicate that the kind of practical assessments which the learners often did promoted knowledge acquisition in many cases. The promotion of knowledge was visible regardless of whether the learners performed a formal or an informal practical task assessment.

Finally, the three sub-questions are not meant to substitute the main question, but rather to jointly provide assistance towards unlocking the realities of practical task integration at school level.

## **5.5 Answering the main research question**

*How do teachers integrate practical tasks as part of their strategies for teaching Natural Sciences in Grade 7 classes?*

This investigation succeeded in unlocking the realities of practical task integration. The primary aim in this study was to find out and describe how teachers integrate practical tasks when teaching NS with specific reference to the Grade 7 learners. Brief background information leading to the initiation of this study was provided in this regard.

Moving a step backward, the African National Congress (ANC) led government to transform all the aspects of the educational system, including the curriculum soon after 1994 (Rogan & Aldous, 2005). The intention was to pave a new route whereby South African learners would be rescued from the long standing practices of content memorisation and regurgitation in pencil and paper tests and examinations (Blom, 2008; du Toit, et al. 2008; Hattingh, et al. 2005; Le Grange, 2008; Maree & Fraser, 2008; Wa Kivilu, 2004). The emphasis would rather be on knowledge and skills development (Hattingh, et al. 2005; Rogan & Aldous, 2005). In 1998, the Post-1994 Education System introduced Natural Sciences as one subject responsible for carrying the mandate of scientific skills development in learners (DoE, 2002). However, the implementation of the new curriculum called C2005 seems to have experienced various problems which led to a succession or a series of curriculum alterations. In general, the alterations were initiated as an attempt to ensure effective

teaching and learning. Therefore, it is against this background that this study was initiated and the objectives that helped to drive the study were arranged as follows:

- To develop a better understanding of how teachers design lessons that present practical tasks.
- To investigate the strategies which teachers use to ensure that practical task implementation becomes effective.
- To understand the way progress in terms of process skills development in the learners is measured or assessed.
- To present a valid and reliable picture about practical task integration at school level.

Therefore, for the sake of exploring this set of objectives, and to properly answer the research questions formulated in Chapter 1, I employed research methodology appropriate to the objectives. Since the research design for this study has been discussed in full in Chapter 3, therefore, here I only provide an outline of the research design as well as reflections on its appropriateness with regard to this study.

I used a qualitative research approach embedded in the interpretive paradigm. I incorporated the interpretive paradigm taking into account the fact that it is viewed as a tradition that seeks to “understand the meaning of human experiences” (Vivar, et al. 2007:65). In turn, Cohen et al. (2007) argue that the meaning of human experience is better understood when the words and actions of the participants are taken into account. Consequently, and very importantly, the interpretive paradigm allowed me to observe the actions and also listen to what the participants had to say about practical task integration.

Furthermore, qualitative research accorded a space for an in-depth study about practical task integration (Gay & Airasian, 2003; Leedy & Ormrod, 2001). Through the application of a qualitative research approach, I was able to focus on events

occurring in natural settings or in a real-life context (Leedy & Ormrod, 2001). Besides this, the engagement of an evaluative case study further permitted me to focus on a single event in-depth (Bassey, 1999) and to gain insight into the practice (Ghauri, et al. 1995). In other words, I was able to be in close proximity and also have direct contact with the participants particularly during lesson observations. The use of an evaluative case study design allowed me to use diverse data collection methods such as document analysis, observations, interviews and a research diary.

In short, I consider the application of a qualitative approach in this study as a great advantage because it enabled me to conduct the “inquiry in a subjective biased manner”, analyse and interpret the words and actions and also stand a better chance to establish a trustworthy picture based on the findings (Creswell, 2005:39).

Additionally, I consistently referred back to the literature and the theoretical framework in order to arrive at a conclusion that answered the question appropriately. Indeed, the findings clearly indicate that the teachers applied traditional teaching approaches when integrating practical tasks in many cases. Usually teachers are the ones who spend time demonstrating particular skills to learners. The role of the teacher is not to support the learners while they are busy working on a practical task only (Harreveld, 2007). Rather, it includes helping the learners on a continuous basis in order to make sense of their discoveries and further apply what they have learnt in a real-life situation (Aubusson, 1994).

Therefore, the findings provided genuine answers as to why some of the learners in Grade 7 classes cannot demonstrate scientific skills. In my understanding derived from the experience I gained through constant consultation of the literature, the theoretical framework and also that I happened to be close to the events that were unfolding, I found that the inability to demonstrate skills is caused by several factors. The major contributory factors include poor involvement of the learners during demonstration of practical skills, teachers not thoroughly preparing practical lessons, a lack of resources and the traditional assessment of practical tasks.

The study revealed that some teachers get into the classroom and teach without first preparing their lessons for the task in question. Furthermore, learners do not get the opportunity to handle the apparatus themselves. Teachers also design formal

school-based assessment instruments which the learners write without approval from the immediate senior, like the HoD, for example Teacher E. These findings suggest that monitoring and supporting the implementation of practical tasks is not effective.

The study revealed that the assessment which teachers consistently depend on when measuring development of scientific skills in the learners promotes knowledge acquisition rather than skills development. The issue of assessing development of practical skills through tests and examination question papers is not only practised in South Africa, even the Republic of Ireland has historically applied a similar method, although some positive innovations were extracted. The Republic of Ireland developed a practical skills assessment model at a later stage which is conducted by an external examiner. Le Grange (2008) argues that even though tests and examinations could still be utilised to assess the mastery of content knowledge, what is key in Science is that process skills are better assessed when the learners do experiments on their own, produce science or technological tools and devices. The argument sounds good, but I never saw any of the teachers practising this during the observations. The literature maintains that a rubric is the best tool for performing this kind of an exercise (DoE, 2007b; Jönsson, 2008; Van Aswegen & Dreyer, 2007).

According to Bennett (2001), practical skills can be successfully assessed by focusing on a limited number of skills and awarding marks for these. A teacher could possibly target and allocate marks for proper demonstration of manipulative skills, observational skills, measurement skills, recognition, understanding of apparatus and so forth. Moreover, practical task assessment helps a teacher to realise the strengths and weaknesses of the teaching approaches used (Cheung & Yip, 2004). In this way, the teacher stands a chance to apply interventional strategies, for example, a teacher can use different strategies to re-teach the skills which the learners did not master (Clough & Olson, 2008). Assessment does not only help teachers, but learners benefit through it as well since it enables them to realise strengths and weaknesses. In turn, learners focus on the abilities which deserve further attention (Van Aswegen & Dreyer, 2007).

Therefore, it is imperative to assess the level of skills development in learners in every practical lesson. Perhaps this is why the literature views practical task assessment as meant to be an “on-going” process (Ornstein & Hunkins, 2004:354) rather than as “an end in itself” (Van Aswegen & Dreyer, 2007:26). Blom (2008:14) agrees that assessment is not an “add-on” activity.

Therefore, capacity building is a prerequisite. The theoretical framework supports the idea of capacitating teachers so that they effectively integrate practical tasks. The literature strongly emphasises that teachers should improve the quality of teaching because that serves as a fundamental foundation for the smooth development of scientific skills in learners (Baird, 1988, [in Baker, 1994]; Ismailov, 2010; Lindemann-Matties, et al. 2009; Rogan & Grayson, 2003; Wiliam, 2006). The problem of improvement in the quality of teaching is not affecting South Africa only, but countries such as Hong Kong and England experience similar situations. The key issue is to try to make capacity workshops realistic to the extent that teachers become immersed in practical task processes. Otherwise teachers may imitate and pass over to the next generation what they have inherited from their former teachers (Barber, et al. 2011; Muwanga-Zake, 2009; Rogan & Aldous, 2005).

## **5.6 Limitations of the study**

The study was focused on a small sample which was limited to teachers with a minimum of two years experience in teaching NS to Grade 7 learners. I therefore focused on a multi-case study with practical task integration in one of the districts of the Department of Basic Education and Training in the Limpopo Province. Although there were many chances to transfer the findings to other regions and provinces in South Africa, I absolutely have no intention of generalising the findings of this study.

## **5.7 Recommendations of the study**

The study aimed to investigate how teachers integrate practical tasks when teaching NS to Grade 7 classes. In general, the findings of the study provided evidence that the teachers attempted to integrate practical tasks, although in most cases the practical tasks happened to receive attention, which is not in accordance with the expectations of the literature. Similarly, the literature reveals that meaningful, hands-on practical work is not happening at school level (Barber, et al. 2011; Hattingh, et al.

2005; Rogan, 2004). For meaningful practical tasks to be implemented, the literature therefore emphasises the availability of the appropriate resources accompanied by real involvement of the learners in concrete tasks or problems (Donkor, 2011; DoE [US], 2009; du Toit, et al. 2008; Hattingh, et al. 2005; Le Grange, 2008; Maree & Fraser, 2008; Michael, 2007; Millar, 2004; Schibeci & Wong, 1994; Shaha, 2011) and the implementation of proper assessment (DoE, 2007b; 2010; Kotze, 2008).

Based on the results I therefore recommend that the head of the department (HoD) and subject advisors should consistently monitor the way teachers integrate practical tasks into their teaching. I strongly believe that consistent monitoring could enable both parties (teachers and the authoritative figures [HoDs] and subject advisors) responsible for curriculum implementation to realise the weaknesses and the strengths surrounding practical task integration early on and therefore devise means for intervention. For further investigation I therefore recommend the following: Investigation based on how practical task implementation is monitored and supported; and investigation into the views of teachers and learners regarding the contact time allocated to practical tasks.

I assume that the findings will add constructive information towards a better understanding of realities concerning scientific skills development in learners and what needs to be done to improve the situation in South African Grade 7 classrooms.

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## APPENDICES

### APPENDIX A

#### DOCUMENT ANALYSIS

The analysed documents included the National Curriculum Statement Policies for the Natural Sciences and the CAPS National Curriculum Statement Assessment Policy for the Natural Sciences. In addition, the work schedule or pace setter, the lesson plans, time tables (personal time table and assessment time table), assessment instruments, memorandum, mark/scores sheets and the workbooks the learners use to write tasks.

**NAME OF TEACHER: TEACHER A**

| CRITERIA                                                                                                                                     | COMMENTS                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                         |                                                                                                                                            |
| 1. National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?             | Yes. The activities done are prescribed in the policy document.                                                                            |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document? | Yes. The learners are assessed according to the policy                                                                                     |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014. |
| 4. Pace-Setter: Is provision made for practical tasks in the year programme?                                                                 | Yes. The practical tasks are clearly outlined.                                                                                             |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                        |                                                                                                                                            |
| 1. Is there any lesson plan for a practical activity?                                                                                        | The participant gave the researcher a copy of the lesson plan.                                                                             |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                           | Yes.                                                                                                                                       |
| 4. Does the lesson plan explain the practical activity to be undertaken by learners?                                                         | Yes.                                                                                                                                       |
| 5. Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                     | Yes.                                                                                                                                       |
| 6. Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                     | No. The lesson plan is silent about groups formation.                                                                                      |
| 7. Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                     | Yes. The space for apparatus is filled up.                                                                                                 |
| 8. Does the lesson indicate the role of the teacher during the practical activity?                                                           | No. It is silent.                                                                                                                          |
| 9. Does the lesson plan indicate the role of the learner?                                                                                    | No. It is silent.                                                                                                                          |
| 10. Does the lesson plan include safety issues?                                                                                              | Yes, although the space is empty/ not completed.                                                                                           |

|                                                                                                                                                                                |                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered).          |                                                                                                                                         |
| 1.Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                                     | The time table only specifies the date, time and period number for the Natural Science s.                                               |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)                       |                                                                                                                                         |
| 1.Is there any legitimate time table for practical task assessment?                                                                                                            | No.                                                                                                                                     |
| 2.Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                             | There is no assessment time table.                                                                                                      |
| <b>ASSESSMENT INSTRUMENT</b><br>(any tool, for instance, test, examination or rubric designed specifically to assess development of practical skills in grade seven learners). |                                                                                                                                         |
| 1 Is there any instrument design for practical task assessment?                                                                                                                | Yes.                                                                                                                                    |
| 2.Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument?         | Yes. The information appears on the assessment tool.                                                                                    |
| 3.Is the assessment instrument legitimate or approved by the relevant authority?                                                                                               | Yes. The assessment instruments are designed the Limpopo Province Department of Basic Education. In other words they are common papers. |
| 4.Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                                   | Yes.                                                                                                                                    |
| 5.Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                                    | Yes.                                                                                                                                    |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                        |                                                                                                                                         |
| 1.Is there a memorandum for the practical task assessment instrument?                                                                                                          | Yes.                                                                                                                                    |
| 2.Does the memorandum correspond with the assessment instrument?                                                                                                               | Yes.                                                                                                                                    |
| 3.Are there marks allocated for each question asked?                                                                                                                           | Yes.                                                                                                                                    |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                                 |                                                                                                                                         |
| 1.Is there any evidence of performance record keeping?                                                                                                                         | Yes. The recorded mark-sheets are in the file of the participant.                                                                       |
| 2.Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                                       | Yes.                                                                                                                                    |
| 3.Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                           | Yes.                                                                                                                                    |
| 4.Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                        | Yes.                                                                                                                                    |
| <b>LEARNERS' PORTFOLIOS</b>                                                                                                                                                    |                                                                                                                                         |

|                                                                                                           |                                                                                                   |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| (an answer sheet or book which a learner uses when responding to a practical work assessment instrument). |                                                                                                   |
| 1.Is there any evidence available to support that learners perform practical activities?                  | Yes. The class workbooks of the learners reflect some practical activities done by the learners.  |
| 2.Is the practical work done by the learner controlled?                                                   | Yes. There is a tick or cross against each answer provided by the learner in the class workbooks. |
| 3.Is there a score allocated to each question asked or practical skill demonstrated?                      | Yes.                                                                                              |

**NAME OF TEACHER: TEACHER B**

| <b>CRITERIA</b>                                                                                                                                                       | <b>COMMENTS</b>                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                                                  |                                                                                                                                            |
| 1. National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                                      | The document is in the file. The activities done are prescribed in the policy document.                                                    |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                          | Yes. The learners are assessed according to the policy                                                                                     |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                                         | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014. |
| 4.Pace-Setter: Is provision made for practical tasks in the year programme?                                                                                           | Yes. The practical tasks are clearly outlined.                                                                                             |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                                                 |                                                                                                                                            |
| 1. Is there any lesson plan for a practical activity?                                                                                                                 | The lesson plan was not counted amongst the documents she handed out to me.                                                                |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                                                    | No comment.                                                                                                                                |
| 4.Does the lesson plan explain the practical activity to be undertaken by learners?                                                                                   | No comment.                                                                                                                                |
| 5.Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                                               | No comment.                                                                                                                                |
| 6.Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                                               | No comment.                                                                                                                                |
| 7.Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                                               | No comment.                                                                                                                                |
| 8.Does the lesson indicate the role of the teacher during the practical activity?                                                                                     | No comment.                                                                                                                                |
| 9.Does the lesson plan indicate the role of the learner?                                                                                                              | No comment.                                                                                                                                |
| 10.Does the lesson plan include safety issues?                                                                                                                        | No comment                                                                                                                                 |
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered). |                                                                                                                                            |

|                                                                                                                                                                                |                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1.Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                                     | The time table only specifies the date, time and period number for the Natural Science s.                                               |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)                       |                                                                                                                                         |
| 1.Is there any legitimate time table for practical task assessment?                                                                                                            | No.                                                                                                                                     |
| 2.Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                             | There is no assessment time table.                                                                                                      |
| <b>ASSESSMENT INSTRUMENT</b><br>(any tool, for instance, test, examination or rubric designed specifically to assess development of practical skills in grade seven learners). |                                                                                                                                         |
| 1 Is there any instrument design for practical task assessment?                                                                                                                | Yes.                                                                                                                                    |
| 2.Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument?         | Yes. The information appears on the assessment tool.                                                                                    |
| 3.Is the assessment instrument legitimate or approved by the relevant authority?                                                                                               | Yes. The assessment instruments are designed the Limpopo Province Department of Basic Education. In other words they are common papers. |
| 4.Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                                   | Yes.                                                                                                                                    |
| 5.Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                                    | Yes.                                                                                                                                    |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                        |                                                                                                                                         |
| 1.Is there a memorandum for the practical task assessment instrument?                                                                                                          | Yes.                                                                                                                                    |
| 2.Does the memorandum correspond with the assessment instrument?                                                                                                               | Yes.                                                                                                                                    |
| 3.Are there marks allocated for each question asked?                                                                                                                           | Yes.                                                                                                                                    |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                                 |                                                                                                                                         |
| 1.Is there any evidence of performance record keeping?                                                                                                                         | Yes. The recorded mark-sheets are in the file of the participant.                                                                       |
| 2.Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                                       | Yes.                                                                                                                                    |
| 3.Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                           | Yes.                                                                                                                                    |
| 4.Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                        | Yes.                                                                                                                                    |
| <b>LEARNERS' PORTFOLIOS</b><br>(an answer sheet or book which a learner uses when responding to a practical work assessment instrument).                                       |                                                                                                                                         |
| 1.Is there any evidence available to support that learners perform practical activities?                                                                                       | Yes. The class workbooks of the learners reflect some practical activities done by the learners.                                        |
| 2.Is the practical work done by the learner                                                                                                                                    | Yes. There is a tick or cross against each answer                                                                                       |

|                                                                                      |                                                 |
|--------------------------------------------------------------------------------------|-------------------------------------------------|
| controlled?                                                                          | provided by the learner in the class workbooks. |
| 3.Is there a score allocated to each question asked or practical skill demonstrated? | Yes.                                            |

**NAME OF TEACHER: TEACHER C**

| <b>CRITERIA</b>                                                                                                                                                       | <b>COMMENTS</b>                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                                                  |                                                                                                                                            |
| 1. National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                                      | Yes. The activities done are prescribed in the policy document.                                                                            |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                          | Yes. The learners are assessed according to the policy                                                                                     |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                                         | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014. |
| 4.Pace-Setter: Is provision made for practical tasks in the year programme?                                                                                           | Yes. The practical tasks are clearly outlined.                                                                                             |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                                                 |                                                                                                                                            |
| 1. Is there any lesson plan for a practical activity?                                                                                                                 | The participant gave the researcher a copy of the lesson plan.                                                                             |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                                                    | Yes.                                                                                                                                       |
| 4.Does the lesson plan explain the practical activity to be undertaken by learners?                                                                                   | Yes.                                                                                                                                       |
| 5.Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                                               | Yes.                                                                                                                                       |
| 6.Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                                               | Yes. The lesson plan indicates that the activities are done in groups.                                                                     |
| 7.Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                                               | Yes. The space for apparatus is filled up.                                                                                                 |
| 8.Does the lesson indicate the role of the teacher during the practical activity?                                                                                     | Yes.                                                                                                                                       |
| 9.Does the lesson plan indicate the role of the learner?                                                                                                              | Yes.                                                                                                                                       |
| 10.Does the lesson plan include safety issues?                                                                                                                        | Yes.                                                                                                                                       |
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered). |                                                                                                                                            |
| 1.Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                            | The time table only specifies the date, time and period number for the Natural Science s.                                                  |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)              |                                                                                                                                            |
| 1.Is there any legitimate time table for practical task assessment?                                                                                                   | No. The only time table available shows periods for class attendance.                                                                      |

|                                                                                                                                                                                |                                                                                                                                                                                |
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| 2.Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                             | There is no assessment time table.                                                                                                                                             |
| <b>ASSESSMENT INSTRUMENT</b><br>(any tool, for instance, test, examination or rubric designed specifically to assess development of practical skills in grade seven learners). |                                                                                                                                                                                |
| 1 Is there any instrument design for practical task assessment?                                                                                                                | Yes.                                                                                                                                                                           |
| 2.Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument?         | Yes. The information appears on the assessment tool.                                                                                                                           |
| 3.Is the assessment instrument legitimate or approved by the relevant authority?                                                                                               | Yes. The assessment instruments are designed the Limpopo Province Department of Basic Education. In other words they are common papers. Very important, a rubric is used most. |
| 4.Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                                   | Yes.                                                                                                                                                                           |
| 5.Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                                    | Yes.                                                                                                                                                                           |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                        |                                                                                                                                                                                |
| 1.Is there a memorandum for the practical task assessment instrument?                                                                                                          | Yes.                                                                                                                                                                           |
| 2.Does the memorandum correspond with the assessment instrument?                                                                                                               | Yes.                                                                                                                                                                           |
| 3.Are there marks allocated for each question asked?                                                                                                                           | Yes.                                                                                                                                                                           |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                                 |                                                                                                                                                                                |
| 1.Is there any evidence of performance record keeping?                                                                                                                         | Yes. The recorded mark-sheets are in the file of the participant.                                                                                                              |
| 2.Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                                       | Yes.                                                                                                                                                                           |
| 3.Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                           | Yes.                                                                                                                                                                           |
| 4.Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                        | Yes.                                                                                                                                                                           |
| <b>LEARNERS' PORTFOLIOS</b><br>(an answer sheet or book which a learner uses when responding to a practical work assessment instrument).                                       |                                                                                                                                                                                |
| 1.Is there any evidence available to support that learners perform practical activities?                                                                                       | Yes. There are written papers which the learners use for indicating practical activities.                                                                                      |
| 2.Is the practical work done by the learner controlled?                                                                                                                        | Yes. There are signs for correct and wrong answers as well as scores opposite each answer.                                                                                     |
| 3.Is there a score allocated to each question asked or practical skill demonstrated?                                                                                           | Yes.                                                                                                                                                                           |

**NAME OF TEACHER: TEACHER D**

| <b>CRITERIA</b>                                                                                                                                                       | <b>COMMENTS</b>                                                                                                                            |
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| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                                                  |                                                                                                                                            |
| 1. National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                                      | Yes. The activities done are prescribed in the policy document.                                                                            |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                          | Yes. The learners are assessed according to the policy                                                                                     |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                                         | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014. |
| 4. Pace-Setter: Is provision made for practical tasks in the year programme?                                                                                          | Yes. The practical tasks are clearly outlined.                                                                                             |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                                                 |                                                                                                                                            |
| 1. Is there any lesson plan for a practical activity?                                                                                                                 | There is an exercise book that the participant uses to design Natural Sciences lessons.                                                    |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                                                    | The subject, date and time are clearly indicated.                                                                                          |
| 4. Does the lesson plan explain the practical activity to be undertaken by learners?                                                                                  | Yes.                                                                                                                                       |
| 5. Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                                              | Yes.                                                                                                                                       |
| 6. Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                                              | No. The lesson plan is silent about group formation.                                                                                       |
| 7. Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                                              | Yes. The space for apparatus is filled up.                                                                                                 |
| 8. Does the lesson indicate the role of the teacher during the practical activity?                                                                                    | No. It is silent.                                                                                                                          |
| 9. Does the lesson plan indicate the role of the learner?                                                                                                             | No. It is silent.                                                                                                                          |
| 10. Does the lesson plan include safety issues?                                                                                                                       | Safety issues are not addressed.                                                                                                           |
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered). |                                                                                                                                            |
| 1. Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                           | The time table only specifies the date, time and period number for the Natural Sciences.                                                   |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)              |                                                                                                                                            |
| 1. Is there any legitimate time table for practical task assessment?                                                                                                  | No.                                                                                                                                        |
| 2. Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                   | There is no assessment time table.                                                                                                         |
| <b>ASSESSMENT INSTRUMENT</b><br>(any tool, for instance, test, examination or rubric)                                                                                 |                                                                                                                                            |

|                                                                                                                                                                         |                                                                                                                                         |
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| designed specifically to assess development of practical skills in grade seven learners).                                                                               |                                                                                                                                         |
| 1. Is there any instrument design for practical task assessment?                                                                                                        | Yes.                                                                                                                                    |
| 2. Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument? | Yes. The information appears on the assessment tool.                                                                                    |
| 3. Is the assessment instrument legitimate or approved by the relevant authority?                                                                                       | Yes. The assessment instruments are designed the Limpopo Province Department of Basic Education. In other words they are common papers. |
| 4. Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                           | Only selected practical activities are assessed.                                                                                        |
| 5. Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                            | Yes.                                                                                                                                    |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                 |                                                                                                                                         |
| 1. Is there a memorandum for the practical task assessment instrument?                                                                                                  | Yes.                                                                                                                                    |
| 2. Does the memorandum correspond with the assessment instrument?                                                                                                       | Yes.                                                                                                                                    |
| 3. Are there marks allocated for each question asked?                                                                                                                   | Yes.                                                                                                                                    |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                          |                                                                                                                                         |
| 1. Is there any evidence of performance record keeping?                                                                                                                 | Yes. The participant keeps the learners performance scores in a record/mark-sheet.                                                      |
| 2. Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                               | Yes.                                                                                                                                    |
| 3. Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                   | Yes.                                                                                                                                    |
| 4. Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                | Yes.                                                                                                                                    |
| <b>LEARNERS' PORTFOLIOS</b><br>(an answer sheet or book which a learner uses when responding to a practical work assessment instrument).                                |                                                                                                                                         |
| 1. Is there any evidence available to support that learners perform practical activities?                                                                               | Yes. The class workbooks of the learners reflect some practical activities done by the learners.                                        |
| 2. Is the practical work done by the learner controlled?                                                                                                                | Yes. There is a tick or cross against each answer provided by the learner in the class workbooks.                                       |
| 3. Is there a score allocated to each question asked or practical skill demonstrated?                                                                                   | Yes.                                                                                                                                    |

**NAME OF TEACHER: TEACHER E**

| <b>CRITERIA</b>                                                                                                                                                       | <b>COMMENTS</b>                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                                                  |                                                                                                                                                                   |
| 1. National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                                      | Yes. The participant prepares practical activities that appear in the policy document.                                                                            |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                          | Yes. The learners are assessed according to the policy                                                                                                            |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                                         | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014.                        |
| 4. Pace-Setter: Is provision made for practical tasks in the year programme?                                                                                          | Yes. The practical tasks are clearly outlined.                                                                                                                    |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                                                 |                                                                                                                                                                   |
| 1. Is there any lesson plan for a practical activity?                                                                                                                 | The participant gave the researcher a copy of the lesson plan.                                                                                                    |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                                                    | Yes.                                                                                                                                                              |
| 4. Does the lesson plan explain the practical activity to be undertaken by learners?                                                                                  | Yes.                                                                                                                                                              |
| 5. Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                                              | Yes.                                                                                                                                                              |
| 6. Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                                              | No. The lesson plan is silent about grouping the learners when carrying out the activity.                                                                         |
| 7. Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                                              | Yes. The apparatus to be used are listed.                                                                                                                         |
| 8. Does the lesson indicate the role of the teacher during the practical activity?                                                                                    | No. It is silent.                                                                                                                                                 |
| 9. Does the lesson plan indicate the role of the learner?                                                                                                             | No. It is silent.                                                                                                                                                 |
| 10. Does the lesson plan include safety issues?                                                                                                                       | Safety issues are not showed in the plan.                                                                                                                         |
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered). |                                                                                                                                                                   |
| 1. Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                           | The time table only specifies the date, time and period number for the Natural Sciences. It does not indicate a specific activity to be done on a particular day. |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)              |                                                                                                                                                                   |
| 1. Is there any legitimate time table for practical task assessment?                                                                                                  | No.                                                                                                                                                               |
| 2. Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                   | There is no assessment time table.                                                                                                                                |
| <b>ASSESSMENT INSTRUMENT</b>                                                                                                                                          |                                                                                                                                                                   |

|                                                                                                                                                                         |                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| (any tool, for instance, test, examination or rubric designed specifically to assess development of practical skills in grade seven learners).                          |                                                                                                                                            |
| 1. Is there any instrument design for practical task assessment?                                                                                                        | Yes.                                                                                                                                       |
| 2. Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument? | Yes. The information appears on the assessment tool.                                                                                       |
| 3. Is the assessment instrument legitimate or approved by the relevant authority?                                                                                       | Yes. The assessment instruments are designed by the Limpopo Province Department of Basic Education. In other words they are common papers. |
| 4. Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                           | Yes.                                                                                                                                       |
| 5. Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                            | Yes.                                                                                                                                       |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                 |                                                                                                                                            |
| 1. Is there a memorandum for the practical task assessment instrument?                                                                                                  | Yes.                                                                                                                                       |
| 2. Does the memorandum correspond with the assessment instrument?                                                                                                       | Yes.                                                                                                                                       |
| 3. Are there marks allocated for each question asked?                                                                                                                   | Yes.                                                                                                                                       |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                          |                                                                                                                                            |
| 1. Is there any evidence of performance record keeping?                                                                                                                 | Yes. The scores or marks are recorded in the mark/ record sheet found in the file of the participant.                                      |
| 2. Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                               | Yes.                                                                                                                                       |
| 3. Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                   | Yes.                                                                                                                                       |
| 4. Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                | Yes.                                                                                                                                       |
| <b>LEARNERS' PORTFOLIOS</b><br>(an answer sheet or book which a learner uses when responding to a practical work assessment instrument).                                |                                                                                                                                            |
| 1. Is there any evidence available to support that learners perform practical activities?                                                                               | Yes. The class workbooks of the learners reflect some practical activities done by the learners.                                           |
| 2. Is the practical work done by the learner controlled?                                                                                                                | Yes. There is a tick or cross against each answer provided by the learner in the class workbooks.                                          |
| 3. Is there a score allocated to each question asked or practical skill demonstrated?                                                                                   | Yes.                                                                                                                                       |

**NAME OF TEACHER: TEACHER F**

| <b>CRITERIA</b>                                                                                                                                                       | <b>COMMENTS</b>                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                                                  |                                                                                                                                                                                   |
| 1. National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                                      | Yes. The activities done are prescribed in the policy document.                                                                                                                   |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                          | Yes. The learners are assessed according to the policy                                                                                                                            |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                                         | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014.                                        |
| 4. Pace-Setter: Is provision made for practical tasks in the year programme?                                                                                          | No evidence of a pace-setter.                                                                                                                                                     |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                                                 |                                                                                                                                                                                   |
| 1. Is there any lesson plan for a practical activity?                                                                                                                 | No. The participant searched many places and ultimately could not provide me with the lesson plan. He promised that I shall get it next time until he withdrew his participation. |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                                                    | No comment.                                                                                                                                                                       |
| 4. Does the lesson plan explain the practical activity to be undertaken by learners?                                                                                  | No comment.                                                                                                                                                                       |
| 5. Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                                              | No comment.                                                                                                                                                                       |
| 6. Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                                              | No comment.                                                                                                                                                                       |
| 7. Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                                              | No comment.                                                                                                                                                                       |
| 8. Does the lesson indicate the role of the teacher during the practical activity?                                                                                    | No comment.                                                                                                                                                                       |
| 9. Does the lesson plan indicate the role of the learner?                                                                                                             | No comment.                                                                                                                                                                       |
| 10. Does the lesson plan include safety issues?                                                                                                                       | No comment.                                                                                                                                                                       |
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered). |                                                                                                                                                                                   |
| 1. Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                           | The time table only specifies the date, time and period number for the Natural Science s.                                                                                         |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)              |                                                                                                                                                                                   |
| 1. Is there any legitimate time table for practical task assessment?                                                                                                  | No.                                                                                                                                                                               |
| 2. Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                   | There is no assessment time table.                                                                                                                                                |

|                                                                                                                                                                                |                                                                    |
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| <b>ASSESSMENT INSTRUMENT</b><br>(any tool, for instance, test, examination or rubric designed specifically to assess development of practical skills in grade seven learners). |                                                                    |
| 1. Is there any instrument design for practical task assessment?                                                                                                               | No provision of assessment instrument was made by the participant. |
| 2. Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument?        | No comment.                                                        |
| 3. Is the assessment instrument legitimate or approved by the relevant authority?                                                                                              | No comment.                                                        |
| 4. Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                                  | No comment.                                                        |
| 5. Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                                   | No comment.                                                        |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                        |                                                                    |
| 1. Is there a memorandum for the practical task assessment instrument?                                                                                                         | No provision of memorandum was made.                               |
| 2. Does the memorandum correspond with the assessment instrument?                                                                                                              | No comment.                                                        |
| 3. Are there marks allocated for each question asked?                                                                                                                          | No comment.                                                        |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                                 |                                                                    |
| 1. Is there any evidence of performance record keeping?                                                                                                                        | Yes. The recorded mark-sheets are in the file of the participant.  |
| 2. Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                                      | Yes.                                                               |
| 3. Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                          | Yes.                                                               |
| 4. Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                       | Yes.                                                               |
| <b>LEARNERS' PORTFOLIOS</b><br>(an answer sheet or book which a learner uses when responding to a practical work assessment instrument).                                       |                                                                    |
| 1. Is there any evidence available to support that learners perform practical activities?                                                                                      | No provision of learners' workbooks was made.                      |
| 2. Is the practical work done by the learner controlled?                                                                                                                       | No comment.                                                        |
| 3. Is there a score allocated to each question asked or practical skill demonstrated?                                                                                          | No comment.                                                        |

**NAME OF TEACHER: TEACHER G**

| <b>CRITERIA</b>                                                                                                                                                       | <b>COMMENTS</b>                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POLICY DOCUMENTS</b><br>(documents supplied by the Department of Basic Education)                                                                                  |                                                                                                                                            |
| 1.National Curriculum Statement Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                                       | Yes. The activities done are prescribed in the policy document.                                                                            |
| 2. National Curriculum Statement: Assessment Policy for the Natural Sciences. Is there any evidence that the participant uses this document?                          | Yes. The learners are assessed according to the policy                                                                                     |
| 3. Curriculum and Assessment Policy Statement. Is there any evidence that the participant uses this document?                                                         | Not available. The investigation was conducted in 2013 whereas Curriculum and Assessment Policy Statement was implemented in January 2014. |
| 4.Pace-Setter: Is provision made for practical tasks in the year programme?                                                                                           | Yes. The practical tasks are clearly outlined.                                                                                             |
| <b>LESSON PLAN</b><br>(a plan designed to provide guidance on how a particular practical activity is going to unfold)                                                 |                                                                                                                                            |
| 1. Is there any lesson plan for a practical activity?                                                                                                                 | The participant gave the researcher a copy of the lesson plan.                                                                             |
| 2. Does the lesson plan indicate the subject or learning area, date and time frame for the completion of the task?                                                    | Yes.                                                                                                                                       |
| 4.Does the lesson plan explain the practical activity to be undertaken by learners?                                                                                   | Yes.                                                                                                                                       |
| 5.Does the lesson plan explain the specific skill to be developed or learning outcomes?                                                                               | Yes.                                                                                                                                       |
| 6.Does the lesson plan indicate whether the practical activity has to be taken by an individual or a group of learners?                                               | No. The lesson plan is silent about groups formation.                                                                                      |
| 7.Does the lesson plan clearly indicate the appropriate apparatus to be used during the practical activity planned for?                                               | Yes. The space for apparatus is filled up.                                                                                                 |
| 8.Does the lesson indicate the role of the teacher during the practical activity?                                                                                     | No. It is silent.                                                                                                                          |
| 9.Does the lesson plan indicate the role of the learner?                                                                                                              | No. It is silent.                                                                                                                          |
| 10.Does the lesson plan include safety issues?                                                                                                                        | Yes, although the space is empty/ not completed.                                                                                           |
| <b>PERSONAL TIME TABLE</b><br>(a document which shows the specific subject or subjects the participant teaches as well as the periods and activities to be rendered). |                                                                                                                                            |
| 1.Does the time table specify the periods and activities to be rendered during practical tasks procession?                                                            | The time table only specifies the date, time and period number for the Natural Science s.                                                  |
| <b>ASSESSMENT TIME TABLE</b><br>(a time table that shows information in details regarding how practical skills development in learners will be measured)              |                                                                                                                                            |
| 1.Is there any legitimate time table for practical task assessment?                                                                                                   | No.                                                                                                                                        |
| 2.Does the assessment time table indicate the subject, grade, date, time, the subject teacher and the invigilator?                                                    | There is no assessment time table.                                                                                                         |
| <b>ASSESSMENT INSTRUMENT</b><br>(any tool, for instance, test, examination or rubric                                                                                  |                                                                                                                                            |

|                                                                                                                                                                        |                                                                                                                                         |
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| designed specifically to assess development of practical skills in grade seven learners).                                                                              |                                                                                                                                         |
| 1.Is there any instrument design for practical task assessment?                                                                                                        | Yes.                                                                                                                                    |
| 2.Does the assessment instrument indicate the subject, grade, date, time, allocation of marks and instructions to follow when responding to the assessment instrument? | Yes. The information appears on the assessment tool.                                                                                    |
| 3.Is the assessment instrument legitimate or approved by the relevant authority?                                                                                       | Yes. The assessment instruments are designed the Limpopo Province Department of Basic Education. In other words they are common papers. |
| 4.Is assessment of a practical activity consistent with the policy documents or pace setter?                                                                           | Yes.                                                                                                                                    |
| 5.Is the assessment instrument clear in terms of the practical skill (s) it has to measure?                                                                            | Yes.                                                                                                                                    |
| <b>MEMORANDUM</b><br>(a document containing possible answers for the legitimate assessment instrument).                                                                |                                                                                                                                         |
| 1.Is there a memorandum for the practical task assessment instrument?                                                                                                  | Yes.                                                                                                                                    |
| 2.Does the memorandum correspond with the assessment instrument?                                                                                                       | Yes.                                                                                                                                    |
| 3.Are there marks allocated for each question asked?                                                                                                                   | Yes.                                                                                                                                    |
| <b>MARK SHEET/RECORD BOOK</b><br>(a document in which scores obtained by learners are recorded or documented).                                                         |                                                                                                                                         |
| 1.Is there any evidence of performance record keeping?                                                                                                                 | Yes. The recorded mark-sheets are in the file of the participant.                                                                       |
| 2.Does the mark-sheet or record book indicate the subject and the names of the learners?                                                                               | Yes.                                                                                                                                    |
| 3.Does the mark-sheet or record book indicate the practical activity score(s) allocated to every individual learner?                                                   | Yes.                                                                                                                                    |
| 4.Do practical activities scores or marks recorded in the mark sheet correspond with scores in the learners' workbooks?                                                | Yes.                                                                                                                                    |
| <b>LEARNERS' PORTFOLIOS</b><br>(an answer sheet or book which a learner uses when responding to a practical work assessment instrument).                               |                                                                                                                                         |
| 1.Is there any evidence available to support that learners perform practical activities?                                                                               | Yes. The class workbooks of the learners reflect some practical activities done by the learners.                                        |
| 2.Is the practical work done by the learner controlled?                                                                                                                | Yes. There is a tick or cross against each answer provided by the learner in the class workbooks.                                       |
| 3.Is there a score allocated to each question asked or practical skill demonstrated?                                                                                   | Yes.                                                                                                                                    |

## APPENDIX B

### FOUR LEVELS OF SUB-CONSTRUCTS.

**Table 1: Four levels of sub-constructs science practical work and assessment from the Profile of implementation (Rogan & Grayson, 2003).**

| Level | Classroom Interaction                                                                                                                                                         | Science Practical Work                                                                                                                                                                                                                                                                                                                  | Science in Society                                                                                                                                           | Assessment                                                                                                                                                                                                                                                            |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Teacher: Makes the necessary resources, including learners and apparatus present. Develops procedures for the activity.                                                       | Teacher uses classroom demonstrations to help develop concepts.<br><br>Teacher uses specimens found in the local environment to illustrate lessons.                                                                                                                                                                                     | Teacher gives learners everyday life activities or related problems to solve.                                                                                | Assessments that cover learner practical skills are given adequately.<br><br>Practical tasks are marked and returned promptly.                                                                                                                                        |
| 2     | Teacher introduces the apparatus to the learners.<br><br>Teacher explains safety issues.                                                                                      | Teacher uses demonstrations to promote a limited form of inquiry.<br><br>Some learners assist planning and performing the demonstrations.<br><br>Learners communicate data using graphs and tables.                                                                                                                                     | Teacher bases a lesson on a specific problem or issue faced by the community.                                                                                | Questions are based on practical work.                                                                                                                                                                                                                                |
| 3     | Teacher guides learners as they develop evidence-based explanations and create situations where learners communicate and justifies explanations on the merit of the evidence. | Teacher designs practical work in such a way as to encourage learner discovery of information.<br><br>Learners perform guided discovery type practical work in small groups, engaging in hands-on activities.<br><br>Learners can write a scientific report in which they can justify their conclusions in terms of the data collected. | Teacher gives learners practical task, for example, to investigate the electrical appliances used at their homes; sources of energy used in their community. | Assessment is based on more than written tests. Other forms of assessment might include: practical activity demonstrations, reports on activities undertaken, creation of charts and improvised apparatus.<br><br>A rubric is used to assess performance of learners. |
| 4     | Teacher: Challenges learners to look for patterns in data.                                                                                                                    | Learners design and do their own open investigations. They reflect on the quality of the design and collected data, and make improvements.<br><br>Learners can interpret data in support of competing theories or explanations.                                                                                                         | Teachers urges learners to undertake a project in their school, example a vegetable garden in which they will apply science to tackle a specific problem.    | Performance on open investigations and community-based projects are included in the final assessment.<br><br>Learners create portfolios to represent their best work.                                                                                                 |

## APPENDIX C: OBSERVATION SCHEDULES.

The appendix is divided into sections A and B.

### SECTION A

This section provides brief general information about the school, the learners, the subject and the theme observed, date and time, the participant and the observer in a tabular form.

### SECTION B

This section shows the observations guideline used to channel the investigations. This guideline for "Observation of a practical lesson: teacher and pupil focus" was taken from Frost, J. (ED) (2010).

### OBSERVATION SCHEDULE

#### SECTION A

NAME OF PARTICIPANT: TEACHER A

Table 2: General information

|                                                         |  |                                                                           |                 |                                                               |                 |                                                                |     |                                                                                                                       |                 |                  |                  |
|---------------------------------------------------------|--|---------------------------------------------------------------------------|-----------------|---------------------------------------------------------------|-----------------|----------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------|-----------------|------------------|------------------|
| 1. Date: <b>03 May 2013</b>                             |  |                                                                           |                 | 2. Name of observer: <b>Mothokwa S S</b>                      |                 |                                                                |     |                                                                                                                       |                 |                  |                  |
| 3. School (Pseudonym): <b>School A</b>                  |  |                                                                           |                 |                                                               |                 |                                                                |     |                                                                                                                       |                 |                  |                  |
| 4. Name of teacher (Pseudonym): <b>Teacher A</b>        |  |                                                                           |                 |                                                               |                 |                                                                |     |                                                                                                                       |                 |                  |                  |
| 5. Theme of Natural science: <b>Heat Transfer</b>       |  |                                                                           |                 |                                                               |                 |                                                                |     | 6. Grade 7: <b>Sampled class</b>                                                                                      |                 |                  |                  |
| 6. Number of learners present                           |  |                                                                           |                 | Number: <b>29</b>                                             |                 |                                                                |     | Boys: <b>14</b>                                                                                                       |                 | Girls: <b>15</b> |                  |
| 7. Number of learners absent                            |  |                                                                           |                 | Number: <b>3</b>                                              |                 |                                                                |     | Boys: <b>3</b>                                                                                                        |                 | Girls: <b>0</b>  |                  |
| 8. Time:                                                |  | 1 <sup>st</sup> period                                                    |                 | <b>Before break</b>                                           |                 | After break                                                    |     | In between                                                                                                            |                 | Last period      |                  |
| 9. Time:                                                |  | Started: <b>09h03</b>                                                     |                 | Ended: <b>09h33</b>                                           |                 | Duration: <b>30</b>                                            |     | Total time: <b>38:40 Sec</b>                                                                                          |                 |                  |                  |
| Period number                                           |  | 1 <sup>st</sup>                                                           | 2 <sup>nd</sup> | 3 <sup>rd</sup>                                               | 4 <sup>th</sup> | 5 <sup>th</sup>                                                | 6th | 7 <sup>th</sup>                                                                                                       | 8 <sup>th</sup> | 9 <sup>th</sup>  | 10 <sup>th</sup> |
| Time spent on talking in class:<br><br><b>7 Minutes</b> |  | Transition time from “in class” to “doing practical” :<br><br><b>None</b> |                 | Time spent on “doing practical”:<br><br><b>23: 40 Seconds</b> |                 | Time spent on returning to class situation.<br><br><b>None</b> |     | Time spent on discussing practical (findings, observation, etc).<br><br><b>8 Minutes writing informal assessment.</b> |                 |                  |                  |

## SECTION B

Table 3: Observation schedule for a practical work

| AVAILABILITY OF INFORMATION                                                                                 | YES/NO |
|-------------------------------------------------------------------------------------------------------------|--------|
| There is evidence of a lesson plan showing a practical activity to be undertaken on a paper.                | Yes    |
| There is evidence of a lesson plan prepared electronically showing the practical activity to be undertaken. | No     |
| No evidence of a lesson plan                                                                                | No     |
| The participant explains the activity well in advance.                                                      | Yes    |
| Introduction of the activity is done on a board.                                                            | Yes    |
| Introduction is written on worksheet.                                                                       | No     |
| Introduction is done on a flip chart.                                                                       | No     |
| Introduction is done electronically.                                                                        | No     |
| Apparatus are ready and well assembled at station (place of demonstration).                                 | Yes    |
| Some stations.                                                                                              | No     |
| Most stations.                                                                                              | No     |
| All stations.                                                                                               | No     |
| No apparatus available.                                                                                     | No     |
| The participant makes apparatus present- level 1.                                                           | Yes    |
| The participant introduces the apparatus-level 2.                                                           | Yes    |
| The participant guides learners as they try to explain the apparatus-level 3.                               | No     |
| The participant challenges learners to look for apparatus fit for the activity-level 4.                     | No     |
| The participant handles and uses apparatus himself or herself.                                              | Yes    |
| Few learners handle and use apparatus.                                                                      | Yes    |
| Most learners handle and use apparatus.                                                                     | No     |
| All learners are given chance to handle and use apparatus.                                                  | No     |
| Learners are individually involved in the activity.                                                         | Yes    |
| The participant involves small groups (less than five learners) in the activity.                            | No     |
| The participant involves large groups (more than five learners) in the activity.                            | No     |
| No involvement of learners in the activity.                                                                 | No     |
| Learners know what to do because the participant developed procedures for the activity-level 1.             | Yes    |
| Learners know what to do because the participant explained the practical activity-level 2.                  | Yes    |
| Learners know what to do because the participant guides them as they are busy with the activity-level 3.    | No     |
| The participant warned the learners about danger that may occur during the practical activity.              | Yes    |
| Safety is not mentioned because the practical activity is free from danger.                                 | No     |

|                                                                                                                                                 |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Safety precaution signs are placed within the environment in which the activity takes place.                                                    | No  |
| The used proportion of the lesson is little.                                                                                                    | No  |
| The used proportion of the lesson is too much.                                                                                                  | Yes |
| The used proportion of the lesson is average.                                                                                                   | No  |
| The demonstrated practical activity relates to the lesson plan.                                                                                 | Yes |
| The demonstrated activity is totally different from the content of the lesson plan.                                                             | No  |
| The demonstrated practical activity relates partially to the lesson plan.                                                                       | No  |
| Learners write a scientific report in which they justify their conclusion-level 3.                                                              | No  |
| One member from each group reports findings to the whole class.                                                                                 | No  |
| No presentation or communication of the findings.                                                                                               | Yes |
| Assessment covering the prescribed scientific practical skills is given-level 1.                                                                | Yes |
| Assessment questions are based on practical work conducted level 2.                                                                             | Yes |
| Assessment of practical activity involves other forms like demonstration, reports, rubric, creation of charts and improvised apparatus level 3. | No  |
| Learners do open investigations, projects and create portfolios to represent their best work.                                                   | No  |
| The practical activity takes place in the classroom.                                                                                            | Yes |
| The activity takes place outside the classroom.                                                                                                 | No  |
| The activity takes place in the laboratory.                                                                                                     | No  |

## OBSERVATION SCHEDULE

### SECTION A

NAME OF PARTICIPANT: TEACHER C

Table 2: General information

|                                                         |                        |                                                                              |                     |                                                           |                 |                                                                                                                   |            |                                                                                                                                          |                 |                  |                  |
|---------------------------------------------------------|------------------------|------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|------------------|
| 1. Date: 30 April 2013                                  |                        |                                                                              |                     | 2. Name of observer: <b>Mothokwa S S</b>                  |                 |                                                                                                                   |            |                                                                                                                                          |                 |                  |                  |
| 3. School (Pseudonym): <b>School C</b>                  |                        |                                                                              |                     |                                                           |                 |                                                                                                                   |            |                                                                                                                                          |                 |                  |                  |
| 4. Name of teacher (Pseudonym): <b>Teacher C</b>        |                        |                                                                              |                     |                                                           |                 |                                                                                                                   |            |                                                                                                                                          |                 |                  |                  |
| 5. Theme of Natural science: <b>Acids and Bases</b>     |                        |                                                                              |                     |                                                           |                 |                                                                                                                   |            | 6. Grade 7: <b>Sampled class</b>                                                                                                         |                 |                  |                  |
| 6. Number of learners present                           |                        |                                                                              |                     | Number: <b>35</b>                                         |                 |                                                                                                                   |            | Boys: <b>14</b>                                                                                                                          |                 | Girls: <b>21</b> |                  |
| 7. Number of learners absent                            |                        |                                                                              |                     | Number: <b>01</b>                                         |                 |                                                                                                                   |            | Boys: <b>0</b>                                                                                                                           |                 | Girls: <b>01</b> |                  |
| 8. Time:                                                | 1 <sup>st</sup> period |                                                                              | <b>Before break</b> |                                                           | After break     |                                                                                                                   | In between |                                                                                                                                          | Last period     |                  |                  |
| 9. Time:                                                |                        | Started: <b>09h08</b>                                                        |                     | Ended: <b>09h33</b>                                       |                 | Duration: <b>30 Min</b>                                                                                           |            | Total time: <b>30 Min</b>                                                                                                                |                 |                  |                  |
| Period number                                           |                        | 1 <sup>st</sup>                                                              | 2 <sup>nd</sup>     | 3 <sup>rd</sup>                                           | 4 <sup>th</sup> | 5 <sup>th</sup>                                                                                                   | 6th        | 7 <sup>th</sup>                                                                                                                          | 8 <sup>th</sup> | 9 <sup>th</sup>  | 10 <sup>th</sup> |
| Time spent on talking in class.<br><br><b>5 Minutes</b> |                        | Transition time from “in class” to “doing practical”<br><br><b>3 Minutes</b> |                     | Time spent on “doing practical”.<br><br><b>17 Minutes</b> |                 | Time spent on returning to class situation.<br><br><b>Approximately 3 minutes were spent to the rugby ground.</b> |            | Time spent on discussing practical (findings, observation, etc).<br><br><b>5 Minutes packing apparatus to the participant’s counter.</b> |                 |                  |                  |

### SECTION B

Table 3: Observation schedule for a practical work

| AVAILABILITY OF INFORMATION                                                                                 | YES/NO |
|-------------------------------------------------------------------------------------------------------------|--------|
| There is evidence of a lesson plan showing a practical activity to be undertaken on a paper.                | Yes    |
| There is evidence of a lesson plan prepared electronically showing the practical activity to be undertaken. | No     |
| No evidence of a lesson plan for a practical activity                                                       | No     |
| The participant explains the activity well in advance.                                                      | Yes    |
| Introduction of the activity is done on a board.                                                            | Yes    |

|                                                                                                          |     |
|----------------------------------------------------------------------------------------------------------|-----|
| Introduction is written on worksheet.                                                                    | No  |
| Introduction is done on a flip chart.                                                                    | No  |
| Introduction is done electronically.                                                                     | No  |
| Apparatus are ready and well assembled at station (place of demonstration).                              | Yes |
| Some stations.                                                                                           | No  |
| Most stations.                                                                                           | No  |
| All stations.                                                                                            | Yes |
| No apparatus available.                                                                                  | No  |
| The participant makes apparatus present- level 1.                                                        | Yes |
| The participant introduces the apparatus-level 2.                                                        | Yes |
| The participant guides learners as they try to explain the apparatus-level 3.                            | Yes |
| The participant challenges learners to look for apparatus fit for the activity-level 4.                  | No  |
| The participant handles and uses apparatus himself or herself.                                           | No  |
| Few learners handle and use apparatus.                                                                   | No  |
| Most learners handle and use apparatus.                                                                  | No  |
| All learners are given chance to handle and use apparatus.                                               | Yes |
| Learners are individually involved in the activity.                                                      | No  |
| The participant involves small groups (less than five learners) in the activity.                         | Yes |
| The participant involves large groups (more than five learners) in the activity.                         | No  |
| No involvement of learners in the activity.                                                              | No  |
| Learners know what to do because the participant developed procedures for the activity-level 1.          | Yes |
| Learners know what to do because the participant explained the practical activity-level 2.               | Yes |
| Learners know what to do because the participant guides them as they are busy with the activity-level 3. | Yes |
| The participant warned the learners about danger that may occur during the practical activity.           | Yes |
| Safety is not mentioned because the practical activity is free from danger.                              | No  |
| Safety precaution signs are placed within the environment in which the activity takes place.             | Yes |
| The used proportion of the lesson is little.                                                             | No  |
| The used proportion of the lesson is too much.                                                           | No  |
| The used proportion of the lesson is average.                                                            | Yes |
| The demonstrated practical activity relates to the lesson plan.                                          | Yes |
| The demonstrated activity is totally different from the content of the lesson plan.                      | No  |
| The demonstrated practical activity relates partially to the lesson plan.                                | No  |
| Learners write a scientific report in which they justify their conclusion-level 3.                       | No  |
| One member from each group reports findings to the whole class.                                          | Yes |

|                                                                                                                                                 |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| No presentation or communication of the findings.                                                                                               | No  |
| Assessment covering the prescribed scientific practical skills is given-level 1.                                                                | No  |
| Assessment questions are based on practical work conducted level 2.                                                                             | No  |
| Assessment of practical activity involves other forms like demonstration, reports, rubric, creation of charts and improvised apparatus level 3. | Yes |
| Learners do open investigations, projects and create portfolios to represent their best work.                                                   | Yes |
| The practical activity takes place in the classroom.                                                                                            | No  |
| The activity takes place outside the classroom.                                                                                                 | No  |
| The activity takes place in the laboratory.                                                                                                     | Yes |

# OBSERVATION SCHEDULE

## SECTION A

NAME OF PARTICIPANT: TEACHER D

Table 2: General information

|                                                            |  |                                                                           |                 |                                                           |                 |                                                                |                 |                                                                                                                  |                 |                 |                  |
|------------------------------------------------------------|--|---------------------------------------------------------------------------|-----------------|-----------------------------------------------------------|-----------------|----------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|------------------|
| 1. Date: <b>29 April 2013</b>                              |  |                                                                           |                 | 2. Name of observer: <b>Mothokwa S S</b>                  |                 |                                                                |                 |                                                                                                                  |                 |                 |                  |
| 3. School (Pseudonym): <b>School D</b>                     |  |                                                                           |                 |                                                           |                 |                                                                |                 |                                                                                                                  |                 |                 |                  |
| 4. Name of teacher (Pseudonym): <b>Teacher D</b>           |  |                                                                           |                 |                                                           |                 |                                                                |                 |                                                                                                                  |                 |                 |                  |
| 5. Theme of Natural science: <b>Separation of mixtures</b> |  |                                                                           |                 |                                                           |                 |                                                                |                 | 6. Grade 7: Sampled class                                                                                        |                 |                 |                  |
| 6. Number of learners present                              |  |                                                                           |                 | Number: <b>23</b>                                         |                 |                                                                |                 | Boys:13                                                                                                          |                 | Girls:10        |                  |
| 7. Number of learners absent                               |  |                                                                           |                 | Number:                                                   |                 |                                                                |                 | Boys:0                                                                                                           |                 | Girls:0         |                  |
| 8. Time:                                                   |  | 1 <sup>st</sup> period                                                    |                 | Before break                                              |                 | <b>After break</b>                                             |                 | In between                                                                                                       |                 | Last period     |                  |
| 9. Time:                                                   |  | Started: <b>10h58</b>                                                     |                 | Ended: <b>11h20</b>                                       |                 | Duration: <b>30 Min</b>                                        |                 | Total time: <b>31 Min</b>                                                                                        |                 |                 |                  |
| Period number                                              |  | 1 <sup>st</sup>                                                           | 2 <sup>nd</sup> | 3 <sup>rd</sup>                                           | 4 <sup>th</sup> | 5 <sup>th</sup>                                                | 6 <sup>th</sup> | 7 <sup>th</sup>                                                                                                  | 8 <sup>th</sup> | 9 <sup>th</sup> | 10 <sup>th</sup> |
| Time spent on talking in class.<br><br><b>5 Minutes</b>    |  | Transition time from “in class” to “doing practical” .<br><br><b>None</b> |                 | Time spent on “doing practical”.<br><br><b>18 Minutes</b> |                 | Time spent on returning to class situation.<br><br><b>None</b> |                 | Time spent on discussing practical (findings, observation, etc).<br><br><b>8 minutes for writing class work.</b> |                 |                 |                  |

## SECTION B

Table 3: Observation schedule for a practical work

| AVAILABILITY OF INFORMATION                                                                                 | YES/NO |
|-------------------------------------------------------------------------------------------------------------|--------|
| There is evidence of a lesson plan showing a practical activity to be undertaken on a paper.                | Yes    |
| There is evidence of a lesson plan prepared electronically showing the practical activity to be undertaken. | No     |
| No evidence of a lesson plan for a practical activity                                                       | No     |
| The participant explains the activity well in advance.                                                      | Yes    |
| Introduction of the activity is done on a board.                                                            | Yes    |

|                                                                                                          |     |
|----------------------------------------------------------------------------------------------------------|-----|
| Introduction is written on worksheet.                                                                    | No  |
| Introduction is done on a flip chart.                                                                    | No  |
| Introduction is done electronically.                                                                     | No  |
| Apparatus are ready and well assembled at station (place of demonstration).                              | Yes |
| Some stations.                                                                                           | No  |
| Most stations.                                                                                           | No  |
| All stations.                                                                                            | No  |
| No apparatus available.                                                                                  | No  |
| The participant makes apparatus present- level 1.                                                        | Yes |
| The participant introduces the apparatus-level 2.                                                        | Yes |
| The participant guides learners as they try to explain the apparatus-level 3.                            | No  |
| The participant challenges learners to look for apparatus fit for the activity-level 4.                  | No  |
| The participant handles and uses apparatus himself or herself.                                           | Yes |
| Few learners handle and use apparatus.                                                                   | Yes |
| Most learners handle and use apparatus.                                                                  | No  |
| All learners are given chance to handle and use apparatus.                                               | No  |
| Learners are individually involved in the activity.                                                      | Yes |
| The participant involves small groups (less than five learners) in the activity.                         | No  |
| The participant involves large groups (more than five learners) in the activity.                         | No  |
| No involvement of learners in the activity.                                                              | No  |
| Learners know what to do because the participant developed procedures for the activity-level 1.          | Yes |
| Learners know what to do because the participant explained the practical activity-level 2.               | Yes |
| Learners know what to do because the participant guides them as they are busy with the activity-level 3. | No  |
| The participant warned the learners about danger that may occur during the practical activity.           | No  |
| Safety is not mentioned because the practical activity is free from danger.                              | Yes |
| Safety precaution signs are placed within the environment in which the activity takes place.             | No  |
| The used proportion of the lesson is little.                                                             | No  |
| The used proportion of the lesson is too much.                                                           | Yes |
| The used proportion of the lesson is average.                                                            | No  |
| The demonstrated practical activity relates to the lesson plan.                                          | Yes |
| The demonstrated activity is totally different from the content of the lesson plan.                      | No  |
| The demonstrated practical activity relates partially to the lesson plan.                                | No  |
| Learners write a scientific report in which they justify their conclusion-level 3.                       | No  |
| One member from each group reports findings to the whole class.                                          | No  |

|                                                                                                                                                 |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| No presentation or communication of the findings.                                                                                               | Yes |
| Assessment covering the prescribed scientific practical skills is given-level 1.                                                                | Yes |
| Assessment questions are based on practical work conducted level 2.                                                                             | Yes |
| Assessment of practical activity involves other forms like demonstration, reports, rubric, creation of charts and improvised apparatus level 3. | No  |
| Learners do open investigations, projects and create portfolios to represent their best work.                                                   | No  |
| The practical activity takes place in the classroom.                                                                                            | Yes |
| The activity takes place outside the classroom.                                                                                                 | No  |
| The activity takes place in the laboratory.                                                                                                     | No  |

## OBSERVATION SCHEDULE

### SECTION A

**NAME OF PARTICIPANT: TEACHER E**

Table 2: General information

|                                                         |                        |                                                                          |                 |                                                           |                 |                                                                |            |                                                                                                                 |                 |                  |                  |
|---------------------------------------------------------|------------------------|--------------------------------------------------------------------------|-----------------|-----------------------------------------------------------|-----------------|----------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------|-----------------|------------------|------------------|
| 1. Date: <b>02 May 2013</b>                             |                        |                                                                          |                 | 2. Name of observer: <b>Mothokwa S S</b>                  |                 |                                                                |            |                                                                                                                 |                 |                  |                  |
| 3. School (Pseudonym): <b>School E</b>                  |                        |                                                                          |                 |                                                           |                 |                                                                |            |                                                                                                                 |                 |                  |                  |
| 4. Name of teacher (Pseudonym): <b>Teacher E</b>        |                        |                                                                          |                 |                                                           |                 |                                                                |            |                                                                                                                 |                 |                  |                  |
| 5. Theme of Natural science: <b>Systems of energy</b>   |                        |                                                                          |                 |                                                           |                 |                                                                |            | 6. Grade 7: <b>Sampled class</b>                                                                                |                 |                  |                  |
| 6. Number of learners present                           |                        |                                                                          |                 | Number: <b>56</b>                                         |                 |                                                                |            | Boys: <b>26</b>                                                                                                 |                 | Girls: <b>30</b> |                  |
| 7. Number of learners absent                            |                        |                                                                          |                 | Number: <b>0</b>                                          |                 |                                                                |            | Boys: <b>0</b>                                                                                                  |                 | Girls: <b>0</b>  |                  |
| 8. Time:                                                | 1 <sup>st</sup> period |                                                                          | Before break    |                                                           | After break     |                                                                | In between |                                                                                                                 | Last period     |                  |                  |
| 9. Time:                                                |                        | Started: <b>10h10</b>                                                    |                 | Ended: <b>10h25</b>                                       |                 | Duration: <b>30</b>                                            |            | Total time: <b>20 Min</b>                                                                                       |                 |                  |                  |
| Period number                                           |                        | 1 <sup>st</sup>                                                          | 2 <sup>nd</sup> | 3 <sup>rd</sup>                                           | 4 <sup>th</sup> | 5 <sup>th</sup>                                                | 6th        | 7 <sup>th</sup>                                                                                                 | 8 <sup>th</sup> | 9 <sup>th</sup>  | 10 <sup>th</sup> |
| Time spent on talking in class.<br><br><b>3 Minutes</b> |                        | Transition time from “in class” to “doing practical”.<br><br><b>None</b> |                 | Time spent on “doing practical”.<br><br><b>12 Minutes</b> |                 | Time spent on returning to class situation.<br><br><b>None</b> |            | Time spent on discussing practical (findings, observation, etc).<br><br><b>5 Minutes for writing classwork.</b> |                 |                  |                  |

### SECTION B

Table 3: Observation schedule for a practical work

| AVAILABILITY OF INFORMATION                                                                                 | YES/NO |
|-------------------------------------------------------------------------------------------------------------|--------|
| There is evidence of a lesson plan showing a practical activity to be undertaken on a paper.                | Yes    |
| There is evidence of a lesson plan prepared electronically showing the practical activity to be undertaken. | No     |
| No evidence of a lesson plan for a practical activity                                                       | No     |
| The participant explains the activity well in advance.                                                      | Yes    |
| Introduction of the activity is done on a board.                                                            | Yes    |
| Introduction is written on worksheet.                                                                       | No     |

|                                                                                                          |     |
|----------------------------------------------------------------------------------------------------------|-----|
| Introduction is done on a flip chart.                                                                    | No  |
| Introduction is done electronically.                                                                     | No  |
| Apparatus are ready and well assembled at station (place of demonstration).                              | Yes |
| Some stations.                                                                                           | No  |
| Most stations.                                                                                           | No  |
| All stations.                                                                                            | No  |
| No apparatus available.                                                                                  | No  |
| The participant makes apparatus present- level 1.                                                        | Yes |
| The participant introduces the apparatus-level 2.                                                        | No  |
| The participant guides learners as they try to explain the apparatus-level 3.                            | No  |
| The participant challenges learners to look for apparatus fit for the activity-level 4.                  | No  |
| The participant handles and uses apparatus himself or herself.                                           | Yes |
| Few learners handle and use apparatus.                                                                   | Yes |
| Most learners handle and use apparatus.                                                                  | No  |
| All learners are given chance to handle and use apparatus.                                               | No  |
| Learners are individually involved in the activity.                                                      | Yes |
| The participant involves small groups (less than five learners) in the activity.                         | No  |
| The participant involves large groups (more than five learners) in the activity.                         | Yes |
| No involvement of learners in the activity.                                                              | No  |
| Learners know what to do because the participant developed procedures for the activity-level 1.          | Yes |
| Learners know what to do because the participant explained the practical activity-level 2.               | Yes |
| Learners know what to do because the participant guides them as they are busy with the activity-level 3. | No  |
| The participant warned the learners about danger that may occur during the practical activity.           | No  |
| Safety is not mentioned because the practical activity is free from danger.                              | Yes |
| Safety precaution signs are placed within the environment in which the activity takes place.             | No  |
| The used proportion of the lesson is little.                                                             | Yes |
| The used proportion of the lesson is too much.                                                           | No  |
| The used proportion of the lesson is average.                                                            | No  |
| The demonstrated practical activity relates to the lesson plan.                                          | Yes |
| The demonstrated activity is totally different from the content of the lesson plan.                      | No  |
| The demonstrated practical activity relates partially to the lesson plan.                                | No  |
| Learners write a scientific report in which they justify their conclusion-level 3.                       | No  |
| One member from each group reports findings to the whole class.                                          | No  |
| No presentation or communication of the findings.                                                        | Yes |

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|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Assessment covering the prescribed scientific practical skills is given-level 1.                                                                | Yes |
| Assessment questions are based on practical work conducted level 2.                                                                             | Yes |
| Assessment of practical activity involves other forms like demonstration, reports, rubric, creation of charts and improvised apparatus level 3. | No  |
| Learners do open investigations, projects and create portfolios to represent their best work.                                                   | No  |
| The practical activity takes place in the classroom.                                                                                            | Yes |
| The activity takes place outside the classroom.                                                                                                 | No  |
| The activity takes place in the laboratory.                                                                                                     | No  |

## APPENDIX D.1

### SEMISTRUCTURED INTERVIEW SCHEDULE

**Table 4: Predetermined questions as guideline for the interview.**

| What a practical task integration involves | Questions to be asked                                                                                                                                                                                                                                                                                                     | What I expect to understand from the respondent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lesson design                              | How do you design a lesson for a practical activity?                                                                                                                                                                                                                                                                      | <p>To determine which level of the Profile of Implementation does the participant teacher use when designing a practical activity lesson.</p> <p>Whether the participant designs a lesson using specimens that are provided by the department of education or any other organisation-(level 1 of the Profile of Implementation).</p> <p>Whether the participant engages learners during the lesson planning stage- (level 2 of the Profile of Implementation).</p> <p>The participant designs a practical activity in such a way as to encourage learner discovery of information-(level 3 of the Profile of Implementation).</p> <p>The participant allows the learners to design a practical activity lesson-(level 4 of the Profile of Implementation).</p> <p>Finally, to decide whether a practical activity lesson design indicates the skills to be executed, specific objective, the strategies to realise the abilities, time frame for the completion of the activity, the resources, and the role of both the teacher and the learner.</p> |
| Developmental skills                       | Which documents do you use to identify the developmental process skills prescribed for grade seven learners?                                                                                                                                                                                                              | To determine whether the participant teacher uses the relevant documents which embrace the prescribed practical skills, e.g. NCS policy for the Natural Sciences and the work schedule.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Implementation                             | <p>How do you integrate a practical activity in your teaching?</p> <p>Where do you find the practical activities that you teach your learners?</p> <p>What challenges do you experience in doing practical activities?</p> <p>How do you address challenges that you encounter during practical tasks implementation?</p> | <p>To determine whether the participant uses:</p> <p>Demonstrations to help develop concepts-(level 1 of the Profile of Implementation).</p> <p>Demonstrations to promote a limited form of inquiry-(level 2 of the Profile of Implementation).</p> <p>To determine whether learners are given an opportunity to perform guided discovery type work in small groups, engaging in hands-on activities-(level 3 of the Profile of Implementation).</p> <p>To determine whether learners are given chance to perform their own open investigations-(level 4 of the Profile of Implementation).</p> <p>Furthermore, I need to establish as to whether:</p> <p>Apparatus are organised well in advance within the environment in which the activity has to take place;</p> <p>The participant explains what learners are supposed to do and for how long should the activity last.</p> <p>Finally, I need to understand whether there are</p>                                                                                                              |

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|                           |                                                                                                                                                                                                                                                                    | barriers to practical tasks implementation and what innovative actions does the participant take to address such barriers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Apparatus/equipment       | <p>What do you use to make your lesson effective?</p> <p>How do you introduce apparatus which learners have to use during a practical activity demonstration?</p> <p>What do you do if there is shortage or lack of apparatus for conducting a practical task?</p> | <p>The objective is:</p> <p>To determine whether apparatus are engaged to help learners understand the activity much better.</p> <p>To determine whether explanation of apparatus takes place before the start of the activity.</p> <p>To determine whether the learners are given time to handle and use apparatus.</p> <p>To determine whether improvisation takes place in case there are no physical apparatus.</p>                                                                                                                                                                                                                                                                                                                                                   |
| Involvement of learners   | What is the role of the learners during a practical activity?                                                                                                                                                                                                      | To determine whether the learners are given an opportunity to do practical activities such as demonstrations, projects, investigations, etc by themselves.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Communication of findings | How are data findings communicated?                                                                                                                                                                                                                                | <p>To establish:</p> <p>Whether the participant teacher knows the essence of communicating data.</p> <p>Whether learners are given an opportunity to communicate data using graphs and tables-(level 2 of the Profile of Implementation).</p> <p>Whether learners are provided chance to write scientific report in which they can justify their conclusions in terms of the data collected-(level 3 of the Profile of Implementation).</p> <p>Whether learners are given an opportunity to collect and interpret data in support of competing theories or explanations-(level 4 of the Profile of Implementation).</p>                                                                                                                                                   |
| Safety precautions        | How do you make learners aware of possible danger during a practical session?                                                                                                                                                                                      | To understand whether the learners are informed about safety issues prior to the start of the session or there are visible safety precautions in place.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Assessment                | <p>How do you assess achievement of practical abilities in learners?</p> <p>When does measurement of a practical activity occur?</p> <p>Who designs the assessment instrument?</p> <p>How is assessment instrument moderated?</p>                                  | <p>To determine whether the assessment instruments are based on the practical activity-(level 2 of the Profile of Implementation).</p> <p>To establish whether the participant assesses learners abilities by applying various forms of assessment, for example, tests, demonstrations, rubrics, reports on activities taken, creation of charts and improvised apparatus-(level 3 of the Profile of Implementation).</p> <p>To determine whether learners are given chance to create portfolios to represent their own work-(level 4 of the Profile of Implementation).</p> <p>To find out:</p> <p>Who designs the assessment instrument,</p> <p>Who does moderation of the instrument and how is it done,</p> <p>About the time acquisition of skills is conducted.</p> |
| Control                   | How do you control completed tasks?                                                                                                                                                                                                                                | To determine whether a performed activity is controlled for identification of strengths and weaknesses in learners so that intervention strategies may be prepared.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## APPENDIX D.2: INTERVIEW TRANSCRIPTS

### TEACHER A

| Teacher | Interview Questions                                                                                          | Responses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| A       | How do you design a lesson for a practical activity?                                                         | Ok. I have a booklet that have some lesson plans. And then I just check the topic which I am supposed to teach. And also checking the lesson plan. From there I try to gather for the things that I need for the lesson plan to be a success.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|         | Which documents do you use to identify the developmental process skills prescribed for grade seven learners? | I use work schedule. It is guiding me on which practical work I must do. And from there I find out the lesson plan in the booklet that I am talking about. If it is not there I design mine. From there I teach the learners.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|         | How do you integrate a practical activity in your teaching?                                                  | Isn't it that I gather all the information needed or the materials needed to use. And from there I just explain to the learners what is expected of them. From there the learners are involved in practical. After showing them how to do this then I involve them. They also do.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|         | Where do you find the practical activities that you teach your learners?                                     | As I said earlier that I use work schedule and then from there I refer to the book, the textbook, learners' book. And then I also have a teacher's guide. I refer to those books. From there I do the practical work with learners.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|         | What challenges do you experience in doing practical activities?                                             | Yes, there are some challenges. Whereby some of these practical activities that I have to do with the learners, there are no other apparatus to be used. The school does not have. So it is a challenge because I have to involve learners to bring along other things. I have to go out and find one, two three. Anything that can help me or help the learners to understand what I want them to achieve. It is a challenge to me because our school does not have other apparatus.<br><br>Sometimes even time. The time that we are given, the period is 30 minutes. This practical work needs time so that these learners can really touch, feel and can do all these other things in time. so we don't have time because when the period is over is over. It is 30 minutes. So these 30 minutes to me I don't think it is enough for practical work. And the other challenge is when these learners, these things of practical work, ...Isn't it that sometimes we use the learners to go out and find one, two, three. You find that sometimes they do not come with those things that we want them to bring along so that we can continue with the activity. It is a challenge. You find that only two learners have these things. And you cannot work with two learners while others are watching. |
|         | How do you address challenges that you encounter during practical tasks implementation?                      | Ja, it is a matter of consultation with the management most of the time. And sometimes the management do help, sometimes you find that it is also difficult for the management as you know the resources of the school, especially money issue. It is a long process. The other thing you find that you end up using your money and in order to be refunded, hei,...it is a process also. This is how we suffer when we do these things.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|         | What do you use to make your lesson effective?                                                               | It depends on what lesson I am going to present. Or if it needs, for example, a spirit like the one I used the other day. I use it very effectively because it represents other things like paraffin and so on. So far I haven't done much of the practical lessons. But the once that I have already                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

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|  |                                                                                                      | done I used that spirit. And the other one I used the things that are here at school. If I find it I use it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | How do you introduce apparatus which learners have to use during a practical activity demonstration? | Ja, I just put them on the table and pick one by one and trying to show them. The name of this is this and it works like this until I complete the apparatus. They must first know them. I just pick one by one and show them as the lesson continues. From there, if they need to be assembled, I assemble them while they are watching.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | What do you do if there is shortage or lack of apparatus for conducting a practical task?            | You know as I plan the lesson, I try to assemble all the apparatus. If I realise that I have got a shortage, if possible, when I check these things and realise that learners can bring them I ask from the learners. Maybe they have it at home. Like the other day I requested them to bring the wooden spoons from home. Then, if they have it, a learner will bring them and I will use that thing. So, this is how I do it. If I do not have at all, then maybe I will use some pictures in the books. If I find it in the book then I just show them and explain how it works. If I do not have I do not have. I just explain to the learners how the activity works. I am thinking that if I happen to see it on a video I can bring it so that they can watch. Unfortunately, so far, some of the things I do find them but even if I do not find other things I can explain. Just explain. This is how it can work here.                                              |
|  | What is the role of the learners during a practical activity?                                        | Ja, learners watch what I am doing. When I assemble or maybe I introduce the apparatus they just listen and watch, you see. So from there I want them also, if possible, to participate by means of maybe assembling the apparatus, touching the apparatus, touching the results, the conclusion and so on. So, thus how I want them all to see, to touch, to test, if it is possible. And from there to work on the experiment if it is an experiment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  | How are data findings communicated?                                                                  | Ja, even if so far I haven't done that thing, it is proper that sometimes the other group may select one of their students to explain what they found. But so far I haven't done that.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|  | How do you make learners aware of possible danger during a practical session?                        | Ja, when learners do these experiments, firstly I explain everything. What is this? What is this? I introduce. If this thing is dangerous I also explain how dangerous it is. When they do that I monitor. I check. Isn't it maybe they are in groups. The first group when they do I check so that they do not go so far. If it is fire, they don't have to touch the fire because they may get injured. So, like the other day when we do that one of heat transfer, there was a wire which was red because it was very hot. And then I did not allow them to touch that other side which was very hot. I just want them to feel if really it is warm. If it is warm then that learner will tell others, to avoid danger. I do monitor them. If it is spirit, they know they mustn't drink spirit. I must tell them that you must drink this, you must touch this. After this then we wash our hands, if maybe we are closer to this thing. So we wash our hands thereafter. |
|  | How do you assess achievement of practical abilities in learners?                                    | Ja, you know. Isn't it that most of the time we give them work after these experiments? You must mark the books if they are written in the books. There is this thing of rubric. If it needs that then I use it. So, I think here, I am also still learning. I cannot claim to do it. Presently, I just allow them to write something then I check.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | When does measurement of a practical activity occur?                                                 | Immediately after I give them the work and then I check their books. While they are busy I check. Isn't it that maybe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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|  |                                         | they are arranged in groups? I check them. I can see that they have achieved this. As they are busy then I am busy monitoring also. I can see how they do it. If they need corrections then I show them. I give them feedback immediately. |
|  | Who designs the assessment instrument?  | It is myself. I just do it may be guided by the documents. As I said this thing of rubric I do not use it. I just check if it needs to be assessed. For the experiment that has been done I also designed the assessment instrument.       |
|  | How is assessment instrument moderated? | Ja, here at our school we take our tools to the head of department (HOD). Only the recorded one. The one which we do not record we do not give them for moderation.                                                                        |
|  | How do you control completed tasks?     | As I said earlier that I am presently giving them written work. After they have done everything then I check. I try to give them written work so that I can mark.                                                                          |

## TEACHER C

| Teacher | Interview Questions                                  | Responses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| C       | How do you design a lesson for a practical activity? | <p>First, you have to look at the module. What is the module about? Then you can start planning out by looking at the teacher's guide, the learners' guide and all kinds of stuff that I collected during the years of teaching as well as the learning outcomes, the assessment standards. You know all that stuff, neh, you have to look. Look at all those requirements in the learning outcomes and assessment standards to see where you are going. So, when you plan for a lesson, especially in Science or Natural Sciences you should look at everything. As easily as possible to try and teach children. And I am a total believer of practical implementation. Try to find something at home.</p> <p>Think about the lesson, speak to colleagues, speak to your wife and ask for suggestions and step back. Plan the whole lesson according to all the stuff that the department wants us to do. According to all the stuff. Let all the evidence, examples, everything, all examples, from speaking to somebody, looking at the internet, all according to the level of the grade 7's. You can go further than the grade 7 level. But is not advised to go beyond that. But when you plan for a lesson in Science, it must be practical as far as possible to help them to know the work.</p> <p>Then you have to go sit. You can plan by writing your own stuff down. I am always doing according to scientific methods of some previous years like, "What is your problem? What is the question? What is the theme?" The stuff that I want the children to know, like this lesson, the different types of energy. This is my aim. I want them to know what the different types of energy are. The second one is, "What am I going to do? What kind of apparatus am I going to use? I am using the scientific methods a lot. And I will give you an example or copy of what we had last. The first one is aim, and the second is apparatus. And you look at all the different kinds of practical stuff that you gonna use.</p> <p>And the third thing is observation. The methods. You ask yourself, "How am I going to give this lesson to the children?" What am I going to do first, second? How am I going to implement the practical stuff that I collected from home? And how am I going to use it in my lesson? It is all about planning. The aim or the problem first and the apparatus or equipment that you need to have.</p> <p>And then the method. How you are going to do the observation. You sit in and you work out for yourself. How is this gonna work? And then the last thing about the scientific methods is conclusion. What happened? Did I answer the question or the problem from all the stuff? All I am working a lot with is the scientific when I prepare a lesson. There are no specific forms that are given to us to work it out but we just made our own form. I will give you one as an example as well. Our own school has set it up for us to work lessons on. It is a very important thing because you have to show your learning area, what is called now subject. You have to show your learning area head where you prepared your lesson. It is all according</p> |

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|  |                                                                                                              | to a form that I am using.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | Which documents do you use to identify the developmental process skills prescribed for grade seven learners? | <p>All in the Curriculum and Assessment Policy (CAPS) documents that we get from the department. Assessment guides, extra copies, curriculum and policy statements. And next year it is going to be CAPS. It is going to be implemented in grade 7 as from next year. Some process skills are collected from internet.</p> <p>I set or design my assessment questionnaire absolutely according to that standard. But everything has to be set according to all those official documents supplied by the department.</p>                                                                                                                                                                                                                                                               |
|  | How do you integrate a practical activity in your teaching?                                                  | <p>Eh, it is all about planning a lesson. When you plan the information that you wanna give to the children, you want the learners to know. When you are busy planning you bring in practical frame because science is living subject. For each statement of that particular lesson give to the children.</p> <p>So, it is very important while you are thinking about the stuff or information that you want them to know. Think about some practical stuff, for instance, minerals. I discussed now with them. Now I can't just tell them light being dim that it shines or bright. You must bring in examples. Things to show them because learning from general statements is not enough. They must be showed the stuff.</p>                                                      |
|  | Where do you find the practical activities that you teach your learners?                                     | The practical activities are from the documents that the department provide and also the textbooks that I use for teaching the Natural Sciences.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | What challenges do you experience in doing practical activities?                                             | There are lot of challenges. The first thing is to see if the children, how much do they know after a practice lesson. So, it is nice for me to let them the other day to write a small or little work of ten (10) marks. Just to ask about the previous work. Just to ask them question, for instance, tomorrow they have to give some answers about the work done today. To find out how good it was my teaching by just asking them a few questions about the work. And if they got 80% (percent) and more, the rest of the class, then I feel good because I can see that I was teaching. My teaching was good. So, I am testing a lot. But not always testing for marks for the reports or reporting stuff. Testing in class to see if they really understand what I teach them. |
|  | How do you address challenges that you encounter during practical tasks implementation?                      | It is not only challenging of the test but it is challenges of life. Not about school work, life is also a challenge to me. Yes, I tell them about the challenges of life. So, yes I tell them about the success.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|  | What do you use to make your lesson effective?                                                               | I think it is coming with age. You have to change your heart and your mind and go to the level of the learners. You cannot speak as an arrogant. You are just a communicator, you are a facilitator. Teachers should teach or speak from his heart. So, I have to make a joke to the children. I tease them. Just to get them relax. I totally believe you have to go down to the standard or level of the children. Then, there is where your lesson is going to be successful. Even if you are at home, you stood up from bad with the wrong foot or whatever or you don't fell well. Even if you are sick, you must be a teacher from your heart 100% perfectly. You have to teach the children. You have to speak to their hearts not to their minds. You                         |

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|  |                                                                                                      | cannot stand there with sickness, disappointment or problems of your colleagues or whatever. Then it is the start of success of your lesson. If your heart is really pleased the learning atmosphere will be good. So, the success of your lesson starts there. And everything will come.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|  | How do you introduce apparatus which learners have to use during a practical activity demonstration? | <p>Right from the start of the year. I introduce the apparatus to the learners that they are going to use during the year. It is a separate lesson which is not included in the textbooks of the children or wherever is a separate lesson that I just incorporated I show them the apparatus and the playing cards. So that they know the apparatus. With each lesson I start with the apparatus so when they start with each lesson they know what the apparatus are. So the laboratory apparatus is not... I had forgotten the word, but they know the apparatus.</p> <p>Like the bat apparatus, they don't know how it is played. It is not long it has been played. It is a very scarce sport. So, you have to tell them about it. Don't waste time to do it They have to know. Most of the children are not used to it.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | What do you do if there is shortage or lack of apparatus for conducting a practical task?            | Some lessons are just lessons that they learn theoretically. Eh .....speak to people. My colleagues at high schools I speak to them to find out if they have something that I can use. Microscope. But there are lots and lots of visual things that you can use, example, videos, DVDs. We have old videos over there. So, there are aids or resources. There are apparatus that you can use for every lesson. Even the internet you can use something because Science is about everything. So, you can. If you really wanna work hard you can find aids or apparatus from anywhere. Sometimes it is difficult. From internet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  | What is the role of the learners during a practical activity?                                        | It is very important for them to work together. You know in my class there are..... The whole class is set up in a group of four each. In that group there is a leader. The group leaders are sitting on the same places. So, when I am looking the group I know exactly where the group leader is or who the group leader is. And the one just next to the group leader is the one with low knowledge. The group leader is the one with knowledge, the clever one. I don't choose them they choose themselves from the test results. The first thing when I get the test results I check the group leaders. Just next to the group leaders are those who cannot learn well so that they can try to learn. Opposite the group leader is a different sex. I just try to set the sexes apart. Two boys two girls in one group so that they can share information. They can't feel shy to share information. There is a secretary and a time keeper in each group. The time keeper has to keep time. Like in each activity I use to give them time to complete. Small group and there must be a leader, record keeper and time keeper. Record keeper records the findings of the observations. So I'm trying to divide my people. I'm not doing things for them. They are doing things for themselves – putting stuff together. In this lesson as well is a great lesson. If you think to get apparatus I'm sure you will get them in the class. There are card they have to use – to match words after a lesson. This is a kind of test a give the learners. If they can match all the cards it means my lesson was very successful. That is the kind of |

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|  |                                                                               | assessment that I give them.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|  | How are data findings communicated?                                           | Information is communicated during worksheets. There are worksheets – the previous worksheet that I gave you. That is a summary of the lesson that I taught the learners. The worksheets provide for questions. But if you don't have the worksheet you write on a piece of paper. But there must be questions about the lesson they learnt.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|  | How do you make learners aware of possible danger during a practical session? | By speaking to the learners may be before the practical lesson. I will tell them if we are working with acids, spirit, etc. I am preparing them not to play around in class. I tell them before hand. A friend of mine has a book that teaches children how to behave in a laboratory on the first page. I read through this with them. I make them aware beforehand if there is any danger. And there are medical aids.                                                                                                                                                                                                                                                                                                                                                         |
|  | How do you assess achievement of practical abilities in learners?             | I test the abilities of the learners according to the correct assessment guidelines given to us. But not all of them. You cannot use all of them. You will just do assessment of what you were teaching. So, I'm using assessment guidelines. I am also using my own guideline. The teacher has to ask about the question again. It is very nice during the practical lesson you can even give them fake marks for the group. Say you say group 1 you got 10 out of 10. I try to test their ability. Testing to see if they have got it right. I do it throughout during the work.                                                                                                                                                                                               |
|  | When does measurement of a practical activity occur?                          | When I'm busy teaching the lesson. The formal assessment is set up by the school and by the department for assessing all the task taught, that is, tasks 1, 2 etc. But not at one practical task – say at least three tasks or four practical tasks. I test the practical ability. I put all the practical marks together to give one mark for the exam. I am not just testing for the sake of testing. I am not just assessing for the sake of assessing. I am assessing or testing the children to see if they can or are able to do the practical work or are they able to understand. Assessment for me is not just writing test. It is to find out what the children know.                                                                                                  |
|  | Who designs the assessment instrument?                                        | It comes from the department. It is all set up clearly by the department what you should do. Still you have to follow your own heart. Do what they ask you to do but follow what you think you can assess.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | How is assessment instrument moderated?                                       | Ja. The principal or the deputy principal moderates the assessment instruments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | How do you control completed tasks?                                           | Marking the books. Sometimes I take them home, but I am not always marking the facts. I am giving them an extra small book with open lines; all the observation questions and the general assignments; all the work they are going to do. The summary of the work they are doing, all these answers in the observation book. First thing, they write in the observation books and we mark them, they write down the correct answers, they write at home, they write the answers from the observation book. When they study for the exam, there is a textbook and exercise book. I am just checking. I don't even have to read the answers because I know the answers are correct. The answers are taken from the observation book. It just a matter of checking and controlling. |

## TEACHER D

| Teacher | Interview Questions                                                                                          | Responses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| D       | How do you design a lesson for a practical activity?                                                         | <p>Actually for practical activities, I disregard the fact that I don't have apparatus. So I do improvise before I can go to class. I think a lot about the lesson. I look at manipulative that can be used. I look at what I have at my disposal. If they are not there, I go to the neighbouring schools and enquire about the particular apparatus that I will be using as to whether they have or not. If they don't have, for instance, instead of a glass beaker I just take a glass of water and use. But the difficulty comes to things that are not available. I even went to the neighbouring school. Fortunately they provide me with one apparatus. This is what I do.</p> <p>I have realised that teaching the practical part of the Science using what you have is easier than explaining to kids theoretically. They even attach me with the apparatus that I use. One learner once saw me coming and told the other learners that Mr Thermometer is coming. Apparatus make the lesson easier for the teacher to present. It makes the learners to attend. And learners don't easily forget what I have taught them. Things that they do at home, making tea. What do they use? Hot water. Tea leaves and sugar. Then what happens to the leaves? The tea leaves do not dissolve, but sugar dissolves. They will say it disappears. When they say disappears I give the correct word that it dissolves not disappear. With the tea leaves, what do we use to strain the tea leaves? They will say the sieve. That is one way of separate mixtures. Water and sugar will pass through the opening of the sieve. But tea leaves will not pass through by the opening of the sieve. Some of the apparatus you just buy. You don't rely on the school to provide you with everything. What you can afford buy. Just like that sieve. It is R19-00 something. I bought it with my own money. So I don't see any problem, because I would have delivered to the kids.</p> |
|         | But when it comes to the design of a lesson plan, how do you do it?                                          | <p>But after I had shown him that the question is basically about designing a lesson for teaching practical activity he responded positively. This is how he responded: Unfortunately I do not follow this template they have given us the lesson preparation I use my college exercise book to write in details what I am going to do. And that person who always checks the syllabus so if there is a lesson that is prescribed for that term.</p> <p>I first of all think about that lesson. And I think about things that I will use to present the lesson clearly. I don't have any particular way of finding a lesson plan. Today's lesson tomorrow can change after realising the mistakes that I did. I don't have a formal way of preparing a lesson plan for a practical activity.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|         | Which documents do you use to identify the developmental process skills prescribed for grade seven learners? | <p>Fortunately when I was still at school I followed the Science stream. So I also go to the internet. Why do I go to the internet? It is because I spent many years of my teaching at high school. So it is a challenge to me teaching kids. Thus why I go to the internet. I look how the lessons for the junior and intermediate phases are structured. And then I align my knowledge with the information that I</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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|  |                                                                          | <p>sourced from the internet. But I use many resources, even these newspapers like “The Teacher” they do have some good lessons. Thus is why now I encourage the staff members to look or read newspapers because they have good lessons. They even provide good methods which can be used to present different topics to kids. The only problem is that I taught 18 years at high school. So, you know that those people are matured. When it comes to these ones you cannot teach them using the same methods (i.e. methods applicable for secondary school learners).</p> <p>You can also use them although that is not allowed. I also at times use them as my aids in class. Then when they see what is happening they will not forget.</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | How do you integrate a practical activity in your teaching?              | <p>Hm,.....starting from what the learners already know. Let say, for example, when they come to school some will say we ate soft porridge. I ask them: “Which ingredient did you make or did you use to make the soft porridge?” Some will say mealie-meal, hot water. We boil that. Ja, no, explaining the word mixture it will be ease. What is taught in class is related to what you do at home. So, that gives me satisfaction of explaining what mixtures are because I already know what they know.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | Where do you find the practical activities that you teach your learners? | <p>Some where...eh.. this workbooks that the government had provided us at the end (last pages of the book) they have illustrated things that you can do experiments. They do give the apparatus that you may need. Fortunately, we do have nutrition programme at school. They do eat beans, rice, samp, etc. So, when you come to mixtures take different things, take samp, take some beans and mix them. Let the learners identify things that they are in the pot. Whatever you are putting. In my case it was samp and beans. You ask them about the ingredients used. They will say a samp, beans. Now, do you have any way to separating the samp from the beans? They will say I just pick beans from samp. So, that is very much simple. It will be difficult maybe when it comes from to substances where now one substance dissolves completely in another one. Where now you are going to use the process of distillation. But with settling and decanting is simple. You just put water in the glass, put some soil and mix them. After a long time soil settles at the bottom, then, you pour out water and you remain with soil. It is very easy.</p> |
|  | What challenges do you experience in doing practical activities?         | <p>The challenge is there. One, to explain an upper lesson in mother tongue. I realised that most of the learners still have a problem. They still not understand English. So, you can mix mother tongue and English, maybe say for few or 10 (ten) minutes. But I found it difficult when teaching learners practical thing, maybe thermometer. I do not know what I am going to say thermometer is in mother tongue. A glass beaker, I cannot say is a cup. It is a glass beaker but I don't know what I am going to call it in mother tongue. This is a difficulty that I am encountering. Translating a Science word in English to mother tongue. That is the difficulty that I am having. Another thing is that learners, when maybe you presented a practical lesson, when you ask them questions, instead of answering what they have seen they will just tell you the names of the apparatus you have used. To say a thermometer. Let say you have asked</p>                                                                                                                                                                                                  |

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|  |                                                                                                      | <p>them a question: "Which instrument do you use to measure temperature?" They will not say thermometer. They will say coldness or hotness. Coldness or hotness, what is that? Which instrument? Which tool? But you find that you say instrument or you say tool the learner doesn't understand what you are saying. So, the difficulty in English words, yes, is one other challenge. Some of the learners even write answers in their mother tongue. You say: "What have you realised?" "What is the mixture?" A learner may answer in mother tongue, "A re ke dinawa le setlhampa" (meaning beans and samp). Instead of saying tool and more different materials They write different materials in "pampiri" (which is a code name I used to replace the proper language used by the participant teacher). The word "pampiri" means a paper in English. He continued. That is the difficulty that I am encountering. Lack of understanding English words, not knowing the correct word or apparatus in their vernacular and then learners just respond by mentioning what they had seen. Maybe the apparatus were used, instead of answering the question directly the learner will say the opposite.</p> |
|  | How do you address challenges that you encounter during practical tasks implementation?              | <p>One that I do is to encourage other teachers to use a medium of instruction although the use of mother tongue should be kept at a minimal. The subject that medium of instruction is English let it be English. That will cap the misunderstanding of the learners. Although I tried to highlight that I realised that mother tongue is still dominating in some of the subjects. That creates a problem. You cannot teach Social Sciences in mother tongue. A medium of instruction is English and you find that teachers spend 20 (twenty) minutes explaining in mother tongue and 10 (ten) minutes in English. That creates a problem.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|  | What do you use to make your lesson effective?                                                       | <p>The involvement. Do not allow as a teacher that the lesson is centred only on you. Give the children to do the experiments while you are busy monitoring. Fortunately, in these lower grades there are no activities that are harmful. So you can just give children to do that while you are busy monitoring so that you correct their mistakes because they do not do activities that are harmful to their health. So, in classes where now you have to mix maybe hydrochloric acid, that is , where you use acids you must be very much strict. Do not allow the children to do those practical things on their own.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|  | How do you introduce apparatus which learners have to use during a practical activity demonstration? | <p>You ask them. First I raise up the apparatus. Ask where they have seen it. Just like the thermometer. Where have you seen it? Although it was a big thermometer some said at the clinic. I said, "What did they do with this at the clinic? Some said that they put it under the tongue and some said under the armpit. What are they actually doing with it? Some answered to check as to whether I am sick. Then you know that the child has an answer. To see as to whether I am sick. The child has an answer but doesn't know exactly what a thermometer is made for. That is where you have to explain that we use a thermometer to check as to whether your body temperature is high or cold. So, with the heat transfer they saw glasses and the glass beakers. Although they are made of glass but they are not the glasses that we use at home to bring water with. You just explain. That is where now we come across a big</p>                                                                                                                                                                                                                                                                 |

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|  |                                                                                                  | <p>problem. Our schools don't have enough apparatus. Some of our kids see apparatus while they are at the universities. I think it will be better for the government to even provide these laboratories to primary schools so that we lessen the teacher's work at high schools because practical tasks will be introduced to them at primary level.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | <p>What do you do if there is shortage or lack of apparatus for conducting a practical task?</p> | <p>Apart from improvising, maybe to avoid using a wrong thing for the right thing. I once went to the former college of education to request a circuit board after having an item as a matter of urgent. They didn't have any difficulty in providing with those. But when I went to the neighbouring schools to go and ask, some of them even though they have got apparatus that are locked in still cabinets doing nothing they find it reluctant to offer me.</p> <p>But some schools do give. After using them I return them. The only problem that I have encountered in class is when I wanted to do an experiment of testing for a starch. So, the iodine solution, I went to the neighbouring chemist to look for it. I didn't find it. I went to the neighbouring schools and ask for iodine solution and only to find that they do not have it. So, I just explained it theoretically. But I could see that the learners are not with me because in their lives they have never seen iodine solution. They have never seen that. So, I just introduced the lesson, taught about iodine as if it is something that they know but they do not know. So, that is where I found my practical lesson was unsuccessful.</p> <p>In response to whether lack of apparatus is also a challenge, the teacher disagreed. Not 100% (percent). Science is a practical subject. We have got a lot of tins that have been used up. You can use them as containers. We have glasses that we use at home to drink water. Although they are not marked you can use them as beakers. People who bake at home, they use jugs for baking cookies. You go to the nearest person you know she is a baker and borrow some apparatus. After using return them to the owner. Some of the things mustn't be littered. So, lack of apparatus is not a major problem. Torches, we do have. Use torches. Energy transfers, stoves we light at homes. Globes that we use at homes use light energy. Energy transfers, electrical energy, heat energy, light energy, etc. So, not having an apparatus I don't think is a problem in as far as presenting Science is concerned.</p> |
|  | <p>What is the role of the learners during a practical activity?</p>                             | <p>As I said practical activity, give learners more chance while you are monitoring. Let them do. Let them speak. I think that time you have seen that I called them in front. Let one put a bigger crystal of salt in hot water and another in cold water, that is, water with ice cubes. Let them stir. They did that themselves. I was asking: "What do you see?" Answer: But this one is disappearing quickly. Why does it disappear quickly? Answer: It is because it is in hot water. What about this? Answer: It is not dissolving. Why? Answer: Because there is ice cubes in the glass beaker. So, practically they just do themselves and you just ask. You will arrive at the solution that you need. They will arrive at the conclusion themselves not knowing that they are busy learning. Bear in mind that children like to play, but let them play constructively. Otherwise the lesson that has been learnt is such a way is not easily forgotten. They cannot forget that.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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| How are data findings communicated?                                           | <p>Although we know that learners cannot understand on the same rate, there are some who will reach the conclusion before others. But never ever allow a learner who understands quickly to be a dominant factor in class because that will create an impression that all the learners understand. Just ask those that you know they take time to understand to tell you what they are observing. Don't force them to tell you the answer in English. Also in mother tongue. What do you observe? Answer in mother tongue: "Ka mo e tologa ka pele" (meaning in this one it dissolves quickly). Just write the findings. Tell them that the right word to use is, "It dissolves quickly", not "E tologa ka pela". "E tologa ka pela" is a mother tongue. I think in that way you will be accommodating all the learners, although some, those that understand quickly will feel bored because now you are repeating what they already know. If possible, those learners at the end should be given a difficult task than those other learners that you know are not good in understanding. So, there, separate those in the more challenging work from the other learners. in that way we will be making those that understand quickly not to become bored.</p> |
| How do you make learners aware of possible danger during a practical session? | <p>Eh, fortunately as I have said the syllabus does not allow us to have those. Even if we have those, I shouldn't keep them in class. Why? I don't have a cabinet where I will lock them in. No cabinet at all. That is why I said the problem is laboratory. I think in future when a school is built, the government, whether high school or primary school, there must be a room meant for laboratory. So, when checking this set up in this syllabus of grade 6 (six) and 7 (seven) there is no where that they are going to use harmful acids or what. So, with the primary schools, there is no any danger. But the main thing is that now, we must be vigilant. Even with apparatus that we are using. Never ever allow kids to use those apparatus in your absent. Be present with them. Tell them about the danger. Like the thermometer. Thermometer is very dangerous. If the glass gets broken, the liquid inside this is mercury. And mercury is harmful to our bodies. So that is why we must never allow them to use in your absence.</p>                                                                                                                                                                                                       |
| How do you assess achievement of practical abilities in learners?             | <p>Assessment. At the end of the lesson I prefer to give them homework. But after realising that now there are some of the learners when they reach home they start playing and they stop doing the school work. I make it a point that when I am going to teach something that is practical I use three periods. Two periods will be a practical work and the last period classwork. I will be with them. Leave the apparatus in front of them to see and remember what they have seen practically and they will answer these questions. But some will write something that they never seen. You will even be surprised yourself because what they have written will not be related to what they had seen. That is one problem that I have seen. They know that I am a Mathematics teacher. I teach them Mathematics as well. I teach them Natural Sciences. Now, a Natural Sciences question can be answered in.....maybe I taught Maths before, and after a period it will be a practical part i Natural Sciences. Then the answer that they will give will be related to Mathematics. They align a teacher with the</p>                                                                                                                                     |

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|  |                                                      | subject that he or she teaches. You ask a question in Natural Sciences and the answer will be in Mathematics because I am teaching those subjects.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | When does measurement of a practical activity occur? | It should be done through a rubric. Rubric should be the one that you use to measure the performance of the kids in as far as practical work is concerned. But I have realised that with the little time that I have, given the amount of work, administrative work that I have including this teaching load, is very much difficult for me to assess each and every learner using a rubric. That is where now I am relying on the feedback that comes through classworks and home works. But practical work needs to have its own rubric where I am going to give the learners that chance to observe. After that you give them the work relating to that practical work. And then you are going to mark it according to the rubric. But as I said the work load does not allow me to do those things, e.g, to teach each and every learner. |
|  | Who designs the assessment instrument?               | The questions. Some of them I formulate myself. Some of them are in the textbooks that the government provides. After each and every activity there are some questions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | How is assessment instrument moderated?              | That is where now I say I let learners exchange their books and they correct themselves. After that they give them to me. I look at to whether they have corrected it correctly. If it is correct I append my signature. Most preferably the learners correct their peer books. Myself I do control. After I had clarified he said: "Oh...when it comes to moderation fortunately I am the one who is supposed to moderate each and every teacher's work. But the situation does not allow.                                                                                                                                                                                                                                                                                                                                                   |
|  | How do you control completed tasks?                  | Controlling is already answered by the participant teacher when attempting to respond to the previous questions about moderation of assessment instruments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## TEACHER E

| Teacher | Interview Questions                                                                                          | Responses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| E       | How do you design a lesson for a practical activity?                                                         | Ok. A lesson plan for a practical activity is different from the lesson plan that you just go and teach in the class. The theory. In that case I must get a pace-setter and a textbook. They guide me. The textbook just guides me on the things that I need to put on a practical. After that I gather the equipment, all the materials that I am going to use in the class for that particular lesson. If it is tomorrow I know that I must get the information today. If there is some information that is missing or things that I need, I go to the principal and let him know that I need one, two, three. Learners just improvise and we teach them practicals as you know that we do not have laboratory. We do not have all those places where we can go and do experiments. But all in all we improvise and do the practical work |
|         | Which documents do you use to identify the developmental process skills prescribed for grade seven learners? | The actual documents are: the first one is the pace-setter because it is the one that shows me which practical I am going to do. The other one is just a textbook. These are the two that I am using.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|         | How do you integrate a practical activity in your teaching?                                                  | Ok. Firstly what I need to teach them is a theory. And from theory, as it develops, I know there are some design processes. They already know especially the grade seven. They know. From there when we go for practicals I start by revising with them. I just tell them what to do on the practical part of it because already they know the theory. And is then that integration comes. From theory, when it develops into practical.                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | Where do you find the practical activities that you teach your learners?                                     | Some of the activities are just from the textbooks. I just pick up from the textbook. And also the pace-setter because already those policy documents I know that I need to use for guidance. Especially a policy document is a guide. I check the pace-setter, I go to the textbook and then I do all those things.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|         | What challenges do you experience in doing practical activities?                                             | Ja, of course, there are some challenges. You may find that when I need some chemicals, we do not have. Those are challenges we are experiencing. There are a lot of challenges. There are a lot. Thus why somehow we just improvise. Those things that are there we just utilise them.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|         | How do you address challenges that you encounter during practical tasks implementation?                      | This is a broad challenge because even when you go to the principal, he says no, we want to buy one, two, three. There are so many things you find that we don't have funds for practicals. Ja, it is a challenge, I cannot address it. Say you don't have money to buy equipment, is a challenge. But if the laboratory was there, we know that we will go to the lab and we do experiments and the like. Is a challenge.                                                                                                                                                                                                                                                                                                                                                                                                                  |
|         | What do you use to make your lesson effective?                                                               | Just to be effective, hm, we start from simple to complex. When we start from simple learners participate. If I say this is a candle and I need to light this candle, they see it practically. They perform it and then it generates some interest in them. When a child grows even if we don't have a thing to show them that this is what is supposed to be done practically, but the little knowledge that they have keeps them going.                                                                                                                                                                                                                                                                                                                                                                                                   |
|         | How do you introduce apparatus which learners have to use during a                                           | Ja, that is very important because they need to know the apparatus and the names of the apparatus. Firstly, I introduce the names of the apparatus. This is a glass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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| practical activity demonstration?                                                         | beaker. They need to know that this is a glass beaker. And somewhere somehow they need to touch it. And then they familiarise themselves with those apparatus. Because if they don't know the names, they cannot know the processes and also know what we are going to use to perform the activity. They need to know the apparatus.                                                                                                                                                                                                                                                                                                                                                                        |
| What do you do if there is shortage or lack of apparatus for conducting a practical task? | Ja, if the apparatus are not there we just leave it. Because you will go around. If you need methane and methane is not here, you want to go to another school and you find that there is nothing at the neighbouring schools, you just leave it and you teach them theory.                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| What is the role of the learners during a practical activity?                             | Ja, in actual fact, as you have seen when we were doing the practicals in the classroom, I lead them. As I said we do theory and then I explain all the apparatus that we are going to use. And I lead them in groups. They form small groups. From there they do practicals on their own. And I just go along those groups and help them to perform the practical work. They do that on their own. And I find it easy for them because they help each other. I also help.                                                                                                                                                                                                                                  |
| How are data findings communicated?                                                       | Oh, yes. Eh, ...let me say another group, they don't know how to deal with something I just help them or we just ask all the groups how did they overcome the challenge. If there are some new findings I stop all the groups. And that particular group will explain that, ok, we have found out this thing. And we were doing one, two, three. From there we just inform the whole class about the new information that they found. So, that every individual should be acquainted with what we are doing.                                                                                                                                                                                                |
| How do you make learners aware of possible danger during a practical session?             | Ja, for example, eh...these chemicals like acid, you explain to them that this is dangerous. You don't handle it. Among the groups you need to find one group leader who is going to lead them. If that thing is dangerous, is one person who is responsible. They don't touch it. Then I will go and monitor around to see if they are doing the right thing. They have to do things in the right way and safe way. So, they need to know that this thing is dangerous. They need not to touch it with bear hands.                                                                                                                                                                                         |
| How do you assess achievement of practical abilities in learners?                         | Ok. In a group work, there are some exam templates. How did they handle the apparatus? I mean according to the steps. So this thing help because you cannot put the marks, you assess generally. You need to demarcate the marks according to the template. They need to have templates. Therefore, you are making something to move or work or we are doing a circuit. Let us take they need to have all those apparatus. I check if the apparatus are there. I give them the marks. When they come to practical work, how they connect, there are some marks for that. And then the conclusion. How did they reach that? And all these things help. They form part of assessment and allocation of marks. |
| When does measurement of a practical activity occur?                                      | Ja. It is individual work. It depends on the practical work. If it is a group work we need to do that that time. I just allocate the marks around randomly. But if it is an individual work I need to take the practical work and check and also the design process will help me. The other thing that helps is exam process. It is very important because the learners need to design that thing. They follow all the steps from there I take the design and the process and I check it. I allocate some marks. From there I take that practical work, I check whether it has been designed                                                                                                                |

|  |                                         |                                                                                                                                                                                                                                                                                                             |
|--|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                         | according to the design plan and design process. I give them the marks.                                                                                                                                                                                                                                     |
|  | Who designs the assessment instrument?  | Ja. Some of them are there in the textbook. Some I copy from the textbook. I cannot say I take these from my mind. I just supplement here and there. This old textbooks have the design processes. But for now from grade four and five I have never seen that. But I am still using the old rubric.        |
|  | How is assessment instrument moderated? | It is a one man's show here. The participant laughed a bit and repeated that it is one man's show here. No one moderates. I just do it and give it to the learners to do a practical activity.                                                                                                              |
|  | How do you control completed tasks?     | Ok. Let me say it is a test, the memorandum will help me. And I assess according to the memorandum. But in the case of practicals, as I have said, the rubric is going to help me. I assess according to the rubric and I allocate the marks according to that. It is how I sum up and give them the marks. |

## APPENDIX E: TEACHER A

### Unit 2: Transfer of heat energy

| Lesson plan 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>Learning Outcomes:</b><br>LO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Assessment Standards:</b><br>AS1.2; AS1.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Integration:</b><br>Language (LO4): Write a report |
| <b>Learning Area:</b> Natural Sciences<br><b>Duration:</b> 45 minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Grade:</b> 7<br><b>Date/Week:</b> 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                       |
| <b>Looking backward at:</b><br>Energy transfer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Looking forward to:</b><br>Practical applications of conduction, convection and radiation                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                       |
| <b>Core knowledge:</b><br><b>ENERGY TRANSFERS AND SYSTEMS</b><br>Hot objects transfer energy to colder objects, until objects reach the same temperature. Hot objects transfer their energy, as heat, in three ways: by conduction, by convection and by radiation. These transfers may be useful or wasteful. Wasteful heat transfer can be controlled by reducing conduction, convection and radiation in a system. Similarly, useful heat transfer can be increased by improving conduction, convection and radiation in a system.<br><b>Content/Context:</b><br>Transfer of heat by conduction, convection and radiation |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Learning activities and assessment:</b><br>Prior knowledge: Test your knowledge activity<br>Activity 1: Investigating heating by conduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                       |
| <b>Form of assessment:</b><br>Formal assessment – Take in learners' reports and assess them using the rubric on p 40 in the Teacher's Guide.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Resources:</b><br>Learner's Book; candles and holders, metal teaspoons, matches, strips of cloth                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                       |
| <b>Expanded opportunities:</b> <ul style="list-style-type: none"><li>Assist those learners who have difficulty grasping the concept of conduction by spending time with them explaining it again after the activity.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                               | <b>Teacher reflection:</b> <ul style="list-style-type: none"><li>Make notes in your reflection file.</li><li>Were the assessment standards met?</li><li>Was a prior knowledge activity useful and necessary?</li><li>Was the experiment successful? If not, how could it be improved?</li><li>Did learners grasp the concept of conduction?</li><li>Were learners able to answer the questions correctly?</li><li>Were learners' reports written logically and with understanding? If not, how could they be improved?</li></ul> |                                                       |

# APPENDIX E. TEACHER C

| LESPLAN / LESSON PLAN                                                                                                                                                                                                                                        |                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| LEERAREA / LEARNING AREA: <u>Natuurwetenskappe</u>                                                                                                                                                                                                           | GRAAD / GRADE: <u>7</u>                                                 |
| MODULE: <u>1. Wat is materie?</u>                                                                                                                                                                                                                            | DATUMS / DATES: <u>(Kyk in Portfolio's)</u><br>Begin / Started: <u></u> |
| EENHEID / UNIT: <u>1-5</u>                                                                                                                                                                                                                                   | Voltooi / Completed: <u>(Van Keulen)</u>                                |
| SKAKEL MET VORIGE LES / LINKS WITH PREVIOUS LESSON                                                                                                                                                                                                           | SKAKEL MET VOLGENDE LES / LINKS WITH NEXT LESSON                        |
| Behandel die "Wetenskaplike Metode" as basis vir alle probleemoplossing. Wensies + Apparaat.                                                                                                                                                                 | Reinskappe van tipiese vastgestelde werk meer in detail te behandel.    |
| INTEGRASIE / INTEGRATION:                                                                                                                                                                                                                                    |                                                                         |
| KRITIEKE UITKOMSTE / CRITICAL OUTCOMES                                                                                                                                                                                                                       |                                                                         |
| 1. Identifiseer en oplos van probleme. / Neem besluite aan die hand van kritiese en kreatiewe denke. / Identify and solve problems and make decisions using critical and creative thinking.                                                                  | ✓                                                                       |
| 2. Werk doeltreffend saam met spanne, groepe, organisasies en die gemeenskap. / Work effectively with others as members of a team, group, organisation or community.                                                                                         | ✓                                                                       |
| 3. Organiseer en bestuur hulself en hul aktiwiteite op 'n verantwoordelike en doeltreffende wyse. / Organise and manage themselves and activities responsibly and effectively.                                                                               | ✓                                                                       |
| 4. Versamel, ontleed en organiseer inligting sowel as kritiese evaluering. / Collect, analyse, organise and critically evaluate information.                                                                                                                 | ✓                                                                       |
| 5. Kommunikasie doeltreffend deur middel van visuele, simboliese en/of taalvaardighede in verskillende vorme. / Communicate effectively using visual, symbolic and/or language skills in various modes.                                                      | ✓                                                                       |
| 6. Gebruik wetenskap en tegnologie doeltreffend en krities deur verantwoordelike teenoor die omgewing en die gesondheid van ander te toon. / Use science and technology critically, showing responsibility towards the environment and the health of others. |                                                                         |
| 7. Begryp dat die wêreld 'n stel verwante stelsels is waarin probleme nie in isolasie opgelos word nie. / Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.      |                                                                         |
| ONTWIKKELINGSUITKOMSTE / DEVELOPMENTAL OUTCOMES                                                                                                                                                                                                              |                                                                         |
| 1. Dink na oor en ondersoek 'n verskeidenheid strategieë om doeltreffender te leer. / Reflect on and explore a variety of strategies to learn more effectively.                                                                                              | ✓                                                                       |
| 2. Neem as verantwoordelike burgers aan die lewe van die plaaslike, nasionale en wêreldgemeenskap deel. / Participate as a responsible citizen in the life of local, national and global communities.                                                        |                                                                         |
| 3. Is kultureel en esteties sensitief in verskeie sosiale kontekste. / Is culturally and aesthetically sensitive across a range of social contexts.                                                                                                          |                                                                         |
| 4. Ondersoek opleidings- en beroepsaanmoedighede. / Explore education and career opportunities.                                                                                                                                                              |                                                                         |
| 5. Ontwikkel entrepreneursvaardighede / Develop entrepreneurial skills.                                                                                                                                                                                      | ✓                                                                       |
| LEERUITKOMSTE EN ASSESSERINGSTANDAARDE / LEARNING OUTCOMES AND ASSESSMENT STANDARDS                                                                                                                                                                          |                                                                         |
| Eenheid 1: LU 2, AS 1                                                                                                                                                                                                                                        | Herroep betekenisvolle inligting                                        |
| Eenheid 2: LU 2, AS 2                                                                                                                                                                                                                                        | Kategoriseer inligting                                                  |
| Eenheid 3: LU 2, AS 4                                                                                                                                                                                                                                        | Pos kennis toe                                                          |
| Eenheid 4: LU 1, AS 2                                                                                                                                                                                                                                        | Onderneem 'n ondersoek en versamel data.                                |
| Eenheid 5: LU 1, AS 2                                                                                                                                                                                                                                        | Onderneem ondersoek                                                     |

2/...

**LEERUITKOMSTE EN ASSESSERINGSTANDAARDE / LEARNING OUTCOMES AND ASSESSMENT STANDARDS**

| Kennte / Knowledge                 | Waardigheid / Skills                  | Waardes /houdings / Values/Attitudes       | Aantekeninge / Notes |
|------------------------------------|---------------------------------------|--------------------------------------------|----------------------|
| Fakta / Facts                      | ✓ Eksperimenteer / Experiment         | ✓ Integriteit / Integrity                  | ✓ Die "Wetenskap"    |
| Proses / Process                   | ✓ Toepas / Apply                      | ✓ Lojaliteit / Loyalty                     | ✓ Wie metode word    |
| Gebeure / Events                   | ✓ Analiseer / Analyse                 | ✓ Empatie / Empathy                        | ✓ Gewaardig          |
| Volgtoekkings / Conclusions        | ✓ Sisteemskoor / Systemise            | ✓ Respek / Respect                         | ✓ Geimplimenteer in  |
| Voorspel / Forecast                | ✓ Beskryf / Describe                  | ✓ Verantwoordelikhed / Accountability      | ✓ elke eksperiment   |
| Reëls / Rules                      | ✓ Bespreek / Discuss                  | ✓ Verdraagsaamheid / Tolerance             | ✓ St. praatseings =  |
| Definisies / Definitions           | ✓ Groepwerk / Group work              | ✓ Demokratias / Democratic                 | ✓ lesing.            |
| Meting / Measuring                 | ✓ Voorlegging / Presentation          | ✓ Selfrespek / Self worth                  |                      |
| Reëlsgesels / Principles           | ✓ Navorsing / Research                | ✓ Doersetlingsvermoë / Persistence         |                      |
| Teorieë / teorie / Theories / laws | ✓ Tegnieke / Techniques               | ✓ Onafhankelikhed / Independence           |                      |
| Opinies / Opinions                 | ✓ Probleemoplossing / Problem solving | ✓ Gemotiveerd / Motivated                  |                      |
| Beslukkenneming / Decisions        | ✓ Verduidelik / Explain               | ✓ Kreatiwiteit / Creativity                |                      |
| Tegnologie / Technology            | ✓ Tekon / ontwerp / Draw / design     | ✓ Kritiese bewustheid / Critical awareness |                      |
| Berekenings / Calculations         | ✓ Vra vrao / Ask questions            | ✓ Netheid / Neatness                       |                      |

| DOEL VAN ASSESSERING / PURPOSE OF ASSESSMENT  |                                 |                            |                              |                            |                       |                                     |                     |                      |  |  |  |
|-----------------------------------------------|---------------------------------|----------------------------|------------------------------|----------------------------|-----------------------|-------------------------------------|---------------------|----------------------|--|--|--|
| Grondtipe /<br>Baseline                       | Diagnosies /<br>Diagnostic      | Formeel /<br>Formative     | Summatief /<br>Summative     | Ander /<br>Other           |                       |                                     |                     |                      |  |  |  |
| ASSESSERINGSMETODES / ASSESSMENT METHODS      |                                 |                            |                              |                            |                       |                                     |                     |                      |  |  |  |
| Proefstoel /<br>Performance                   | Vorige leer /<br>Prior learning | Onderhoude /<br>Interviews | Bespreking /<br>Conferencing | Vraag /<br>Questions       | Groep /<br>Group      | Self /<br>Self                      |                     |                      |  |  |  |
| ASSESSERINGSTRUMENTE / ASSESSMENT TOOLS       |                                 |                            |                              |                            |                       |                                     |                     |                      |  |  |  |
| Skytbord /<br>Chalk board                     | Projektor /<br>Projector        | Vraelys /<br>Question list | Toets /<br>Tests             | Reëlboek /<br>Rubrics      | Taak /<br>Assignm.    | Aktiwiteitsblad /<br>Activity sheet | Uitsel. /<br>Exhib. | Stukke /<br>Stickers |  |  |  |
| ASSESSERINGSTECHNIEKE / ASSESSMENT TECHNIQUES |                                 |                            |                              |                            |                       |                                     |                     |                      |  |  |  |
| Projek /<br>Project                           | Navorsing /<br>Research         | Taak /<br>Assignment       | Debat /<br>Debate            | Rollspel /<br>Role play    | Grafiek /<br>Graph    | Onderhoude /<br>Interviews          |                     |                      |  |  |  |
| Knaat /<br>Maps                               | Pinkkele /<br>Posters           | Tuugvoer /<br>Report       | Bespreking /<br>Discussion   | Breinkaat /<br>Mind map    | Skets /<br>Drawing    | Demonstrasie /<br>Demonstration     |                     |                      |  |  |  |
| ONDERRIGBENADERING / TEACHING APPROACH        |                                 |                            |                              |                            |                       |                                     |                     |                      |  |  |  |
| Instrukse /<br>Instructions                   | Probleemopl. /<br>Problems.     | Groepwerk /<br>Group work  | Naversing /<br>Research      | Bespreking /<br>Discussion | Reëlboek /<br>Rubrics |                                     |                     |                      |  |  |  |

| ERKSWYSE / LEERDERAKTIVITEIT / METHOD / LEARNER ACTIVITIES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | UITGEBREIDE GELEENTHEDE / EXPANDED OPPORTUNITIES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><u>Praktiese werk</u> word gedoen vir eenheid 1-5.</p> <p><u>Eenhed 1:</u> Hoe kan eksperimenteel bewys word dat: - materie massa het en (a)<br/>- plek opneem? (b)</p> <p>a) massastate en teoreties die definisie van massa verduidelik.</p> <p>b) klasbeoordeel tot ooreenstemming toe met H.O. Plaat op H.O.</p> <p><u>Eenhed 2:</u> Verduidelik of materie in vastestof, vloeistof of gas is deur eksperimenteel te verduidelik. Skryf se: a) vorm?<br/>b) dampenskerpte?</p> <p><u>Eenhed 3:</u> Demonstree faseverandering eksperimenteel - ijs, water, stoom.</p> <p><u>Eenhed 4:</u> Bepaal verskillende volume deur die twee metodes gebruik te maak:<br/>a) Bepaal deur lineaal<br/>b) Bepaal deur die verplasing van water.</p> <p><u>Eenhed 5:</u> Bepaal verskillende massas van verskeie voorwerpe volgens die korrekte metode.</p> | <p><u>Verkying 1:</u> Hoe gaan jy eksperimenteel bewys dat in vloeistof en in gas plek opneem?</p> <p><u>Verkying 2:</u> Is water in vastestof, vloeistof of in gas? Verduidelik.</p> <p><u>Verkying 3:</u> "Lêbreinling" op bl. 3 van "Kluis op Natuurwetenskappe".</p> <p><u>Verkying 4:</u> Hoeveel koppies water in 'n plesing?</p> <p><u>Verkying 5:</u> "Die massa van 4 kg wat in 4 kg staal is nie dieselfde nie". Verduidelik.</p> <p>HULPMIDDELS / BRONNE / TEACHING AIDS / REFERENCES</p> <p>Handboek<br/>Plakate<br/>Kwartale<br/>Internet<br/>Praktiese Wetenskap Instrumente.</p> <p>NABETRAGTING / REFLECTION</p> |

## APPENDIX E: TEACHER D

### MATTER AND MATERIALS.

Christine: What do you see around you?

Expected answers: window panes

- desks

- chairs

- table

- chalkboard

- toys

- gears - people

→ Grant: now the examples given into living and non-living things.

Explanation: All the living and non-living are made of a common thing called matter, matter is made of small particles called atoms.

What is matter? It is anything on or around the earth and in space.

### 3 states of matter

1. Solid - eg. ice, iron, sand, stones, brick, wood, glass, steel
2. Liquid - eg. water, oil, petrol, benzene, diesel, methylated sp.
3. Gas - eg. oxygen, carbon dioxide, hydrogen, nitrogen, helium

### 2 properties of matter

1) matter occupies space

2) matter has mass

Arrangement of particles of matter.

The particles that matter is made of are arranged differently in all the three states/phases.

1. In solids the particles are closely packed in an orderly way, meaning the spaces between the particles are equal.

### A characteristics of solids

1. Solids are hard - a force of attraction
2. Volume of solids is stable - between the particles is
3. Solids keep their own shape - strong

\* In liquids the spaces between the particles are bigger than the space between the particles in a solid. Hence the particles in a liquid are free to move around each other. Liquids do not have a fixed shape because they take the shape of the container they are in.

\* In gases the particles move fast and freely. The particles fill the space they are in. The particles of a gas can be compressed.

\* MIXTURES. A mixture is two or more different materials that have been mixed together. In other mixtures the different materials that have been mixed can be seen with naked eyes whereas in others the mixed materials can't be seen. In mixtures where the materials can be seen we can simply pick one material with our hands. A mixture where one material seems to have disappeared into the other are called solutions.  
eg. sugar and milk and salt and water.

Explain what a solute and a solvent are.

A substance that makes other substances to dissolve when mixed with it is called a solvent and a substance that dissolves in other substances is called a solute.  
eg. Sugar dissolves in water, therefore water is called a solvent and sugar a solute.

\* Ways of separating mixtures (This needs some practical work) to be done later

1. sieving

2. filtering

3. hand sorting

4. settling followed by decanting (pouring out)

Substances that dissolve when mixed with water are called soluble substances eg sugar dissolves in water. Substances that do not dissolve when mixed with water are called insoluble substances eg oil and water, sand & water.

Classwork

24-04-2013

Q What is a mixture?

A mixture where one material can no longer be seen is called a homogeneous mixture.

Q Salt dissolves in water, water is called a solvent.

Q Salt dissolves in water, salt is called a solute.

Q What are soluble substances?

Q What are insoluble substances?

### METHODS OF SEPARATING MIXTURES.

1. Hand sorting - refers to simply picking up one material from the mixture by hand.

Apparatus - a glass bottle - plate  
- beans  
- soup.

Learners will be use their hands to pick one material from the other.

2. Sieving.

Apparatus - sieve  
- tea leaves

Learners will sieve the mixture, the leaves will not go through the sieve.

3. Settling and decanting (pouring out).

Apparatus - sand - glass beaker  
- water

Mix the two together, let the mixture settle, after

4. Filtering

Apparatus: paper filter  
              - water

              - sand

              - glass beaker

# APPENDIX E: TEACHER E

## TEMPLATE OF A LESSON PLAN

|                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Learning Area: <b>N. Sciences</b>                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Grade: <b>7</b>                                                                                                                                                                                                                                   |
| Learning Outcome: <b>A. 2. 1.2.5.5</b>                                                                                                                                                                                                                                                                                                                                             | Date / Week: <b>1 - 3 &amp; 1-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                   |
| Duration: <b>4 hours</b>                                                                                                                                                                                                                                                                                                                                                           | Context: <b>ENERGY &amp; CHARGE</b>                                                                                                                                                                                                                                                                                                                                                                                                                  | Content: <b>ENERGY SYSTEM</b>                                                                                                                                                                                                                     |
| Units with previous lesson:                                                                                                                                                                                                                                                                                                                                                        | Investigate: <b>LO</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | Material and materials: <b>None</b>                                                                                                                                                                                                               |
| Expanded opportunity                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                   |
| Activity - TEACHER                                                                                                                                                                                                                                                                                                                                                                 | Activity - LEARNER                                                                                                                                                                                                                                                                                                                                                                                                                                   | Activity                                                                                                                                                                                                                                          |
| <p>THE TEACHER WILL</p> <p>TEACH THE TEACHER</p> <p>PROVIDE</p> <p>i. Energy systems.</p> <p>- Gravitational system</p> <p>- Mechanical system</p> <p>- Electrical system</p> <p>- Chemical system</p> <p>Assessment:</p> <p>Investigate</p> <p>Experimentation</p> <p>Workbook</p> <p>Quiz &amp; class test</p> <p>Resources</p> <p>Teacher reflection (for future reference)</p> | <p>Learn about the following:</p> <p>1. Gravitational system is a force that is found on the ground.</p> <p>- It is the force that attracts the body towards the centre of the earth.</p> <p>2. Mechanical system</p> <p>3. Electrical system</p> <p>- Energy from electricity.</p> <p>- e.g. All households use electricity.</p> <p>- e.g. stove, refrigerator, radios etc.</p> <p>4. Chemical system</p> <p>- energy stored in food, coal etc.</p> | <p>1. Sun, fuel, coal, and hydro electric power.</p> <p>2. Energy from electricity.</p> <p>3. All households use electricity.</p> <p>4. Stove, refrigerator, radios etc.</p> <p>5. Chemical system</p> <p>6. energy stored in food, coal etc.</p> |
| <p>SCIENCE ACTIVITIES 7 Book, Pictures.</p>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                   |

# APPENDIX F

| PERIOD    | 1          | 2          | 3          | 4          | 5          | 6           | 7           | 8           | 9           | 10          | 11          |
|-----------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| TIME      | 7:30-08:00 | 8:00-08:30 | 8:30-09:00 | 9:00-09:30 | 9:30-10:00 | 10:00-10:30 | 10:30-11:00 | 11:00-11:30 | 11:30-12:00 | 12:00-12:30 | 12:30-13:00 |
| MONDAY    |            |            |            |            | XXX        | XXX         | NS          | NS          | NS          | XXX         | NS          |
| TUESDAY   |            | NS         | NS         |            | NS         | XXX         | NS          | NS          | NS          | XXX         | NS          |
| WEDNESDAY | NS         | NS         |            |            | XXX        | NS          | NS          | NS          | NS          | XXX         | NS          |
| THURSDAY  | NS         |            |            |            | NS         | XXX         | NS          | NS          | NS          | XXX         | NS          |
| FRIDAY    | NS         | NS         |            |            | NS         | XXX         | NS          | NS          | NS          | XXX         | NS          |
|           | 6          | 6          |            |            | 7          | XXX         | 4           | NS          | NS          | XXX         | 4           |
| NS        | 7 PER      |            |            |            |            |             |             |             |             |             |             |
| NS        | GR4        |            |            |            |            |             |             |             |             |             |             |
| NS        | GR7        |            |            |            |            |             |             |             |             |             |             |
| NS        | GR5        |            |            |            |            |             |             |             |             |             |             |
| NS        | 7 PER      |            |            |            |            |             |             |             |             |             |             |
| NS        | 7 PER      |            |            |            |            |             |             |             |             |             |             |
| NS        | 7 PER      |            |            |            |            |             |             |             |             |             |             |

APPENDIX G

PRIMARY SCHOOL  
NATURAL SCIENCES ASSESSMENT PLAN  
GRADE 7

| ACTIVITIES     | TERM 1     |     |            | TERM 2             |     |            | TERM 3           |     |            | TERM 4 |     |            |
|----------------|------------|-----|------------|--------------------|-----|------------|------------------|-----|------------|--------|-----|------------|
|                | LO's       | ASS | DATE       | LO's               | ASS | DATE       | LO's             | ASS | DATE       | LO's   | ASS | DATE       |
| PROJECTS       | Assignment |     |            | Practical Research |     |            | Research Project |     |            |        |     |            |
|                | 1-2        | 1-4 | 15-08-2012 | 1-2                | 1-4 | 15-08-2012 | 1-2              | 1-4 | 15-08-2012 |        |     |            |
| FORMAL TESTS   | 1-2        | 1-3 | 21-03-2012 | 1-2                | 1-3 | 19-06-2012 | 1-2              | 1-4 | 19-09-2012 | 1-2    | 1-4 | 15-11-2012 |
| INTERNAL TESTS | 1-2        | 1-3 | 14-02-2012 | 1-2                | 1-3 | 23-05-2012 | 1-2              | 1-3 | 13-09-2012 | 1-2    | 1-2 | 09-11-2012 |

## APPENDIX H

# Primary School

Year plan for the "Science" part of Natural Sciences:

Grade 7

| Module          | Theme                                  | Module           | Theme                                   |
|-----------------|----------------------------------------|------------------|-----------------------------------------|
| <b>Module 1</b> | <b>What is matter?</b>                 | <b>Module 7</b>  | <b>Non-renewable energy sources</b>     |
| Unit 1          | Matter is everything                   | Unit 1           | What is an energy source?               |
| Unit 2          | Phases of matter                       | Unit 2           | Formation of fossil fuels               |
| Unit 3          | Phase changes                          | Unit 3           | Uses of fossil fuels                    |
| Unit 4          | Measuring volume                       | Unit 4           | Environmental issues                    |
| Unit 5          | Measuring mass                         | <b>Module 8</b>  | <b>Alternative energy sources</b>       |
| <b>Module 2</b> | <b>Choosing the right material</b>     | Unit 1           | Nuclear energy                          |
| Unit 1          | Types of materials                     | Unit 2           | Biomass                                 |
| Unit 2          | Properties of materials                | Unit 3           | Food                                    |
| Unit 3          | Testing a material                     | Unit 4           | Energy from water                       |
| Unit 4          | Designing a product                    | Unit 5           | Energy from wind                        |
| <b>Module 3</b> | <b>Electrical properties of matter</b> | Unit 6           | Energy from sunlight                    |
| Unit 1          | Some matter can carry electricity      | <b>Module 9</b>  | <b>Energy systems</b>                   |
| Unit 2          | Conductors                             | Unit 1           | Types of energy                         |
| Unit 3          | Insulators and resistors               | Unit 2           | Energy in a torch                       |
| <b>Module 4</b> | <b>Acids and bases</b>                 | Unit 3           | Energy in a solar pump                  |
| Unit 1          | Acids and bases in our lives           | Unit 4           | Energy in a fire                        |
| Unit 2          | Acids                                  | Unit 5           | Transferring and transforming of energy |
| Unit 3          | Bases                                  | Unit 6           | Energy efficiency                       |
| Unit 4          | Touching and tasting                   | <b>Module 10</b> | <b>Transfer of heat energy</b>          |
| Unit 5          | Indicators in the home                 | Unit 1           | Conduction                              |
| Unit 6          | Scientific indicators                  | Unit 2           | Convection                              |
| Unit 7          | Acids in the human body                | Unit 3           | Radiation                               |
| Unit 8          | Acid rain damage                       | Unit 4           | Heat energy efficiency                  |
| Unit 9          | How to reduce acid rain                | <b>Module 11</b> | <b>Using energy wisely</b>              |
| <b>Module 5</b> | <b>Neutralisation</b>                  | Unit 1           | Energy through the ages                 |
| Unit 1          | Acids and bases are opposites          | Unit 2           | Saving energy at home                   |
| Unit 2          | Neutralisation in the laboratory       | Unit 3           | Saving petrol                           |
| Unit 3          | Neutralisation in the body             | Unit 4           | Saving energy by reducing waste         |
| <b>Module 6</b> | <b>All about energy</b>                | Unit 5           | Making compost                          |
| Unit 1          | What is energy?                        |                  |                                         |
| Unit 2          | Energy systems                         |                  |                                         |
| Unit 3          | Energy in South Africa                 |                  |                                         |

# Primary School

Year plan for the "Biology" part of Natural Sciences:

Grade 7

| Module           | Theme                            |
|------------------|----------------------------------|
| <b>Module 12</b> | <b>Our place in the universe</b> |
| Unit 1           | Our solar system                 |
| Unit 2           | Small solar bodies               |
| Unit 3           | Stars                            |
| <b>Module 13</b> | <b>Fossil records</b>            |
| Unit 1           | Early life on Earth              |
| Unit 2           | What are fossils?                |
| Unit 3           | The first lizard - Plateosaurus  |
| <b>Module 14</b> | <b>Plants and animals</b>        |
| Unit 1           | Sorting and classifying          |
| Unit 2           | The plant kingdom                |
| Unit 3           | The animal kingdom               |
| <b>Module 15</b> | <b>Habitats</b>                  |
| Unit 1           | What is a habitat?               |
| Unit 2           | Biomes                           |
| Unit 3           | The grassland biome              |
| Unit 4           | The tundra                       |
| Unit 5           | The meerkat                      |
| <b>Module 16</b> | <b>Destroying the balance</b>    |
| Unit 1           | Natural resources                |
| Unit 2           | Wood                             |
| Unit 3           | Rain forests                     |
| Unit 4           | Oil                              |
| Unit 5           | Acid rain                        |
| <b>Module 17</b> | <b>Natural disasters</b>         |
| Unit 1           | Fires                            |
| Unit 2           | Volcanoes                        |
| Unit 3           | Floods                           |
| Unit 4           | Earthquakes                      |
| <b>Module 18</b> | <b>The plant kingdom</b>         |
| Unit 1           | Above plants                     |
| Unit 2           | Algae                            |
| Unit 3           | Fungi                            |
| Unit 4           | Ferns                            |
| Unit 5           | Conifers                         |
| Unit 6           | Angiosperms                      |

| Module           | Theme                          |
|------------------|--------------------------------|
| <b>Module 19</b> | <b>Arthropods</b>              |
| Unit 1           | Arthropods in general          |
| Unit 2           | Insects: The locust            |
| Unit 3           | Crustaceans: The crab          |
| Unit 4           | Arachnids: The spider          |
| Unit 5           | Diplopods: The millipede       |
| <b>Module 20</b> | <b>Molluscs</b>                |
| Unit 1           | The soft-bodied animals        |
| Unit 2           | The garden snail               |
| <b>Module 21</b> | <b>Fish</b>                    |
| Unit 1           | The goldfish                   |
| Unit 2           | Features of the goldfish       |
| <b>Module 22</b> | <b>Amphibians and reptiles</b> |
| Unit 1           | Reptiles: The lizard           |
| Unit 2           | Amphibia: The frog             |
| <b>Module 23</b> | <b>Birds</b>                   |
| Unit 1           | The pigeon                     |
| <b>Module 24</b> | <b>Mammals</b>                 |
| Unit 1           | Introduction to mammals        |
| Unit 2           | The rat                        |

## APPENDIX I

| AKADEMIESE BELEID: / ACADEMIC POLICY |                                                                                                                                                                                                                                                                                      |             |                  |            |                   |       |     |       |     |       |     |       |     |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|------------|-------------------|-------|-----|-------|-----|-------|-----|-------|-----|
| 1.                                   | <b>ASSESSERING: / ASSESSMENT</b>                                                                                                                                                                                                                                                     |             |                  |            |                   |       |     |       |     |       |     |       |     |
| 1.1                                  | <b>Doelgerigte evaluering: / Continuous evaluation:</b>                                                                                                                                                                                                                              |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Die volgende kan gesoen word: / The following can be done:                                                                                                                                                                                                                           |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Summatiewe assessering (toets) - Ten minste 1 formele toets moet per kwartaal geskryf word. / Summative assessment (test) - At least 1 formal class test has to be written per term.                                                                                                 |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Werkopdragte / Assignments                                                                                                                                                                                                                                                           |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Groepassessering / Group Assessment                                                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Projek (Tipe) / Projects (Assignments)                                                                                                                                                                                                                                               |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Waarneming / Observation                                                                                                                                                                                                                                                             |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Rolspel / Role play                                                                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Gevallestudies / Case studies                                                                                                                                                                                                                                                        |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Meting / Measurement                                                                                                                                                                                                                                                                 |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Puntvervalouing: / Mark ratios:                                                                                                                                                                                                                                                      |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | Vir al Gr. 4 - 7 word die half van puntevervalouings soos volg toegepas: / From Gr. 4 - 7 the following mark ratios are applied:                                                                                                                                                     |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      |                                                                                                                                                                                                                                                                                      |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | <table> <tr> <th>Deurlooptyd</th><th>Formele toetsing</th></tr> <tr> <th>Continuous</th><th>Formal Evaluation</th></tr> <tr> <td>Gr. 4</td><td>80%</td></tr> <tr> <td>Gr. 5</td><td>70%</td></tr> <tr> <td>Gr. 6</td><td>60%</td></tr> <tr> <td>Gr. 7</td><td>50%</td></tr> </table> | Deurlooptyd | Formele toetsing | Continuous | Formal Evaluation | Gr. 4 | 80% | Gr. 5 | 70% | Gr. 6 | 60% | Gr. 7 | 50% |
| Deurlooptyd                          | Formele toetsing                                                                                                                                                                                                                                                                     |             |                  |            |                   |       |     |       |     |       |     |       |     |
| Continuous                           | Formal Evaluation                                                                                                                                                                                                                                                                    |             |                  |            |                   |       |     |       |     |       |     |       |     |
| Gr. 4                                | 80%                                                                                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
| Gr. 5                                | 70%                                                                                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
| Gr. 6                                | 60%                                                                                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
| Gr. 7                                | 50%                                                                                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
|                                      | (Verfening in verskillende veldke) / (Detail in different subjects)                                                                                                                                                                                                                  |             |                  |            |                   |       |     |       |     |       |     |       |     |
| 1.2                                  | <b>Formele toetsing: / Cyclic tests:</b>                                                                                                                                                                                                                                             |             |                  |            |                   |       |     |       |     |       |     |       |     |
| 1.2.1                                | Geskrywe vraestelle moet netjies, leesbaar en in keurige taal geskryf word. / Written questionnaires must be written neatly and legibly.                                                                                                                                             |             |                  |            |                   |       |     |       |     |       |     |       |     |
| 1.2.2                                | Eenvoudige opsakke vir vraestelle word verskaf (sien voorbeeld - p. 3) / All test nos. 12 / All questionnaires must have the following headings (see example p - 3). Computers : Font : Arial size 12                                                                                |             |                  |            |                   |       |     |       |     |       |     |       |     |
| 1.2.3                                | Alle vraestelle moet tweetaal opgestel word - Afrikaans en Engels. / All questionnaires must be bilingual - Afrikaans and English. Questionnaires in Afrikaans, English and African Languages will be set in only that language.                                                     |             |                  |            |                   |       |     |       |     |       |     |       |     |

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| 2      |                                                                                                                                                                                                                                                                                       |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.2.4  | Alle vraestelle moet ten 'n aparte afdrukkeelde voorsien word. / All questionnaires must have a separate answer sheet.                                                                                                                                                                |
| 1.2.5  | 'n Week (Donderdag) voor getoelikeerde toets (vragers inwerkingsprogram) geskryf word. / One week (Thursday) before test is due to be written (according to the term programme), the questionnaire, with a complete memorandum, must be submitted to the Head of Department (H.O.D.). |
| 1.2.6  | Verhoof handig alle vraestelle geskryf op Vrydag by akademiese hoof in / Subject H.O.D. to hand in all the questionnaire simultaneously at the Academic Head of Department the next morning (Friday).                                                                                 |
| 1.2.7  | Proffesors die vraestelle deeglik voor ingehandig word vir duplikaat, / Prof's read the questionnaire thoroughly and with care, before submitting it for duplication.                                                                                                                 |
| 1.2.8  | Op die laaste moet vraestelle Woensdag voor toets gestel, gepak in koeriers en in stookteer geskryf word. / Questionnaire must be counted, packed in envelopes and in the store room by the Wednesday prior to the test.                                                              |
| 1.2.9  | Vraestelle word alfabeties ingeleen. / Learners must hand in their answer sheets strictly in alphabetical order, boys and girls mixed.                                                                                                                                                |
| 1.2.10 | Statistiek (outrekske) moet deurspoelende Dinsdag by verhoof ingehandig word. / Statistics (green sheets) must be at the subject head by the Tuesday following the test.                                                                                                              |
| 1.2.11 | Woensdag moet boeke word geskryf op Dinsdag by departement hoof ingehandig word. / The following day (Wednesday) all statistics must be handed in to the Head of Department.                                                                                                          |
| 1.2.12 | Gemiddelde vraestelle moet so gou as moontlik (nie later as 2 weke na toets geskryf is) aan rektors teruggegee word vir keur. / Marked questionnaires to be handed to learners (no later than 2 weeks test was written).                                                              |
| 1.2.13 | Nie later as 'n week nadat toets aan rektor geskryf is, word dit ingeleen, gekontroleer en veilig bewaer. / Within a week after tests were handed to learners, tests must be returned, controlled and be in safe keeping. Records to be kept of tests not signed or not returned.     |

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## APPENDIX J

|                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SURNAME AND NAME: .....<br><br><div style="display: flex; justify-content: space-around; font-weight: bold;"> <span>PRIMARY SCHOOL</span> <span>GRADE 7</span> </div> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### RUBRIC FOR PRACTICAL TASK: DESIGNING A GREENHOUSE EFFECT MODEL

|                                         | LEVEL 1                                                                      | Level 2                                                     | Level 3                                                     | Level 4                                                     | Marks out of 50 | Score /50 |
|-----------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-----------------|-----------|
| Criteria                                | Outstandingly achieved                                                       | Achieved                                                    | Partially achieved                                          | Not achieved                                                | 5               |           |
|                                         | Problem or need not identified or incorrectly identified                     | Problem or need partially identified                        | Problem or need identified                                  | Problem or need fully and clearly identified                | 5               |           |
| Design                                  | Design brief does not describe need and solution                             | Design brief partially describe need and solution           | Design brief describe need and solution                     | Design brief fully and clearly describe need and solution   | 5               |           |
|                                         | Design specifications not written or not appropriate                         | Design specifications not complete                          | Appropriate design specifications written                   | Detailed design specifications written                      | 5               |           |
|                                         | No design drawings made                                                      | Design drawings poor and not labelled                       | Design drawings neat labelled                               | Neat, clear, fully, labelled design drawings made           | 5               |           |
| Make/double marks for component of task | Greenhouse project not made or poorly made, does not meet any specifications | Greenhouse project not well made, meets some specifications | Well made, neat, meets drawing of greenhouse specifications | Well made, neat drawing of greenhouse, meets specifications | 10              |           |
| Evaluate                                | No evidence of evaluation                                                    | Evaluation is incomplete or not appropriate                 | Evaluation complete and appropriate                         | Evaluation well thought out and comprehensive               | 10              |           |
| Total Marks                             |                                                                              |                                                             |                                                             |                                                             | 50              |           |

## APPENDIX K

12/03/2013

Class List:

Class Educator

| No | AccessionN | Surname | First Name (Nick Name) | 100 |  |  |  |  |  |
|----|------------|---------|------------------------|-----|--|--|--|--|--|
| 1  |            |         |                        | 06  |  |  |  |  |  |
| 2  |            |         |                        | 26  |  |  |  |  |  |
| 3  |            |         |                        | 25  |  |  |  |  |  |
| 4  |            |         |                        | 17  |  |  |  |  |  |
| 5  |            |         |                        | 25  |  |  |  |  |  |
| 6  |            |         |                        | 16  |  |  |  |  |  |
| 7  |            |         |                        | 14  |  |  |  |  |  |
| 8  |            |         |                        | 20  |  |  |  |  |  |
| 9  |            |         |                        |     |  |  |  |  |  |
| 10 |            |         |                        | 12  |  |  |  |  |  |
| 11 |            |         |                        | 27  |  |  |  |  |  |
| 12 |            |         |                        |     |  |  |  |  |  |
| 13 |            |         |                        | 35  |  |  |  |  |  |
| 14 |            |         |                        | 13  |  |  |  |  |  |
| 15 |            |         |                        | 16  |  |  |  |  |  |
| 16 |            |         |                        | 35  |  |  |  |  |  |
| 17 |            |         |                        | 22  |  |  |  |  |  |
| 18 |            |         |                        | 22  |  |  |  |  |  |
| 19 |            |         |                        | 23  |  |  |  |  |  |
| 20 |            |         |                        | 31  |  |  |  |  |  |
| 21 |            |         |                        | 06  |  |  |  |  |  |
| 22 |            |         |                        | 13  |  |  |  |  |  |
| 23 |            |         |                        | 13  |  |  |  |  |  |
| 24 |            |         |                        | 25  |  |  |  |  |  |
| 25 |            |         |                        | 20  |  |  |  |  |  |
| 26 |            |         |                        | 26  |  |  |  |  |  |
| 27 |            |         |                        | 35  |  |  |  |  |  |
| 28 |            |         |                        | 13  |  |  |  |  |  |
| 29 |            |         |                        | 17  |  |  |  |  |  |
| 30 |            |         |                        | 31  |  |  |  |  |  |
| 31 |            |         |                        | 32  |  |  |  |  |  |
| 32 |            |         |                        | 26  |  |  |  |  |  |
| 33 |            |         |                        | 41  |  |  |  |  |  |
| 34 |            |         |                        | 16  |  |  |  |  |  |
| 35 |            |         |                        | 33  |  |  |  |  |  |
| 36 |            |         |                        | 22  |  |  |  |  |  |
| 37 |            |         |                        | 33  |  |  |  |  |  |
| 38 |            |         |                        | 27  |  |  |  |  |  |
| 39 |            |         |                        | 25  |  |  |  |  |  |
| 40 |            |         |                        | 30  |  |  |  |  |  |
| 41 |            |         |                        | 20  |  |  |  |  |  |
| 42 |            |         |                        |     |  |  |  |  |  |

# APPENDIX K:

DEPARTMENT OF EDUCATION –MOPANI DISTRICT  
PRIMARY SCHOOL

RECORDING SHEET FOR NATURAL SCIENCES GRADE 4 – 7

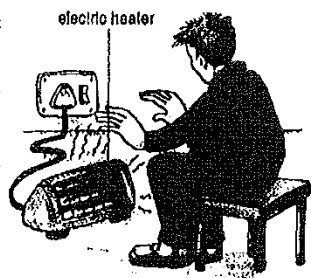
GRADE: 7

EDUCATOR:

| Terms              | Term1  |        |       | Term2             |      |       | Term3 |      |       |
|--------------------|--------|--------|-------|-------------------|------|-------|-------|------|-------|
| Tasks              | Test 1 | Test 2 | Total | Test1/<br>project | Exam | Total | Test  | Test | Total |
| Date of assessment | 14/2   | 23/3   |       |                   |      |       |       |      |       |
| Maximum marks      | 50     | 100    | 100   | 50                | 50   | 100   | 50    | 50   | 100   |
| LEARNERS' NAMES    |        |        |       |                   |      |       |       |      |       |
|                    | 14     | 7      | 21    |                   | 22   |       | 12    | 13   | 25    |
|                    | 25     | 22     | 47    |                   | 38   |       | 12    |      |       |
|                    | 29     | 12     | 41    |                   | 25   |       | 22    | 29   | 51    |
|                    | 17     | 13     | 30    |                   | 42   |       | 30    | 19   | 49    |
|                    | 35     | 35     | 70    |                   | 59   |       | 34    | 48   | 82    |
|                    | 39     | 27     | 66    |                   | 40   |       | 33    | 37   | 70    |
|                    | 37     | 37     | 74    |                   | 42   |       | 35    | 40   | 75    |
|                    | 11     | 5      | 16    |                   | 31   |       | 27    | 11   | 38    |
|                    | 22     | 7      | 29    |                   | 19   |       | 23    | 16   | 39    |
|                    | 11     | 8      | 19    |                   | 17   |       | 31    | 14   | 45    |
|                    | 24     | 16     | 40    |                   | 44   |       | 28    | 20   | 48    |
|                    | 17     | 20     | 37    |                   | 46   |       | 18    | 32   | 50    |
|                    | 24     | 16     | 40    |                   | 37   |       | 32    | 28   | 60    |
|                    | 32     | 31     | 63    |                   | 24   |       | 12    | 29   | 41    |
|                    | 19     | 13     | 32    |                   | 60   |       | 41    | 39   | 80    |
|                    | 16     | 12     | 28    |                   | 28   |       | 11    | 21   | 32    |
|                    | 28     | 24     | 52    |                   | 35   |       | 15    | 39   | 54    |
|                    | 42     | 14     | 56    |                   | 18   |       | 29    | 32   | 60    |
|                    | 26     | 12     | 38    |                   | 49   |       | 28    | 15   | 43    |
|                    | 20     | 16     | 36    |                   | 21   |       | 13    | 12   | 25    |
|                    | 20     | 10     | 30    |                   | 22   |       | 10    | 18   | 28    |
|                    | 25     | 32     | 57    |                   | 52   |       | 32    | 47   | 79    |
|                    | 21     | 20     | 41    |                   | 20   |       | 10    | 16   | 26    |
|                    | 26     | 40     | 66    |                   | 75   |       | 16    | 48   | 64    |
|                    | 12     | 12     | 24    |                   | 24   |       | -     | 4    |       |
|                    | 30     | 25     | 55    |                   | 27   |       | 10    | 14   | 24    |
|                    | -      | 27     | 27    |                   | 31   |       | 29    | 30   | 59    |
|                    | 22     | 10     | 32    |                   | 30   |       | -     | 32   |       |
|                    | 13     | 6      | 19    |                   | 31   |       | 31    | 22   | 53    |
|                    | 14     | 14     | 28    |                   | 18   |       | 27    | 13   | 40    |
|                    | 20     | 12     | 32    |                   | 31   |       | -     | 25   |       |
|                    | 15     | 10     | 25    |                   | 43   |       | 24    | 19   | 43    |
|                    | 34     | 14     | 48    |                   | 43   |       | 24    | 32   | 56    |
|                    | 47     | 19     | 66    |                   | 35   |       | 37    | 40   | 77    |

APPENDIX L

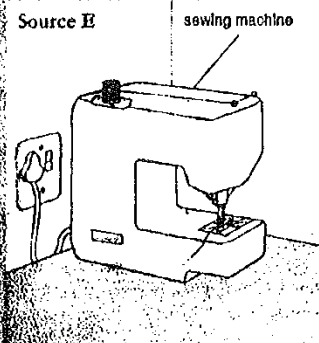
Source C



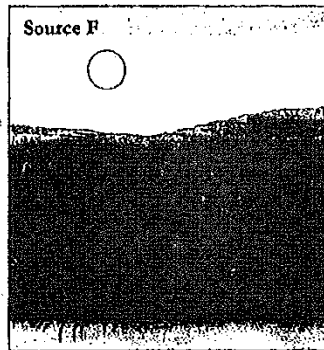
Source D



Source E



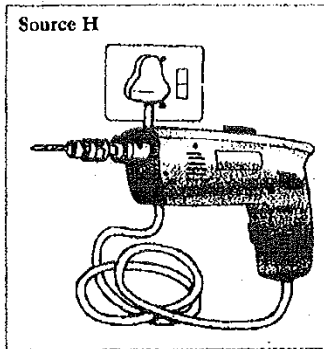
Source F



Source G



Source H



APPENDIX M

# SAFETY PRECAUTIONS IN THE LABORATORY

\* \* \* \* \*

1. The Laboratory should be locked when not in use. Nobody are allowed in Laboratory during brakes.
2. Learners are not allowed to do practical work without the teacher telling them to do so.
3. The following chemicals are always to be locked up:
  - \* Chemicals which is poisonous, such as mercury, chloroform and all acids.
4. Big glass containers must be kept low to the ground. Don't ever pick it up at the neck of the bottle.
5. All bottles must have clearly marked etiquettes.
6. Concentrated acids are very dangerous. Wash yourself with lots of water and a solution of natrium bicarbonate.
7. Do not taste any kind of chemicals or liquids in the Laboratory! See everything as poisonous.
8. Liquids such as benzene, menthalated spirits, ether, turpentine and alcohol must be kept away from flames.
9. Gas outlets must be closed when not in use.
10. Mercury fumes are dangerous. Do not spill mercury in the Laboratory. Do not touch mercury with your bare hands.
11. Playing and running are not allowed in the Laboratory.
12. Learners may only work with glass apparatus when the teacher tell them to do so.
13. Bunsen burners must be two thirds full at all times. Never lit one burner with another one.
14. You can only use knives and needles in the presence of the teacher!
15. Basins must be clean at all times. Don't throw acids in the basins.
16. You are not allowed to take any apparatus out of the classroom.
17. Don't touch any electrical apparatus with wet bare hands.
18. Immediately report any kind of accident to the teacher.
19. *Prevention is better than cure !!!*

## APPENDIX N

# Scientific Method

### 1. Aim / Problem

(What do you want to find out?)

### 2. Apparatus / Equipment

(What do you need for the investigation?)

### 3. Method

(How will you go about doing the investigation?)

### 4. Observation

(What happened?)

### 5. Conclusion

(What did you find out? - Refer to the "aim")

APPENDIX O

## NATURAL SCIENCES

*"What is expected from me as a learner?"*

A. Important Information:

1. Feel free to ask if there is any problems concerning Natural Sciences.
2. No excuses for homework not done. Do your work for the next period. Letter!
3. Absentees: Find out exactly what work to do for the next period. Ask the teacher/friend.
4. Tests/exams: Make arrangements if you missed a test otherwise you won't get marks!!

B. Homework books, observation books, text books:

1. Do your work neatly and in full sentences.
2. All homework books, observation books and text books must be at school at all times. No "Desi-fix"! Penalties for damaged text books, as set up by the school!

C. Sketches:

1. All sketches must be very neat and in pencil.
2. A Soft HB pencil is recommended for sketch work.
3. Draw your sketches with a blunt not a sharp pencil.
4. All sketches must have a heading. Underline it.
5. The labels and label lines must be in pen.
6. All labels must be right underneath each other.
7. All labels must be at the right hand side of the sketch.
8. No colouring of sketches are allowed.
9. Draw a line at the end of your unit to show the teacher that you are finished with your work.

D. Projects and assignments:

1. All projects/assignments are compulsory and will count marks (except group projects/assignments).
2. Project/assignments can be done in school or at home.
3. Projects/assignments can be done in groups or individually.
4. Projects/assignments must be handed in on the deadline - otherwise no marks!

APPENDIX P

## Natural Sciences

### *To the parents...*

Natural Sciences is as far as possible a practical learning area. The learners are working in groups of four. They are doing practical work as far as possible. They are doing conclusions and observations, where necessary, in their observation books. We mark the answers and the learners have to do the correct answers for homework into their exercise books.

Assignments or the homework, where necessary, are given with each module. These questions must be done by the learner before the start of the following period (or as indicated by the teacher). He/she will receive a mark on each "Module". The mark will be out of ten and will consist of the following: handwriting, correctness and completeness of the answers, sketchwork and the general neatness of their book (see evaluation form at the end of each module).

Enrichment work can be done if he/she wants to do extra work. The exercise books (neat books) are checked by just signing it. All the correct answers of all the questions are given to the learners to write down in their observation books.

Exam papers and tests are set up from the handbook as well as the exercise books. Pupils will get marks on: one formal test per term, two/three diagnostic tests per term (not mentioned small informal tests about the past weeks' work), one practical observation mark per term, one project/research assignment, marks for the homework books and the exam paper.

**Please feel free to phone me if there is something wrong with the marks of your child.**

Please sign the form that accompanies this letter each month.

Cell. no. ....

APPENDIX Q

# Natural Sciences

Sign before the 7th of each month. Indicate whether the household is incomplete.

| Maand     | Vader |  | Moeder |  |
|-----------|-------|--|--------|--|
| January   |       |  |        |  |
| February  |       |  |        |  |
| March     |       |  |        |  |
| April     |       |  |        |  |
| May       |       |  |        |  |
| June      |       |  |        |  |
| July      |       |  |        |  |
| August    |       |  |        |  |
| September |       |  |        |  |
| October   |       |  |        |  |
| November  |       |  |        |  |

Signature of father:

Cell.no. \_\_\_\_\_

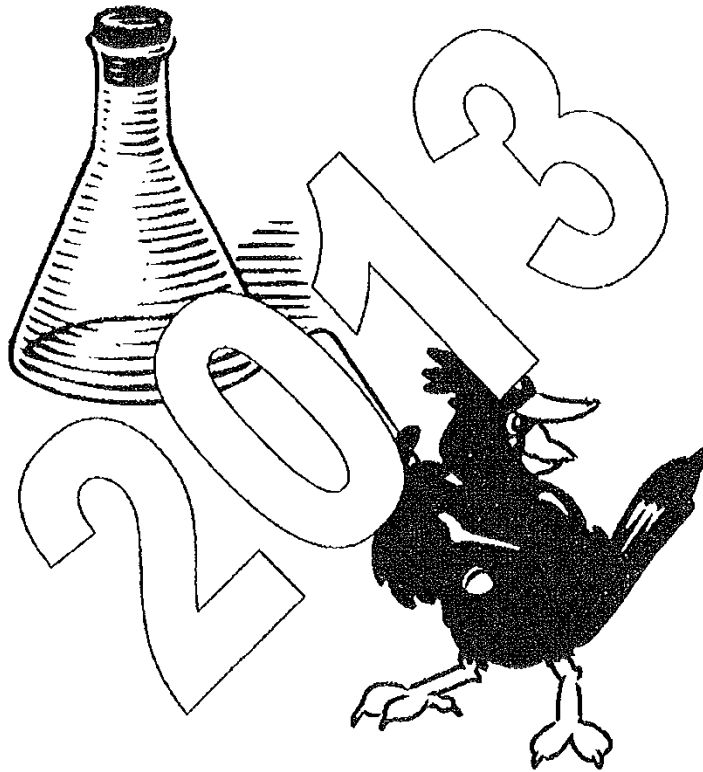
Signature of mother:

Cell.no. \_\_\_\_\_

APPENDIX R

# Natural Sciences

## Observation Book



**Name & Surname:** \_\_\_\_\_

**Grade 7** \_\_\_\_\_

## APPENDIX S



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA  
Faculty of Education

11 October 2013

STUDENT NO: 29501319

Mr SS Molhokwa  
PO Box 3575  
Tzaneen  
0850

Dear Mr Molhokwa

### APPROVAL OF TITLE: DISSERTATION

DEGREE: MEd: Assessment and Quality Assurance in Education and Training

I have pleasure in informing you that the following has been approved:

TITLE: The integration of practical tasks in teaching Natural Sciences in Grade seven

SUPERVISOR: Mrs E Randall  
CO-SUPERVISOR: Dr E Gaigher

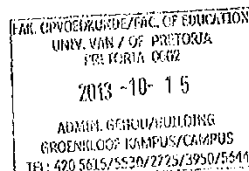
The requirements for dissertations are listed in the General Information and Regulations of the University. Consult Regulations G.30 to G.61 which are related to mini-dissertations and the assessment thereof.

Summarised guidelines for the submission and technical details of dissertations, a checklist as well as a "Notice of Submission" are attached. Kindly note that, in accordance with Regulation G.60 1(a), your written "Notice of Submission" should reach the Student Administration three months prior to submission.

Your registration as a student must be renewed annually before 28 February until you have complied with all the requirements for the degree. You will only be entitled to the guidance of your supervisor if annual proof of registration is submitted.

Yours sincerely

*E. Benkes*  
for DEAN  
FACULTY OF EDUCATION



Administration Building, 1109  
Groenkloof Campus, University of Pretoria  
PRETORIA 0002  
Republic of South Africa

(012) 420 6605  
(012) 420 5933

lize.yenbaalon@up.ac.za  
www.up.ac.za/education

## APPENDIX T



PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

Enquiries: Dr. Makola MC, Tel No: 015 290 5460, E-mail: [makolaMC@edu.limpopo.gov.za](mailto:makolaMC@edu.limpopo.gov.za)

UNIVERSITY OF PRETORIA  
FACULTY OF EDUCATION

Dear Mothokwa S.S

RE: Request for permission to Conduct Research

|                                  |           |
|----------------------------------|-----------|
| LIMPOPO PROVINCE                 |           |
| DEPARTMENT OF EDUCATION          |           |
| 4                                | ZM2-11-21 |
| H.O.D.'S OFFICE                  |           |
| PRIVATE BAG X6409 POLOKWANE 0700 |           |

1. The above bears reference.
2. The Department wishes to inform you that your request to conduct a research has been approved- TITLE: THE INTERGRATION OF PRACTICAL TASKS IN TEACHING NATURAL SCIENCE IN SOUTH AFRICA, i.e. Tzaneen (Mopani) District
3. The following conditions should be considered:
  - 3.1 The research should not have any financial implications for Limpopo Department of Education.
  - 3.2 Arrangements should be made with both the Circuit Offices and the schools concerned.
  - 3.3 The conduct of research should not anyhow disrupt the academic programs at the schools.
  - 3.4 The research should not be conducted during the time of Examinations especially the forth term.
  - 3.5 During the study, the research ethics should be practiced, in particular the principle of voluntary participation (the people involved should be respected).
  - 3.6 Upon completion of research study, the researcher shall share the final product of the research with the Department.

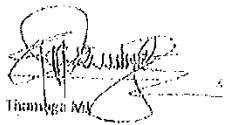
Page 1 of 2

Gmt. 113 Diegaard & 24 Exclusion Street, PO BOX 400, 0700, Private Bag X6409, POLOKWANE, 0700  
Tel: (015) 290 7600, Fax: (015) 297 6920/62204400

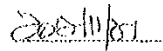
*"The heartbeat of Southern Africa - Development is about people"*

4. Furthermore, you are expected to produce this letter at schools/ Offices where you intend conducting your research as evidence that you are permitted to conduct the research.
5. The department appreciates the contribution that you wish to make and wishes you success in your investigation.

Best wishes.

  
Thanyga Mkh

Head of Department

  
Date

APPENDIX U



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of Education

Department Science, Mathematics &  
Technology Education

28 February 2013

Dear Learner

I am a student at the University of Pretoria. I am studying for Master's degree (MEd) in the field of education. I have to observe how teachers present practical tasks when teaching the natural sciences learning area in grade seven.

My study is titled: The integration of practical tasks in teaching natural sciences in South Africa. Doing practical work includes skills for handling and using science apparatus. However, I am not going to ask you to do or say anything when you are busy or after the lesson. I only need to check how your teacher teaches you practical activities in natural sciences.

I am not going to write the name of any learner who will be present during the practical activity lesson. I will use a tape-recorder for the purpose of helping me to collect information.

If you agree that I observe your teacher presenting a practical activity in your presence, please fill in the assent form provided below. If you have any questions, please contact me or my supervisors at the numbers given below, or via E-mail.

S.S. Mothokwa (Student)

Contact number: 0724177496

E-mail: [sydmoneytho@gmail.com](mailto:sydmoneytho@gmail.com)

E. Randall (Supervisor)

Dr. L. E. Mnguni (Co-supervisor)

SS Mothokwa (Student no. 29501319)  
ES Randall (Supervisor)  
Dr. LE Mnguni (Co-supervisor)  
Prof. Max Braun (HOD)  
Natural Science Building, Room 2-5  
Groenkloof Campus, University of Pretoria  
PRETORIA 0002  
Republic of South Africa

Tel number: 072 417 7496  
Tel number: 012 420 5685  
Tel number: 012 420 5570  
Tel number: 012 420 5659  
Fax number: 012 420 5621

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E-mail address: [lindelani.mnguni@up.ac.za](mailto:lindelani.mnguni@up.ac.za)  
E-mail address: [max.braun@up.ac.za](mailto:max.braun@up.ac.za)  
[www.up.ac.za/education](http://www.up.ac.za/education)