EXPLORING THE CLASSROOM PRACTICES OF NATURAL SCIENCES TEACHERS WHEN TEACHING MATTER AND MATERIAL IN SOME OF THE SCHOOLS IN THE SIYABUSWA CIRCUIT

BY

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DECLARATION

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I, ***Thuli Gladys Ntuli***, hereby declare that this dissertation is my own original work and have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution. Further, I have acknowledged all sources used and have cited these in the reference section.

Signature

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SUMMARY

The study explored the classroom practices of Natural Sciences teachers when teaching the Matter and Material strand in senior phase schools in the Siyabuswa circuit. The following research questions were explored: What is the nature of the teacher's teacher knowledge when teaching Matter and Material strand in the senior phase schools? What is the nature of the teacher's instructional strategies when teaching the Matter and Material strand in the senior phase schools? How does the teacher's teacher knowledge and instructional strategies shape the classroom interactions and discourse? The qualitative case study approach was employed, wherein three teachers participated. Interviews and observation were used for data collection. The findings revealed that Natural Science teachers lack content knowledge and inadequate Subject Matter Knowledge which influences their instructional strategies, hence their classroom interactions and discourses. Recommendations were made to the Department of Education and government to look into the factors that influence the teaching of Natural Sciences as far as teacher's knowledge and contextual factors are concerned.

Key words: **Classroom practices, Teacher knowledge, Instructional strategies, Classroom interactions and discourses, Senior Phase, Matter and Material**

UKURHUNYENYA

Irhubhululo leli liphathelene nomfundisi nakafundisa ngekumbeni isifundo se Natural Sciences khulu khulu sitjheje amakghono kunye nobukgwari I Matter and Material strand emabangeni aphakathi (Senior Phase) isiyingi sange Siyabuswa. Imibuzo erhujululiweko netsengiweko ngelandelako: inzindzolwazi lomfundisi lingangani lokha nakafundisa isifundo se Matter and Material strand emabangeni aphakathi (Senior Phase)? Anjani amakgono womfundisi nakafundisa / nokwethula isifundo se Matter and Material strand emabangeni aphakathi (Senior Phase)? Ingabe ilwazi neendlela zokufundisa zomfundisi ziletha njani ukuzwisisa nokuragela phambili kwesifundo ngekumbeni? Irhubhululo elingeneleleko mayelana nokufuna ilwazi ngesihloko esingehla lisetjenzisiswe. Kusetjenziswe abafundisi abathathu kulelirhubhulo.

Ukuhlolwa kwelwazi babuzwe imibuzo begodu baphoswa ilihlo elibukhali ukubuthelela inzinzolwazi. Imiphumela iveze pepeneneni bona abafundisi be Natural Sciences bayatlhayela ngelwazi kunye nelwazi elingeneleleko mayelana nesifundo, lokho kunomthelela omumbi ngendlela abathula ngayo ilwazi kunye nendlela yokuzwisisa kwabafundi. UMnyango wezeFundo kunye norhulumende bayelelisiwe bona batjheje amaphuzu anemithelela emimbi lokha nakufundiswa isifundo se Natural Sciences khulu khulu inzinzo lwazi lomfundisi kunye neenqabo zokufunda.

Amagama atjhejiweko: **Ukufundisa ngekumbeni, Inzinzolwazi lomfundisi, lindlela zokufundisa, Ukulalela, ukukhuluma nokuzwisisa ngekumbeni, Emabangeni aphakathi, ngaphasi kwesihloko se Matter and Material**

OPSOMMING

Die studie is die ondersoek na klaskamer praktyke van Natuurwetenskaponderwysers wanneer onderrig gegee word in Materie-en Materiale vesel in senior fase skole, in die Siyabuswa omgewing. Die volgende navorsingsvrae was ondersoek: Wat is die aard van die onderwyser se onderrigkennis wanneer Materie-en Materiale vesel in senior fase skole onderrig word? Wat is die aard van die onderwyser se onderrigstrategie wanneer Materie-en Materiale vesel in senior fase skole onderrig word? Hoe vorm die onderwyser se kennis-en onderrigstrategieë die klas se interaksies en diskoers? Die kwalititatiewe gevallestudie benadering was toegepas waartydens drie onderwysers deelgeneem het en die versamelde data gebruik was. Die bevindinge het die Natuurwetenskaponderwysers se gebrek aan inhoudskennis en onvoldoende Vakkennis, wat hul onderrigstrategieë nadelig beïnvloed uitgewys, vandaar hul klaskamer en interaksie diskoerse. Aanbevelings is gemaak aan die Departement van Opvoeding en die Regering om ondersoek in te stel na wat die onderrig van Natuurwetenskappe benadeel in so verre dit die kennis van die onderwysers betref.

Sleutelwoorde: Klaskamer Praktyke, Onderwyser kennis, Onderrig Fase, klas se interaksies en diskoers Materie en Materiale.

ABBREVIATIONS

CAPS	Curriculum and Assessment Policy Statement
CK	Content Knowledge
DBE	Department of Basic Education
DoE	Department of Education
FET	Further Education and Training
GET	General Education and Training
IRF	Initiation Response Feedback
IRFRF	Initiation Response Feedback Response Feedback
NCS	National Curriculum Statement
NS	Natural Sciences
PCK	Pedagogical Content Knowledge
SMK	Subject Matter Knowledge
SP	Senior Phase

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CHAPTER 1:
INTRODUCTION

This chapter introduces the research background and problem statement of the study. It further introduces the research questions, aims and objectives. In addition, the chapter discusses the rationale, delimitations and ethical considerations of the study. It concludes with an outline of each chapter of the study.

1.1. RESEARCH BACKGROUND

The South African education system has endured a series of curriculum reforms since the Apartheid era. These reforms in the South African Education system were aimed at addressing the injustices and inequalities caused by Apartheid command policies by using education as an instrument (Jansen, 1998; Bantwini, 2010). While science education is being refined the system will only be effective if there are qualified teachers to teach the subject. Kola (2013) states that Natural Science teachers are important in the teaching and learning of science and there is no progress of science education in any country without considering a teachers' contribution in education system. Wang and Fwu (2007) further argue that there is no good education without good quality teachers. In science education, there is a necessity for qualified and specialised science teachers to teach the subject. This will not only ensure content accuracy and the use of appropriate instructional strategies, but also aid in an increase in motivation and interest of learners.

According to Onwu and Mogari (2004), teacher's incompetence's in teaching (Natural Sciences) is one of the constraints to effective teaching in South Africa's Education system, particularly science education. The researcher has observed that teachers in NS classrooms are faced with the issues of; a lack of resources, inappropriate teacher training and a lack of learner's interest in learning science. Muwanga and Zake (2001) highlight that the lack of qualified Natural Science teachers and, in some instances the availability of teachers who may not have the adequate qualifications to teach the subject, is one of the many challenges faced by science education. Mji and Makgato (2006) asserts that lack of

knowledge and skills in science teaching remains the problem in South African science education.

Numeral Studies (Howie, 2003) have stated a number of weaknesses in the teaching and learning of mathematics and science in South Africa. The International comparisons show that South African students rank at the bottom of the countries included in the Trends in International Mathematics and Science Study (TIMSS). TIMSS 2011 International Science Results show that there is evidence of grade nine South African learners who are performing poorly in Natural Sciences; the achievement level is too low, with an estimation of between only 15 and 25 percent of students achieving the required curricula. South African learners seem to have lost interest in science as cited by Goodrum et al. (2001). Sedibe (2014) suggests that the complexity of the subject might be the main cause of such a great number of declining interest in learners. This negative approach manifests in the Senior Phase level in schools and prevents learners studying science subjects further.

Even after so many curriculum reforms in the South African Education system, the teaching of Natural Sciences in senior phase schools still remains a challenge. Gitlin and Margonis (1995), Fullan and Miles (1992) and Bantwini (2010) all argue that curriculum reforms do not guarantee that the existing challenges and problems will endure the immediate solutions. As a Natural Science teacher in one of the senior phase schools the researcher has observed some of the struggles that Natural Sciences teachers go through when teaching Matter and Material strand. In several content workshops attended the researcher has observed teachers venting their frustrations about how they struggle with the content, especially Matter and Material strand as it requires science content knowledge which some of them do not have due to a lack of specialisation in the subject.

When filling the attendance register for attendance, teachers are required to fill in their teaching quantifications as well. Looking at their teaching qualifications was evident enough as to why they are frustrated. Most of them are not specialists in the subject because they specialise in Life Orientation, Geography

and History, therefore they may not have adequate qualifications to teach the subject. The anecdotal observations from these content workshops made the researcher realise that there are challenges in the teaching of the science subject, particularly Matter and Material strand,that was evident enough to warrant further research. Even though numerous studies have been conducted by Sedibe (2014); Bantwini and Feza (2017); Nomxolisi et al. (2016) on Natural Sciences in senior phase schools, none of them have looked specifically with reference to the classroom practices of teachers when teaching Matter and Material strand. Consequently, this study will focus on the classroom practices of senior phase teachers when teaching Matter and Material strand in some schools of Siyabuswa circuit in the Mpumalanga province. In this study classroom practices entails Teacher's teacher knowledge, Instructional strategies and Classroom interactions and discourses.

1.2. PROBLEM STATEMENT

From what the researcher has observed in their school most educators who are teaching Natural Sciences do not have the necessary qualifications to teach the subject. Some of the educators specialise in Life Science, Life Orientation and Economics without any qualifications in Natural Science and yet they are teaching the subject. Furthermore, in some of the Natural Sciences content workshops the researcher participated in it has been observed that a similar trend exists where teachers complain about how they struggle in teaching some of the strands, for example Matter and Material. Consequently, this study will explore the classroom practices of senior phase teachers when teaching Matter and Material strand in some schools of the Siyabuswa circuit in the Mpumalanga province.

1.3. RESEARCH QUESTIONS

1.3.1. Research main question

What are the classroom practices of teachers when teaching Matter and Material in the senior phase?

1.3.2 Sub-questions

- What is the nature of the teacher's teacher knowledge when teaching Matter and Material strand in the senior phase?
- What is the nature of the teacher's instructional strategies when teaching Matter and Material strand in the senior phase?
- How does the teacher's teacher knowledge and instructional strategies shape the classroom interactions and discourse**?**

1.4. AIMS AND OBJECTIVES

1.4.1. Research main aim

- This study is aimed at exploring the classroom practices of senior phase teachers when teaching Matter and Material strand.

1.4.2. Objectives of the study

The objectives of this study are:

- To understand the nature of teacher's teacher knowledge when teaching Matter and Material strand in the senior phase schools.
- To understand the nature of teacher's instructional strategies when teaching Matter and Material strand in the senior phase schools.
- To understand the interactions and discourse when teaching Matter and Material strand in senior phase schools.

1.5. RATIONALE OF THE STUDY

As a natural science teacher in senior phase school, the researcher attended a Natural Science content workshop. The anecdotal observations on Natural Science teachers made the researcher wonder about their classroom practices when teaching Matter and Material strand because these teachers would vent their frustration on the difficulties and challenges they encounter when teaching the subjects relating to the Matter and Material strand. This was evident enough to the researcher to see that there are challenges in their classroom practices when teaching the subject particularly Matter and Material strand.

The results of this study should help in finding solutions to challenges and experiences that senior phase Natural Sciences teachers have such as teaching a topic outside of their specialisation and a lack of resources. Although the study is narrowed to senior phase Natural Sciences teachers and subject specialists, the results will also disclose the problems faced by teachers during Natural Science teaching, in particular the Matter and Material strand. Furthermore, the outcomes of this study advise possible resolutions to make Matter and Material strand teaching more meaningful to learners and teachers.

1.6. RESEARCH ETHICS

The researcher attended to important ethical considerations such as informed consent, voluntary participation and withdrawal by participants which were all considered. Confidentiality and anonymity, as well as protection from harm was made a priority.

1.7. DELIMITATION OF THE STUDY

This study focused on three Natural Sciences teachers in the Siyabuswa circuit because some teachers in this circuit vented their frustrations on teaching particular strands in the subject. It was also convenient for the researcher to identify participants that best fit the criterion of perceiving the strand to be difficult to teach. For this reason, the study did not focus on participants who did not perceive the strand to be difficult to teach. Therefore, the delimitation of the study is one of only focusing on the phenomenon under research. The literature review was restricted to that which assisted to answer the research questions of this study in terms of teacher's teacher knowledge, instructional strategies, classroom interactions and discourses. Therefore, all that which was not relevant to the study was not part of the literature reviewed.

1.8. RESEARCH STRUCTURE

This section highlights the outline and organisation of all the chapters included in this study.

Chapter 1: Introduction

in this section the following are presented: research background, problem of the study, research questions, rationale of the study, aims and objectives, structure of the research and chapter summary.

Chapter 2: Literature review

This section focuses on factors that influence the teaching of Natural Sciences. Further to that it reviews literature on studies that have been conducted on classroom practices of Natural Sciences teachers when teaching matter and material strand in the senior phase. The conceptual framework underpinning this study is presented in this chapter.

Chapter 3: Methodology and Design

This section presents the methodology and design of the research that were employed in order to explore the classroom practices of Natural Sciences teachers when teaching matter and material strand in some of the senior phase schools of Siyabuswa circuit.

Chapter 4: Data analysis, discussion and findings

This section presents data obtained from three senior phase natural sciences teachers. The analysis of the results, discussions and findings are presented in this section.

Chapter 5: Teacher practices and recommendations of the research

This chapter presents the answers to the research questions, summaries of the findings, contributions of the research as well as recommendations of the study**.**

1.9. SUMMARY OF THE CHAPTER

This section provides data of the research background followed by the problem of the study. The research questions, rationale, aims and objectives of this research are also provided. This section also indicates what the next four chapters comprise of. In conclusion, the next chapter presents the literature review including the conceptual framework underpinning this study**.**

CHAPTER 2:
LITERATURE REVIEW

2.1. INTRODUCTION

Even after twenty-five years since democracy dawned in South Africa, science education challenges have not yet enjoyed an immediate solution of improvement in science teaching and learner performance, in particular in senior phase schools. Literature reviewed in this study discusses some of the factors influencing the poor performance in Natural Sciences. Natural Science has been perceived by teachers and learners as one of the more complex subjects in senior phase schools particularly Matter and Material strand (Murphy et al, 2007; Harlen and Holroyd, 1997). It is also the purpose of this study to explore the senior phase teacher's classroom practices when teaching matter and material strand, this is because of the researcher's anecdotal evidence wherein she has observed some of her colleagues who are teaching Natural Sciences in senior phase schools struggling with this topic and how they vent their frustrations in the content workshops that are conducted at circuit level, thus this researcher felt a need to conduct this study. The results of the reviewed literature are discussed in sequence. Firstly, a discussion of Matter and Material strand in CAPS. Secondly, teaching Matter and Material strand in senior phase. Thirdly, the views of several researchers associated to factors influencing the teaching of Natural Sciences. Lastly, conceptual framework underpinning this study followed by classroom interaction and discourse in Natural Sciences classrooms will be discussed.

2.2. MATTER AND MATERIAL IN CURRICULUM AND ASSESSMENT POLICY STATEMENT (CAPS)

Through the identified faults and challenges in the Revised National Curriculum Statements (RNCS), Curriculum and Assessment Policy Statement (CAPS) came into existence (DBE, 2011b). The National Curriculum Statement Grades R-12 (NCS, 2011) stipulates policy on curriculum and assessment in the schooling sector. To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. The

general aims of this curriculum are to ensure that the knowledge and skills acquired by learners could be used in a meaningful way in their lives. In the CAPS curriculum knowledge strands are divided into four parts and are used as a tool for organising the content of the subject of the Natural Sciences.

Natural Sciences Knowledge Strands

- Life and Living
- Matter and Material
- Energy and Change
- Planet Earth and Beyond

The Knowledge Strands are a tool for organising the subject content. In teaching Natural Sciences, it is important to emphasise the links learners need to make with related topics to help them achieve a thorough understanding of the nature and connectedness of subject matter in Natural Sciences. Links must also be made progressively across grades to all Knowledge Strands (NCS: 2012). Since Natural Sciences is a diverse area of sciences it requires to be putting more emphasis on it in terms of performance.

Natural Sciences at the senior phase level is considered as a foundation layer of other specific disciplines that are learned at FET level such as Life Sciences, Physical Sciences, Earth Sciences or Agricultural Sciences. It further prepares learners to be actively involved in democratic society which upholds human rights and assists them in becoming more responsible citizens towards the environment (CAPS, DBE: 2011). The process of teaching and learning of Natural Sciences incorporates different ways and processes that help with everyday life. Learners are also equipped with skills that assist in thinking reasonably. These skills are also acquired in situations that explore the questions they have about the natural world, inspire their creativity and grow their level of thinking (CAPS, DBE; 2011). It is imperative that learners learn Natural Sciences in schools and continue with it in FET schools.

Matter and material is one of the strands that is embedded within Natural Sciences content. This strand is common in both GET and FET phase according to CAPS subject statements of both N.S (DBE, 2011a) and Physical sciences

FET (DBE, 2011a). The focus of this strand on both RNCS (2002) and CAPS, DBE (2011) documents is on the properties and uses of materials, and on understanding their structure, changes and reactions in order to promote desired changes. Matter and material strand in GET phase consists of the following topics: properties of matter, mixtures, acids and bases, the periodic table, atoms, the particle model of matter, compounds and chemical reactions N.S (DBE, 2011a). There are common topics in both GET and FET phase such as periodic table and mixtures etc.

Looking at the table in Appendix N, it is evident that Natural Sciences and Physical Sciences have a link and are interconnected. If a learner has difficulty in comprehending a topic on mixtures in GET phase it will be difficult for the learner to comprehend it at FET phase. This is because topics at FET are a continuation of GET topics, but in this level they are more complex and abstract and require learners to be critical thinkers, they further require the background knowledge learned from the previous grades.

In the study conducted by Mudau and Nkopodi (2015), they explore one of the topics in matter and material strand which is on the periodic table. They summarise what is taught in GET and its continuation in the FET. Their findings agree with this statement: “Natural Sciences in senior phase level is considered as a foundation layer of other specific disciplines that are learned in FET level such as Life Sciences, Physical Sciences, Earth Sciences or Agricultural Sciences” according to CAPS, DBE (2011). However, according to CAPS subject statements of both N.S (DBE, 2011a) and Physical sciences FET (DBE, 2011a), there are topics that are not taught throughout the phase like mixtures in GET phase is only taught in grade 7 and 8 and not in grade 9, and then will be introduced again in grade 10, which is an FET phase. The question is then why it is not taught in grade 9? How will a learner connect the concepts if they were not learned in the previous grade? The researcher found this as one of the limitations of CAPS (DBE, 2011a).

2.3. TEACHING OF MATTER AND MATERIAL STRAND IN THE SENIOR PHASE

To one who comprehends anything about education it is obvious that science education in primary and senior phase schools is very important. It is in these phases where learners are introduced to the basics of what science is and how it works. It is understandable that children before school already have certain knowledge about nature. Based on the studies conducted by Malinovskaya (2002) it can be claimed that the interest of leaners learning matter and material strand at this level is very often stronger as learners very naturally receive a lot of information from their surroundings (home surroundings, multimedia and so on). It is without doubt that senior phase schools can be introduced very widely to matter and material (e.g. the classification of the materials, different chemical reactions and so on). Matter and material strand is defined by Lamanauskas (2005) as a primary chemistry science. This strand has been perceived by most learners as being difficult, consequently research indicates that learners generally have very poor conceptions of the properties of matter (Murphy et al, 2007; Harlen and Holroyd, 1997). They cannot differentiate between macroscopic and microscopic descriptions of matter (Viiri, Hirvonen, Saari et al., 1999). Further to that the is an increasing concern that learners are bored with matter and material strand and that does not only impact on the strand but on the subject as a whole.

While reviewing the literature for this study the researcher identified some misnomers in CAPS DBE (2011a). One of the misnomers identified was that according to CAPS DBE (2011a), learners in grade 7 are taught the periodic table of elements before being introduced to an atom. Only in the next grade atoms as a concept is introduced. This implies that learners in grade 7 learn about the elements in the periodic table without knowing what makes up those elements. The sequence should be that learners learn what atoms are in grade 7. In grade 8 they then learn what elements are and what they are made up of using the background knowledge learned in the previous grade about atoms rather than the other way around. This misnomer could be among other factors contributing to boredom of learners in learning this strand, because learners find it hard to link the concepts. Lamanauskas (2003) argues that learners are interested in

science classes when the content of the taught material is comprehensible, attracts attention and imagination, encourages them to intensively work and is problematic. This remains a responsibility of the Department of Basic Education to restructure other topics in the statements so that they show sequence and logic.

2.3. FACTORS INFLUENCING THE TEACHING OF NATURAL SCIENCES (NS) IN THE SENIOR PHASE

2.3.1 Lack of Natural Science specialist teachers

Throughout all of the various education systems South African education has endured, there are still schools that have under-qualified science teachers, especially in rural areas (Onwu & Stoffel, 2005). Shulman defines teachers' understanding as a first step in effective learning as it determines which content is to be learned and how best it should be taught (Shulman, 1987:7). Onwu and Stoffel assert the importance of having Natural Sciences specialist teachers in schools (Onwu and Stoffel, 2005). The knowledge gained by the teacher through professional and academic qualifications is referred to by Science Community Representing Education (SCORE) (2011) as 'specialism', it is the kind of knowledge that the teacher should have in order to be regarded as a specialist in the subject. The studies conducted by Dudu (2013) and Makgato and Mji (2006) show a trending challenge in the South African science education system, which is the lack of qualified science teachers. Not only the study conducted by Dudu (2013) and Makgato and Mji (2006) but (Stols et al. 2007; Taylor and Moyana 2005) also observe this similar trend, (wherein they further reveal that these teachers also lack adequate content knowledge.

To assure quality teaching and learning in Natural Sciences, the issue of teacher's content knowledge should be well addressed. Harlen and Holroyd (1997) argue that the limited subject matter knowledge that senior phase teachers have contributes to a lack of confidence and affects their competencies in doing their work, which subsequently leads to misconceptions, which they then transfer to learners. Literature has reviewed that how well an educator teaches the content in the classroom depends entirely on their area of specialisation.

(Danielsson and Warwick, 2013). Murphy et al. (2007) found that when teachers teach out of their area of specialisation, they only teach the content they understand and leave the rest, which negatively impacts on learner's performance in Natural Sciences. Rogan and Grayson (2003) further argue that the type and level of training and qualifications that the teacher receives determines how the teacher teaches in the classroom.

One of the reasons that contributes to teacher's incompetency in teaching Natural Sciences is that they are teaching out-of-field. Teaching out of field is a situation wherein a teacher is bound to teach subjects that are not within their area of specialisation, according to Ingersoll and Gruber (1996). Du Plessis, Gillies and Carroll (2014, p. 90) further argue that these teachers teach subjects that they did not learn during their tertiary schooling and which were not part of their qualifications and therefore have no teaching methodology for the subject. These North American and Australian based researchers suggest that all teachers are qualified to teach but not all teachers can teach in every area of specialisation.

All teachers can teach but not every teacher can teach Natural Science. For a teacher to qualify to teach Natural Sciences they should ideally have a degree in Natural Science and a professional teaching qualification. If the teacher teaches out-of-field, it can have a negative impact on the subject because some of the strands of the subject will not be taught. This will compromise the teaching of subject. Studies conducted by Nomxolisi (2016) show a positive correlation between a teacher's academic qualification and learner performance, as teachers who are specialists in Natural Science tend to produce learners who perform well in the subject. Angrist and Lavy (2001) are of the view that Natural Science teachers should be well-trained to teach the subject and be specialists in what they teach to ensure effective teaching and learning of Natural Sciences in schools.

2.3.2. Resources

Various researchers note that the availability of resources and learner performance are directly proportional to each other Human Rights Watch, 2004; Maponya, 2010; Molokoe & Ndandani, 2014; Bantwini & Feza, 2017). That sentiment is supported by Idiaghe (2004), who discovered that learners from previously disadvantaged schools are performing poorer compared to those from well-resourced schools. Natural Science is a doing subject because it consists of two components which are theoretical and practical components, hence enough support is needed in terms of resources to get maximum results from teaching and learning. This implies that learners cannot learn the subject effectively without adequate resources such as laboratory equipment because at any time learners need to be able to do experiments and practicals in the lab. The importance of adequate and suitable resources in Natural Sciences teaching is further reiterated by Mudulia (2012) when he states that scientific discoveries are achieved by experiments and observation rather than telling. This therefore highlights the dire need for the availability of laboratories to ensure effective teaching and learning of science. According to the Department of Basic Education (DBE, 2012), for Natural Science teachers in the senior phase to properly plan and execute their duties, schools must provide them with the right resources for each topic.

The Department of Basic Education (DBE, 2012) policy document stipulates that it is within every learners right to have learning materials such as textbooks, however the conditions make it impossible for that to happen, especially for schools in rural areas. The policy document (DBE, 2012) further reiterates the need and importance for science learners to be equipped with the right resources and enough space to carry out sensitive scientific experiments. From this assertion, the issue of safety of learners when they are using science equipment arises. The Department of Basic Education (DBE, 2012) emphasises that it is the responsibility of teachers that safety rules and standards are adhered to when conducting experiments in the laboratory. To further give support to Natural Science teachers, CAPS, Natural Science Grades 7 - 9 DBE (2011) provides and lists resources needed for teaching Natural Sciences against each topic. With necessary material assistance, Tobin believes that with adequate scientific resources Natural Science learners are afforded a chance to be actively involved

in their learning (Tobin; 1990). This is further emphasised by Osborne and Collins (2000), who believe that learners can only construct scientific knowledge and investigative processes by being actively involved in their learning process. Orji (2006) further argues that the ultimate performance of learners depends on the availability and proper use of library materials such as science laboratory materials.

Today, with the advent and rise of Information technology in the world, Wong et al (2006) emphasise the need and importance of technology in supporting interactive learning in the classroom. The usage of technological resources such as video presentations when teaching Energy and Change strand in Natural Sciences, enable learners to find it simpler to grasp. The usage of smart boards and virtual reality could make the teaching of Natural Science more interactive. Grabe & Grabe (2007) believe that one of the advantages of incorporating ICT in the teaching and learning of Natural Science is that it ensures that different concepts are presented, taught and understood differently and in a way that stimulates learners' thinking. With the availability of ICT in Natural Science, Pickersgill (2003) believes that this helps learners with the provision of relevant information instead of being inactive receivers of information. The usage of smart boards and virtual reality could make the teaching of Natural Science more interactive. Even though necessary equipment could be provided a qualified Natural Science teacher remains central in effective teaching and learning.

2.3.3. Language use in science teaching and learning.

The issue of language has also been listed as another obstacle towards learners performing well in Natural Science. In many South African schools, English is the medium of instruction, therefore learners find themselves forced to be fluent in English. According to Tan and Tan (2008), learning any subject, especially Natural Science, in a second language has proven to be more challenging and difficult for learners whose home language is not English. The challenge of the medium of instruction does not only affect learners. But it is further aggravated when science teachers themselves are not proficient or fluent in English hence that affects the teaching and learning of Natural Sciences.

However, Ferreira (2011) argues that fluency in English does not solve the language issue in the effective teaching and learning of Natural Sciences. Ferreira (2011) states that science is also a language that needs to be learned. Schaffer (2007) further notes that science is a language and a content in its own context. Therefore, learners whose home languages are not English struggle with science as both the language and subject are foreign to them. South Africa is a diverse country in terms of languages, and a majority of learners are not first language English speakers. It is illustrated by Mokiwa and Msila (2013) that the issue of the language barrier in South Africa has a strong effect on educational quality. Previously disadvantaged schools, especially in remote and uncivilised areas, encounter difficulties with the use of English as a medium of instruction. Taylor and Prinsloo (2005) allude to the fact that if learners were taught in their first language, learners would pass Natural Science in their majority. Alidou et al. (2006) have recommended that developing learners' skills in listening, speaking, reading and writing needs to be enhanced in both their first language and in English. Taylor and Vinjevold, (1999) have further stated that good performance in school depends on basic literacy skills of which the majority of black South African children from disadvantaged homes do not have access to. As a result of a poor command of the English language, learners are unable to read the learning materials provided for them and the tasks and exercises they are given are often conceptually too difficult and beyond their ability. The issue of language as illustrated in Brigido et al. (2010); Murphy and Beggs' (2003) observations has led to primary school learners who may have an interest in science but that interest tends to diminish in secondary and high schools. This has brought to the fore the importance of teachers in encouraging learners to continue with science in higher grades. Scantlebury (2012) has taken the issue of learners' interest in science to another level.

According to Redd, the difficulty in understanding the English language makes it challenging for teachers and learners to interact effectively (Redd, 2004). It is therefore the responsibility of society, the education department and teachers to work together to assist learners to comprehend English as the medium language of instruction.

2.3.4 Teaching difficulties in Natural Sciences

Abd-El-Khalick and Akerson (2009) argue that even though science could be made known to people in different ways, the best way of knowing it is through teaching it. The main aim of teaching science is that learners should develop problem-solving skills and inquiry. Furthermore, science should be taught in such a way that learners make meaningful learning. (Leach & Scott, 2003).

If science teaching takes place and teachers fail to achieve these aspects (development of inquiry, problem solving skills and meaningful learning) then teaching will be deemed unsuccessful (Abd-El-Khalick & Akerson, 2009). Not only would teaching be deemed unsuccessful but it would be a clear indication that a teacher has teaching difficulties in the subject (Mudau; 2013).

A survey carried out in some of the schools in the Eastern Cape shows that most teachers have difficulties in teaching science in schools. Muwanga-Zake (2001) asserts that the main teacher challenges in teaching Natural Sciences are caused by an inadequate knowledge and comprehension of science concepts and processes. Not only does the survey that was carried out by Muwanga-Zake confirm teaching challenges in science, but so too does another survey carried out by Selvaratnam (2011), who discovered that quite a number of science teachers in KwaZulu Natal schools were also battling when it came to solving basic scientific concepts. These studies have revealed that there are difficulties in teaching science in South African schools across the country.

Kleickmann et al. (2013) state that Content knowledge (CK) and Pedagogical content knowledge (PCK) are some of the major contributing factors of teaching difficulties in science because they are determining factors of how well-versed the teacher is in teaching the subject. For the teacher to be competent in his or her work s/he needs PCK and CK and must further be able to integrate the two. Content knowledge is referred to by Ball, Thames and Phelps (2008) as knowledge of the subject matter and in the teaching of Science it refers to how knowledgeable the teacher is in science as a subject. In order for one to teach effectively, knowledge of the subject should be detailed. In showing the

importance of the teachers' deep understanding of the subject matter he or she teaches, Shulman (1992) states that the teacher should be able to critique issues in order to realise truth value. McDermott (2006) further supports Shulman (1992) by asserting that teachers need to understand the topics they are going to teach at a deeper level.

South African teacher training is also a contributing factor to teaching difficulties in science Muwanga-Zake (1998). Most of South African teacher training institutions did not train teachers in such a way that they have a deeper meaning of what they will be teaching in schools and hence they have limited content knowledge (CK) (Rollnick et al., 2008). Since this has been on-going for years, the Department of Education had to come up with strategies or solutions to counteract the existing problem. The Department of Education introduced in-service training such as Professional development to develop teachers in their professional role (National Staff Development Council NSDC; 2007). The Department of Education introduced such training interventions so that teachers could be developed professionally, and furthermore introduced teacher development programmes such as content workshops (Loucks-Horsely, Stiles, Mundry, Love and Hewson, 2003) wherein teachers can assist each other with the content they deemed troubling to them. However, these once-off programmes such as workshops are deemed ineffective and do not improve learner performance (Ono and Ferreira, 2010; Borko, 2004). This is because teachers would be treating only one topic while they will be expected to teach the entire syllabus in schools irrespective of how competent they are in teaching the topic.

2.3.5 Misconceptions in Matter and Material strand

Misconceptions are being defined by different researchers in different contexts but all definitions boil down to one concept which is "alternative ideas or concepts learners bring into class". For example, Sanders (1993) describes misconceptions as the result of everyday usage of unscientific language which results in the formation of incorrect concepts that reflect in formal learning, while Keeley (2012) describes them as the ideas that learner's held that are conflicting

with modern scientific thinking and natural world. Mudau (2013) defines misconceptions as state of clash of the different concepts (incorrect conception).

All people have misconceptions regardless of age and gender according to Gooding & Metz (2011), hence learners do not come in the classroom as blank slates. When learners enter the science classroom in senior or high school they arrive with misconceptions about science concepts (Keeley; 2012). Most of these misconceptions are acquired by learners at a young age when they try to make sense of their natural world, while some are transferred to them by adults.

Misconceptions are considered as major factors that hinder effective learning. The review of the literature shows the work of researchers on the possible sources of misconceptions in science. Language is deemed to be one of the causes of misconceptions in science. Sanders (1993) further asserts that unscientific everyday language use may result in incorrect concept formation during formal learning. Clerk and Rutherford (2000) argues that misapprehension of others' explanations and language misunderstanding may cause misconceptions as well.

Textbooks are also regarded as other sources of misconceptions since they can give misleading information either through illustrations or written text (NRC, 2012). Not only do learners have misconceptions, but so too do teachers. However teachers are regarded as a main contributing factor in the transferring of misconception. A teacher who has a minimal understanding of science and yet has to teach the subject tends to have greater misconceptions because they have limited subject matter knowledge of science. The study by Bayraktar (2009) shows misconceptions held by teachers and also claims that teachers' misconceptions were likely to be transferred to the learners. If teachers' misconceptions are transferred to learners it goes without saying that those misconceptions will affect teaching and learning, as alluded to by Prescott and Mitchelmore (2005) and Prescott (2004).

Studies on misconceptions have been carried out in different countries by different researchers. These are some of the misconceptions identified in matter and material strand.

- Ross and Munby (1991) studied Canadian senior high-school learners' understanding of the concepts related to acids and bases. The aim of the study was to identify misconceptions held by senior phase learners particularly in Matter and Material strand. They found that learners had difficulties in differentiating between bases and ions. Furthermore, they had challenges in writing and balancing equations. Some learners held the view that OH- ions were found in acids. Their findings showed that learners did not understand all of the concepts taught by teachers or teachers held misconceptions and transferred them to their learners.

- Gussarsky and Gorodetsky (1990) conducted a study on senior high school learners concerning the concepts of chemical equilibrium. They found that learners had difficulties of relating the left and right side of an equation, instead they treated them as separate units. Learners also failed to identify the position of the system at chemical equilibrium.

Even though misconceptions are easier to transfer to learners, they are very difficult if not impossible to correct. Keeley (2008) explained that replacing these misconceptions with accurate scientific knowledge could be difficult because once the information is learned, whether correctly or incorrectly, it is difficult to edit or delete. Educational consultants Gooding and Metz (2011) believe that (p. 34):

- First, until there's a change on learners' perception about their natural world they will hold onto the misconceptions they have.
- Second, the longer learners hold onto a misconception, the more complex it will be for them to unlearn.

It is advisable to avoid misconceptions as much as possible which will make teaching and learning more effective.

2.3.6 Prior-knowledge in science

Keeley (2012) posits that learners do not come into the science classroom as clean slates, hence they come with pre-conceived ideas about science topics

and concepts. These pre-conceived ideas could be defined as prior knowledge. Prior knowledge is defined differently by different researchers, but all definitions have a common denominator which defines prior knowledge as “what the learner already knows” and “what the learner brings into the classroom”. For example, Jonassen and Grabowski (1993) defined prior knowledge as the knowledge that the learners brings to the classroom before the lessons, and Bruner (1960) defined prior knowledge as the heart for successive learning, wherein new knowledge is continually being built upon what is already known to learners. So prior knowledge in this study will mean what the learner already knows and what they bring into the science classroom to make leaning meaningful.

Ausubel (1961) clearly emphasised prior knowledge as a foundation for meaningful learning. He further argued that for meaningful learning to occur, learners have to find a link between what has been learned and the existing knowledge. Therefore, the utmost factor in any meaningful learning is what has previously been learned. For meaningful learning to take place, both the learner and the teacher must play equal roles, wherein learners bring pre-conceived ideas and concepts about science and the teacher will then use the pre-conceived ideas to build and link new knowledge. If either of these conditions is not met, then rote learning instead of meaningful learning will take place Taber (2001).

In science, the degree of chronological dependence of the content is so great that the role of prior knowledge is considered as a starting point for successive learning because all of the concepts of science are linked. Gagne (1968) further posit that some of the sequences were so definite that without the mastery of a prior step there could be no further progress in the subsequent ones. For example, If a learner struggles to master the Matter and Material topic in the senior phase school it will be difficult for him/her to comprehend it in high school. This is because it is a continuation of the topic learned in the senior phase yet in high school it is categorised as Matter and Material (Chemistry). The topic in high school will be more complex and abstract hence it will need the prior knowledge learned in senior phase.

Prior knowledge has been considered to be the most important single factor that influences learning. In a study conducted by Taber (2001), she discovered that prior knowledge is a determining factor for meaningful learning, meaning if learners do not possess adequate prior knowledge then intended learning cannot take place. Tobin (1992) further emphasise that teachers can use learners' prior knowledge as a yardstick to determine opportunities for meaningful learning that stimulates conceptual change. Posner, Strike, Hewson, and Gertzog (1982) describe conceptual change in science as any change in knowledge structures concerning the re-arrangement of settings in science ideas that learners bring to the learning environment. Gagne (1968) posit that existing knowledge should be mastered before new ones are taught. This means that teachers should first determine a learners' prior knowledge in the topic before teaching about it. That will bring an insight to the teacher on where to start and how to plan for the lesson.

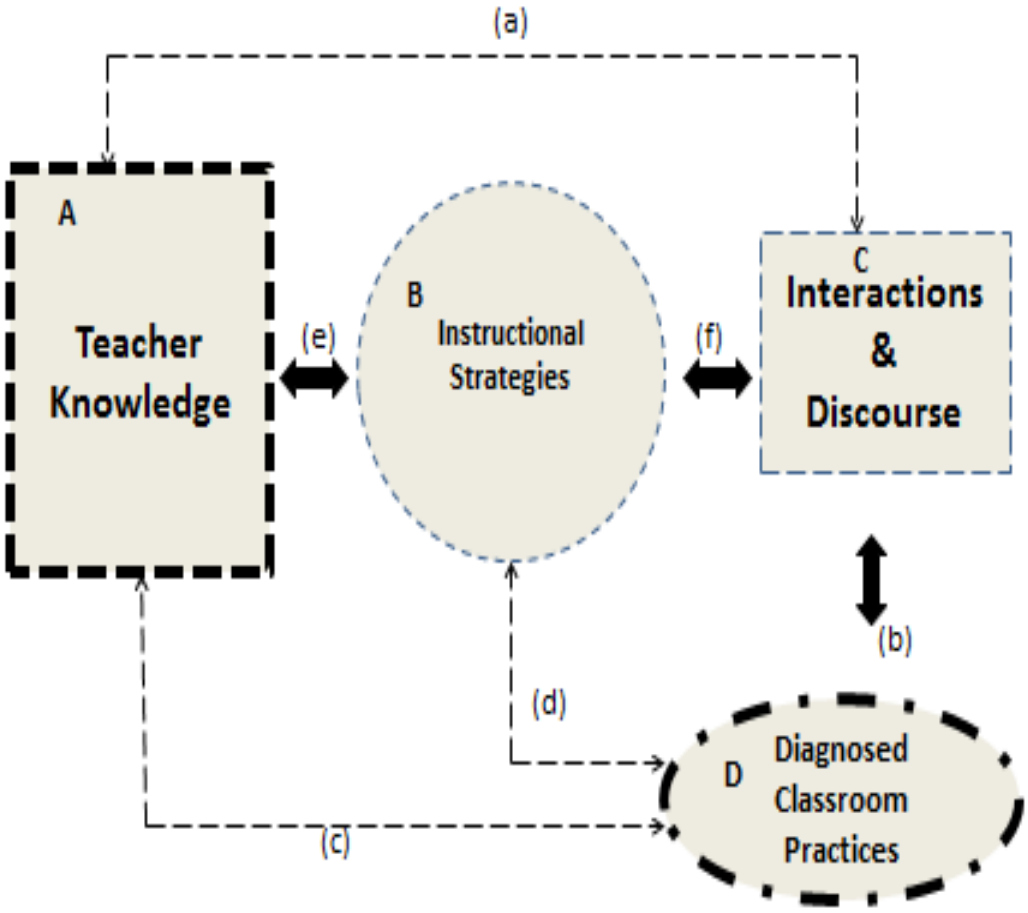
2.4. CONCEPTUAL FRAMEWORK

According to Maxwell (2005:33), conceptual framework is made up of systems of schemes that could be used to as an eye to see through the informed research. A conceptual framework is something that is not convenient, but builds from different pieces connected together. (Maxwell, 2005). These assumptions were taken into consideration when developing the conceptual framework for this study.

The classroom practice diagnostic framework (CPDF) by Mudau (2016) was considered as the framework of this study to answer the research questions. Why particularly this framework? CPDF focusses on teacher's teacher knowledge, instructional strategies and interaction and discourse as the proponents of classroom practices. The design behind this framework is that a Natural Science teacher with content knowledge and context knowledge will be able to choose relevant instructional strategies to use in the classroom. The approach chosen by a Natural Science teacher is made up of epistemological perspectives and traditional teaching methods that will lead to the interaction and discourse types to be chosen. A benefit of this is that if the types of discourse are not effective, the teacher could potentially go back and choose another approach which they

think can yield the best discourse and interactions. This framework can only be effective if the teacher has adequate content and context knowledge in Natural Science. If not, the framework will not be of any assistance. Dudu (2013) states that teachers who lack adequate content and context knowledge tend to have a challenge in choosing appropriate teaching strategies. Since the focus of this study is on teacher's classroom practices, CPDF was used as a frame of reference when diagnosing these practices.

2.5. THE CLASSROOM PRACTICE DIAGNOSTIC FRAMEWORK (CPDF)



Classroom Practice Diagnostic Framework (CPDF)

2.5.1 How does the Classroom Practice Diagnostic Framework woks (CPDF)

The CPDF has four phases (A, B, C and D). The phases are arranged in chronological order. Phase A consists of a very important aspect of effective teaching and learning and that is teacher knowledge. Teacher knowledge is made up of content, context and learners' understanding of knowledge. Phase B entirely depends on teachers' knowledge because the teacher uses his or her knowledge to decide on appropriate instructional strategies to be used. Instructional strategies are made up of epistemological perspectives, traditional teaching methods, explanatory frameworks and activities. The type of instructional strategies chosen by the teacher will determine the types of interaction and discourse in the classroom which is found in phase C. In phase C we find Classroom interactions and discourse. The stress in this phase is on the types and patterns of discourse, communicative approach and the teacher questioning. Types of discourse include the authoritative, dialogic and reflective discourses. Phase C concludes what has been done in phase A and B. phase D is the outcome of phases A, B and C. All phases are dependent on each other as they are intertwined..

Before explaining the application of the CPDF framework, it is imperative to explain each frame of the CPDF.

2.5.2 Teacher's teacher knowledge

Several studies stress the importance of the knowledge teachers hold, highlighting that in addition to assimilating academic knowledge, teachers also need to incorporate knowledge derived from experiential and practical experiences in the classroom. Research also shows that variations in opportunities to learn in teacher preparation are related to differences in learner achievement: teachers from countries that are top performers in PISA and TIMSS tend to have a higher level of pedagogical content and subject matter knowledge. From the above view it is empirical to discuss teacher's teacher knowledge, the effect it has in science education and why it is a part of the CPDF framework.

The above assertion is supported by a study conducted which reveals that there is an existence of inadequate teacher content knowledge in South African senior phase schools, especially in teachers who teach Natural Sciences (Stols et al. 2007; Taylor and Moyana, 2005). Teachers' teacher knowledge is a crucial component in the teaching and learning of any subject. In the present study teachers' teacher knowledge comprises of three aspects which are: Content knowledge, Context knowledge and learners' understanding. Content knowledge (CK) is a key component of teacher competence that affects learners' progress (Kleickmann et al. 2013). Content knowledge is referred to by Mudau (2013) as knowledge of the subject matter and in the teaching of Natural Science it refers to how knowledgeable the teacher is or how well the teacher masters the Subject Matter Knowledge (SMK). In this study it refers to Natural Science as a subject. SMK also refers to the teacher's understanding of the structure and nature of discipline and learning of the unfamiliar content knowledge. According to Shulman (1986, 1987), SMK is based on two main areas: the organisation of concepts, facts, principles and theories and the nature and structures of knowledge which refer to the ways in which truth or falsehood, validity or invalidity are established (Shulman, 1986, p.9). In other words, the teachers' SMK integrates not only knowledge of specific topics of the curriculum but also knowledge about the epistemology of science or the nature of scientific knowledge.

One can argue that one of the most important characteristics of being a good science teacher is having very good SMK. However, research studies, which have struggled to find a relationship between SMK and good teaching (Abell, 2007; Childs & Mc Nicholl, 2000; and Kind, 2009) posit that while a good background in SMK is a prerequisite for good teaching, it is not the only requirement. Kind (2009) further argues that though the specialist may produce good results, that does not necessarily confirm that good teaching prevails in the classroom (p.1559). In fact, subject specialists do not teach for deep knowledge to take place, but rather they resort to teach through processes of knowledge transmission. According to Shulman (1986, 1987), science teachers need to develop PCK which they will use to blend content and pedagogy into an understanding of how particular topics, problems, or issues are organised,

represented, and adapted to the diverse interests and abilities of learners and presented for instruction (Shulman, 1987, p. 8).

In order for one to teach effectively, subject knowledge should be detailed in showing the importance of the teachers' deep understanding of the subject matter he or she teaches. Shulman (1992) states that the teacher should be able to review issues in order to discover truth value. The teacher should be an expert and a specialist in the subject that he or she teaches and have a high level of SMK. Studies show that the level of SMK greatly influences how the subject is taught (Kind et. al, 2011). Davis et al. (2007) posit that when teachers have a high level of subject matter knowledge, they stand a good chance of using advance teaching practices (p. 622). Having an in-depth knowledge of the subject matter helps teachers provide alternative explanations or use different approaches to help learners understand complex scientific concepts.

Childs and McNicholl (2007) contend that when teacher has a low subject matter knowledge, their chances of choosing appropriate instructional strategies for science teaching explanations in the classroom is partial. Furthermore, teachers with low levels of SMK tend to resort to rote learning and they cannot detect learners' difficulties and misconceptions. Van Driel & Verloop (2002) elaborate that this is because they cannot choose the appropriate instructional strategies. If the teacher's subject matter knowledge is questionable it goes without saying that he or she does not have confidence in a subject that they are teaching. Harlen & Holroyd (1997) argue that confidence in a subject is directly proportional to the knowledge in the subject, meaning the deeper the knowledge and understanding the teacher has in the subject the greater their confidence will be in the subject and that will result in learners performing better in the subject, and is also applicable in the reverse situation (p.103). Wayne & Youngs (2003) have discovered a relationship between adequate teachers' content knowledge and learners' performance, as the two are directly proportional, meaning a teacher who has adequate knowledge in the subject stand a greater chance of producing good results, however this would not be the case with when there is weak content knowledge.

From the researchers; assertions it is imperative for every teacher to have an adequate SMK and PCK and to be specialists in the subject they teach because these aspects have a greater influence in education and they further determine learners' performance in the subject.

2.5.3 Instructional strategies

According to Conklin (2007:5) instructional strategies are those that are needed by a teacher to enhance learning for diverse learners. However, a teacher should not rely on a single strategy when going to class (Halai & Khan, 2011). Hollon, Roth and Anderson (1991) indicate that instructional strategies should be used as a tool to stimulate learners' thinking ability and made them aware of the importance of their thinking ability during their learning process. In this study instructional strategies entail; epistemological perspectives, explanatory frameworks and activities. According to Mudau (2013), Epistemological perspectives will refer to how knowledge is demonstrated to learners, whether it is rational or empirical. Empiricism is the gaining of knowledge through experiences, while rationalism is the gaining of knowledge through reasoning. Explanatory frameworks are the analogies, models and/or illustrations the teacher uses to make learning accessible to learners. The problems, demonstrations, simulations, investigations, or experiments which the teacher uses to help learners understand the subject matter are called activities. The choice of instructional strategies is greatly influenced by teacher's content knowledge according to Kuzniak and Rauscher (2011), which means that a teacher who lacks subject matter knowledge will not find it easy to choose the appropriate instructional strategies, and hence the teacher will resort to rote learning. This implies that a teachers' teacher knowledge and instructional strategies are dependent upon each other.

According to Dudu (2013) there are serious concerns about the state of science education in South Africa and further observations that are concerned around teachers' lack of content knowledge in science, challenges in the use of inappropriate instructional strategies as well as unprofessional conduct. Teachers who lack experience, confidence and general pedagogic content knowledge will often resort to methods of expository teaching because they are

not specialists and confident in what they teach. Furthermore Magnusson et al. (1999, p. 112) assert that having limited knowledge in a subject can affect the choice of appropriate instructional strategies.

Natural Science teachers should have a thorough understanding of what Science is and how it can be appropriately taught in order to come up with learner centred inquiry-based teaching, instructional strategies and learning approaches. In this view, teachers will not adopt traditional, rote-learning and theoretical approaches to science teaching and learning. Teachers have to be qualified and have a high level of SMK in order to effectively utilise inquiry-based activities and choose appropriate instructional strategies so that Natural Science teaching will be meaningful to learners (Webb & Glover, 2004).

2.5.4 Classroom interactions and discourses

Smart & Marshall (2012) define classroom discourse as different interactions between a teacher and learner, mostly in the form of discussions or debate in the classroom. Mortimer & Scott (2003) believe that the interactions between teachers and learners in class is very important as learners get to properly understand through questioning, discussions and debates. Gee (1996) further describes discourse as connected pieces of language which, put together, make sense to some community of people. In this context, Gee (1996) asserts that the community of people is made up of the teacher and learners in the Natural Sciences classroom. According to Gomez (2007), in Natural Sciences, there are ways used to get learners to be comfortable with expressing themselves to teachers. In the present study, classroom interactions and discourse entails two aspects: one is interaction, which is the engagement between the teacher and learners and learners themselves. Mudau (2013) states that classroom interaction involves teachers and learners closely working together to find solutions or solve certain scientific ideas and concepts.

There are four classes of communicative approach, namely interactive/authoritative, interactive/dialogic, non-interactive/dialogic and non-interactive/authoritative (Mortimer & Scott, 2003). According to Mudau (2013), there are definitions and descriptions to these approaches. The Interactive-

authoritative approach describes the teachers' way of provoking or encouraging responses from learners, but rejects them if they are incorrect, as the focus here is only on correct answers. An interactive-dialogic approach takes place during an open discussion, this is where there are no incorrect answers, and learners' views are considered even though they may not be exactly the same as the ones considered to have accepted scientific meaning. Non-interactive-authoritative approach is self-explanatory and is the opposite of interactive authoritative and interactive dialogue. This is where information is being presented without any responses, and learners are expected or required to grasp and understand the information without questioning or making any suggestions. Non-interactive-dialogic approach, according to Mudau (2013), is when teachers are allowed to make their own additions on top of the formal guide. This is aimed at making learners understand the ideas or concepts better, however learners are still not requested or allowed to make any contributions.

Smart & Marshall (2012) have further added other aspects to the realm of classroom interaction and discourse. Smart & Marshall (2012) describe these discourses as different interactions between teachers and learners in an oral manner. Mudau (2013) has given these types of discourses as; Authoritative discourse, Dialogic discourse and Reflective discourse. He describes Authoritative discourse as the type of discourse where teachers invite leaners' responses through questions and factual statements. Dialogic discourse on other hand provokes and encourages debate between teachers and learners to determine and further develop understanding by learners. Lastly, Reflective discourse is when teachers engage with learners and look to get alternative ideas or ways of solving or understanding concepts and ideas from learners. This is a way of ascertaining or finding out the extent to which learners understand concepts and ideas.

Natural Science teachers are faced with the responsibility of using discourse enabling activities and methods when teaching the subject content. These should be activities that encourage learners to interact with each other, with the subject content and with their Natural Science teacher. Moje (2001) believes that these approaches help a lot in giving learners opportunities to read, talk, investigate

and write about questions of interest to them. Teacher's teacher knowledge, instructional strategies and classroom interactions and discourses are linked because only a teacher with adequate content knowledge will be able to choose appropriate instructional strategies and the type of instructional strategies chosen will give rise to the choice on discourses, but it all begins with a teacher who has adequate content knowledge in the subject.

2.5.5 The CPDF application

The CPDF was used to detect the classroom practices of Natural Science senior phase teachers when teaching Matter and Material strand. This framework entails: teachers' knowledge, instructional strategies and classroom interactions and discourses which are basic components that influence effective teaching and learning and learners' performance (Abd-El-Khalick & Akerson, 2009).

The first frame of this framework is teachers' knowledge, which entails the kinds of knowledge the teacher should possess in order to teach effectively. It also stresses that the teacher should be aware of the knowledge that learners have before-hand and the misconceptions thereof before introducing new subject matter to the learners. If the teacher identifies misconceptions in learners' knowledge this will affect how the teacher uses instructional strategies and classroom interactions and discourses to address the identified misconceptions Hausfather (2001). The framework does not focus on learner's misconceptions only. In a study conducted by Bayraktar (2009), he indicated that teachers as well as learners have misconceptions which they further transfer to learners during the process of teaching and learning.

The CPDF framework was further used to detect how the teacher teach the subject. The main aspects that were focused upon is how the teacher uses the instructional strategies and interactions and discourses to introduce new subject matter and the kind of communicative approaches thereof. Furthermore, the framework was used to detect how the teacher uses instructional strategies and classroom interactions and discourses to monitor how learners adopt the new subject matter (Leach & Scott, 2003). During the process of adopting new knowledge the teacher must ensure that the new knowledge presented links to learners' prior knowledge.

The final phase of the framework is the application phase. The framework was used as a point of reference to detect the types of instructional strategies and classroom discourses the teacher uses to create occasions for learners to answer questions, discuss knowledge and solve problems to ensure knowledge development (Hausfather, 2001). Nola (1997:59) further asserts that when learners go through the steps of reasoning on their own, they develop a deeper understanding of the knowledge they have. The teacher should be careful of the instructional strategies that they use when teaching because if they entail question and answer and lecture techniques they might not promote reasoning and thinking ability, which are pre-requisite of problem solving skills and inquiry (Nola, 1997).

2.6 CONCLUSION

In conclusion, the researchers' literature review has discussed in detail the aspects of classroom practices and how each aspect impacts the teaching of Matter and Material strand in the senior phase schools. The chapter has further discussed the framework that underpins this study. In the next chapter the research methodology is described.

CHAPTER 3:
METHODOLOGY AND DESIGN

3.1. INTRODUCTION

The aim of this study was to explore the classroom practices of senior phase teachers when teaching the matter and material strand in some of the schools in the Siyabuswa circuit. This chapter presents the research methodology, research design, research context, rigour, data management, ethical considerations and summary.

3.2. QUALITATIVE APPROACH

The research approach used in this study was qualitative in nature. Creswell (2007) and Maree (2010) indicate that a qualitative approach is considered as a method of inquiry by making sense of central phenomena in studying participants in their context. In this study the researcher observed classroom practices of Natural Science teachers teaching matter and material strand in senior phase schools, observations were made with the aim of understanding and describing their classroom practices and how they teach Natural Science. De Vos et al. (2002) further states that a qualitative research approach stimulates a participant's account of meanings and first-hand experience. It produces descriptive data in the participant's own written or spoken words because the researcher collects first-hand information obtained directly from the participants (Miles and Huberman, 1994). It further involves identifying the participant's beliefs and values that underlie the phenomena.

Since a qualitative approach is concerned with making sense of central phenomena (Creswell, 2007 and Maree, 2010), it was used for this study because it provided possible explanations of the phenomena under exploration. This approach further allows an interaction between a researcher and participants (De Vos et al., 2002). Due to the nature of the investigation it was imperative for the researcher to maintain close contact with the participants as they are deemed to be information rich, hence their responses assisted the researcher in answering the research questions of this study. Furthermore, the classroom practices had to be understood from the participant's point of view, hence a qualitative approach is an appropriate approach for this study.

3.3. CASE-STUDY APPROACH

According to McMillan (2004) a case study is defined as an in-depth investigation of one entity or experience which is carefully defined and characterised by time and place. This approach is a specific instance that illustrates a more general principle (Cohen, Manion & Morrison 2002). In this study a case-study approach was used because the researcher was more interested in getting in-depth details of what was being explored (Njie and Asimiran, (2014). This approach also allowed a researcher to understand the participant's behaviour and their experiences better, and to further understand the contextual factors underlying their action. A case-study approach further recognises the uniqueness and dynamic nature of contexts as well as performing an in-depth investigation of human interactions in a unique instance (De Vos el at. 2002). The researcher had an obligation to interact with the participants as they are deemed to be information rich in that they were knowledgeable and informative about the phenomenon under exploration and moreover to elicit data through observations and interviews that will assist in answering the research questions of the study (Crabtree and Miller, 1999).

Guba and Lincoln (1985) classify case studies into several types, which are: explanatory case studies, exploratory case studies, descriptive case studies, multiple-case (collective) studies, intrinsic case studies and instrumental case studies. In this study the researcher used the multiple case-study design because it enabled the researcher to explore the classroom practices of Natural Sciences teachers when teaching matter and material. Each case was treated as a unique case.

3.4. THE NATURE OF THE RESEARCH

This study was underpinned by an interpretive model which assumes that all human activity is meaningful and as a result has to be interpreted along with the social context (Scott and Usher, 1996). Cohen et al. (2000) further assert that an interpretative paradigm seeks to understand the subjective world of human experience. Such an approach can be used to explain social actions, texts and documents (Wellington, 2000). Due to the above definitions, the choice of the research design and the nature of the problem under investigation, the study

followed an interpretive approach, which allowed for greater understanding of the classroom practices of Natural Science teachers when teaching matter and material strand in the senior phase.

Even though the data analysis for this study was rooted in the participant's responses during the interviews and observations only, the researcher's experiences of teaching matter and material strand, attendance at content workshops and cluster meetings also had an impact on the resultant interpretations of the analysis. The interpretative paradigm allowed the researcher to look at participants as individuals, each with their own contextualised classroom practices. Participants were studied in their natural environment, which is the classroom, and gave the researcher a greater opportunity to understand the perceptions they have of their own activities (Hussey and Hussey, 1997). In this regard it was their classroom practices.

3.5 RESEARCH CONTEXT

In this section of the chapter, the researcher outlines the research setting, the sampling process and the criteria used for selecting participates as well as further discussing the cases.

3.5.1 Research setting

The setting of this study is in the Mpumalanga province. The Mpumalanga province is one of the nine provinces of South Africa. Mpumalanga lies in eastern South Africa, bordering Swaziland and Mozambique. It shares borders with the South African Provinces of Limpopo to the north, Gauteng to the west, the Free State to the south west and KwaZulu-Natal to the south. The province has four districts, namely: Nkangala, Gert-Sibande, eHlanzeni and Bohlabela district. The Nkangala district has 1 020 592 people in the population, in which the most spoken language of this population is isiNdebele (2001 Census). Learners from this district come from semi-rural areas. The Nkangala district consists of schools and circuits. This district consists of 20 circuits, in which the Siyabuswa circuit lies where there are 15 senior phase schools.

This study was conducted in the Siyabuswa circuit which is one of the circuits in the Nkangala district because that is where the researcher is based. Other factors that motivated the researcher to conduct the study in this circuit and district are because of anecdotal evidence and the observed trends in the subject meetings and contents workshops she attended. From her observations on how teachers vent their frustrations on the difficulty and complexity of Natural Science topics, particularly the matter and material strand, raised an interest and a need for conducting this study.

In this study the data was collected in the Nkangala district from three senior phase schools in the Siyabuswa circuit.

3.5.2 Sampling process

De Vos et al. (2002) state that sampling is one of the most important concepts in research, which involves selecting a portion from a population as a representative of that population. Sampling is necessary in research because complete coverage of a population is seldom possible. In qualitative data collection, purposive sampling was used to select participants and sites that can purposefully inform an understanding of the research problem of the study (Creswell, 2007). This sampling method was used as it would save the researcher time and costs, thus it promoted feasibility for this study. Furthermore, the selected participants had to be working in the selected schools for more than three years and teaching the subject, which ensured that the learners would be used to the teachers' teaching style. Moreover this sampling was appropriate because the participants were information rich in that they were knowledgeable and informative about the phenomenon under exploration, hence the aim of this study was to explore the nature of classroom practices when teaching matter and material strand in senior phase schools.

The Nkangala district has more than twenty circuits, the Siyabuswa circuit is one of them and has fifteen senior phase schools, however only three of the fifteen senior phase schools were selected to participate in this study.

Purposive sampling was used to select the participants of this study. Sampling was done based on the following proposed criteria:

- All participants must be teaching Natural Sciences in senior phase schools, particularly in the Siyabuswa circuit
- Participants had at least one recognised teaching qualification in Natural Sciences
- Participants were willing to participate in the study

The researcher was able to include three participants according to the prescribed criteria. This greatly reduced the researchers' expenses because there was no need for the researcher to travel long distances to collect data from each and every school in the Siyabuswa circuit. The participants and school names are not revealed in this study. Pseudonyms were used instead. The proposed pseudonyms for both participants and schools are as follows:

- Kate from Hope combined school
- John from Light combined school
- Rose from Faith school

3.5.3 Cases

For exploring the teachers' classroom practices when teaching Matter and Material strand in senior phase schools in the Siyabuswa circuit, the study focused on three senior phase schools. The researcher interviewed and observed teachers from each school. The study comprises of cases of three Natural Sciences teachers. The cases of the study are detailed below:

CASE 1: KATE FROM HOPE COMBINED SCHOOL:

Hope combined school is situated in an anonymous village in the Mpumalanga province. Hope combined school offers grade R-9, it is a bi-lingual school offering both isiNdebele and Sepedi as home languages. However, the school is dominated by Ndebele speaking learners. The majority of the teachers within the school speak isiNdebele, however they are Pedi's. The Majority of the learners in this school reside where the school is situated.

Hope combined school is not well-resourced when it comes to teaching aids and facilities. The school has 317 registered learners and does not have a science

laboratory. The school has one grade 7 class, with 41 learners registered for grade 7. Natural Sciences is allocated three hours per week, the period for Natural Sciences is broken up into 30 minute short and 60 minute long periods. Learners are taught in English as a medium of instruction. Kate is a black female teacher and has been in the teaching field for 4 years. She has been teaching Natural Sciences for 4 years. She teaches Natural Sciences mainly to grade 7 and some other grades. She holds a Diploma in teaching where she specialised in Mathematics, Natural Sciences, Social Sciences and Geography

CASE 2: JOHN FROM LIGHT COMBINED SCHOOL

Light combined school is situated in the village. Light combined school is not well-resourced and the infrastructure of the school does not look good at all. The majority of the learners in the schools reside in the village not far from where the school is situated. Learners and teachers in the Light combined school speak isiNdebele and Sepedi. Light combined school is a bi-lingual school where it offers both isiNdebele and Sepedi as Home-languages. The school has a number of 407 registered learners. There is only one class in grade 7 wherein 38 learners are registered. Light combined school does not have a laboratory. John is a black male teacher and holds a Secondary Teachers Diploma specialised in Mathematics and Physical Sciences as well as a further Diploma in Management and a Bachelor of Technology (BTech) degree in Management. John has 25 years teaching experience and 15 years teaching Natural Sciences.

CASE 3: ROSE FROM FAITH COMBINED SCHOOL

Faith combined school is situated in the village. Faith combined school consists of Ndebele and Sepedi speaking staff and learners. However, isiNdebele is the dominant language of the school. Faith combined school has 504 enrolled learners and the school is not well-resourced. Faith combined school offers grade R-9 and does not have a science laboratory. Natural Sciences is allocated three hours per week, with shorter periods of 30 minutes and longer ones of 60 minutes. The learners are taught in English as the medium of instruction. There is only one class allocated for grade 7 in which there are 61 learners. Rose is a black female teacher and she’s been teaching for 15 years. She has been

teaching Natural Sciences for 15 years. She holds a Senior Primary Teachers Diploma (SPTD) where she specialised in Mathematics and General Sciences.

3.6 RIGOUR

In qualitative research a researcher is referred to as a data gathering instrument (Maree, 2007). Maree further illustrates that when qualitative researchers speak of “validity and reliability” they are referring to research that is credible and trustworthy. Guba (1981) proposes four criteria that he believes should be considered by qualitative researchers in pursuit of a trustworthy study: credibility, transferability, dependability and confirmability. The researcher used the following criteria to ensure that the work of the study is trustworthy and of high quality.

- Credibility (internal validity)
- Dependability
- Confirmability
- Verisimilitude
- Triangulation
- Pilot study

3.6.1 Credibility (internal validity)

Credibility is a way of ensuring that the research findings are congruent with the reality and making sure that the reader believes the findings of the research process Flanagin and Metzger (2007). In this study credibility was enhanced by ensuring that the findings for this study were derived only from the data collected (Maxwell, 1992).

3.6.2 Dependability

According to Maree (2010), dependability can be defined as the degree to which the reader can be convinced that the findings did indeed occur as the researcher says they did. Dependability of a qualitative collected data were established through member checking (Creswell, 2007).

3.6.3 Confirmability

Lincoln and Guba (1985) describe confirmability as the degree of neutrality or the extent to which the findings of the study are shaped by participants and not by researchers' interest or motivation. Furthermore, it ensures that the findings are derived from the data and is a true reflection of what has transpired when the data was collected and confirms that the study was properly conducted. The researcher employed triangulation to ensure confirmability in this study. The researcher corroborated the information collected through the interviews with what was observed in the classrooms. The researcher avoided more involvement or any form of relationship with the participants as this could cause bias in the research study.

3.6.4 Verisimilitude

In this study the researcher uses direct quotes from the participants when analysing and presenting the findings from the collected data, this was done so as to avoid the presented data from being questioned or deemed unreliable. To ensure verisimilitude the researcher further wrote the participants voices in italics to indicate that these were the participant's voices not the researcher's.

3.6.5 Triangulation

Triangulation is the use of different methods or multiple techniques (usually three) to confirm findings (Berg, 2007). McMillan and Schumacher (1993) allude to the fact that triangulation determines credibility of the study. To obtain this the researcher used interviews and observations to ensure the credibility and accuracy of the data. Denzin (1978) argues that in a qualitative study a combination of multiple research methods must be corroborated in order to achieve the findings. To establish this the researcher corroborated participant's responses from the interviews together with observations from the classrooms, which is methodology triangulation because multiple methods of data collection techniques were used.

3.6.6 Pilot study

Babbie (1990) defines a pilot study as an overview of the entire study design. A pilot study is a very crucial part of any research project as it gives an overview beforehand of what to expect when conducting a research study and it further serves to investigate the feasibility of the study and bring possible deficiencies that may rise to the fore (Huysamen, 1994). In this study the reason for piloting the instruments assisted the researcher in determining whether the instruments were comprehensible and appropriate to the needs of the study in order to make some modifications or keep them as they were (Dipoy and Gitlin, 2016).

The instruments for this study were submitted to the supervisor for comments. Thereafter they were refined with one participant who was not part of the main study but similar to the participants from whom the data for this study will be collected. The following was learned during the pilot study:

- When the researcher was observing the participant, she did not record them, which was a lesson to be learned that she should videotape the participants
- The participant did not understand some of the questions, hence the researcher had to do a lot of explanations

- The participant was not audible enough, hence the researcher has learned that she must put the recording device closer to the participants
- A few of the questions were leading questions, hence they were refined
- Other research questions were ambiguous, they were refined after the pilot study
- The pilot study assisted the researcher to develop and exercise a data analysis scheme (DAS)

In conclusion, the pilot study was eye-opening for the researcher and further prepared them to handle the main study.

3.7. DATA MANAGEMENT

In this section of the chapter, the researcher will give a detailed discussion on data collection techniques, the process of collecting data, how the data was interpreted and analysed as well as how the data was presented.

3.7.1 Data collection techniques

This subsection is aimed at presenting all the different types of data collecting techniques that were used in this study and how they were used. The techniques that were used to gather data for this study are observations and interviews. These techniques are discussed in detail in the subsection below.

CLASSROOM OBSERVATIONS

According to Maree (2007), observation is the systematic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with them. Furthermore, observation is an everyday activity whereby we use not only our senses (seeing, touching, hearing, smelling and tasting) - but our intuition – to gather information. In a qualitative data gathering method, observation is used to enable the researcher to gain a deeper insight into and understanding of the phenomenon being observed (Maree, 2007). Observation also makes it easier for the researcher to observe participants' natural behaviour and how they interact with their learning and teaching environment without asking them specifically. In this study the

researcher observed the participants in their workplace, which is in senior phase schools where teaching and learning takes place.

Before the researcher went to senior phase schools to observe the participants, they designed a classroom observational tool which would be used to collect the data. The observational tool was aimed at evaluating the classroom practices of senior phase teachers, which entail: teacher's teacher knowledge, instructional strategies, classroom interactions and discourses in the Natural Sciences classroom. In the study conducted by Mudau (2013), he states that it is not quite possible to capture classroom interactions and discourses using alternative methods other than observation techniques, hence for this reason the observation technique was used to gather information on teacher's classroom practices when teaching matter and material strand in the senior phase schools in the Siyabuswa circuit.

The researcher used video and direct recording to gather the data during observations. The video recording assisted the researcher to capture everything that the participants were doing in the classroom (from introducing the topic, movements made when presenting the lesson, eye-contact maintained with the learners, to classroom interactions). The video recording assisted the researcher a lot when she was analysing the data because if she had not utilised it, it could have been difficult to capture everything that happened in the classroom or rather she could have forgotten other things that happened in the classroom.

INTERVIEWS

An interview is a two-way conversation in which the interviewer asks the participant questions with the aim of collecting data to learn about the ideas, beliefs, views, opinions and behaviour of the participant (Maree, 2007). Rammala (2009) further states that an interview is one of the most common methods of data collection used by researchers to inform them about social life. The technique of individual face-to-face interviewing treats the interview as a system for getting information from the interviewee to the interviewer (De Vos, 2001).The aim of qualitative interviews is to see the world through the eyes of the participant, and they can be a valuable source of information provided they are

used correctly, furthermore, the aim of using qualitative interviews is to obtain rich knowledge and social reality (Maree, 2007). Interviews are conducted to find out from the participant's things that the researcher cannot observe like feelings, thoughts and intentions.

In this study the researcher uses a face-to-face semi-structured interviews and audio recording. The researcher chose a semi-structured interview because this kind of interview is flexible which means it allows new questions to be brought up during the interview. Silverman (1993) alluded to the fact that a semi-structured interview involves a set of open-ended questions that allow for spontaneous and in-depth responses. The use of semi-structured interviews also enabled participants to describe their experiences and attitudes towards teaching Natural Sciences, particularly matter and material strand. The audio recorder was used to tape the participant's responses in order to make sure that the researcher has captured their responses correctly. After the interview the researcher allowed participants to listen the interview for further clarifications, if any, and ensured that the researcher captured exactly what the participant wanted to say. This kind of interview was regarded as important as it provided the researcher with the qualitative data used to answer the research questions of this study.

3.7.2 Data collection process

Since access to the research sites could be an issue, the researcher requested permission from the District Department of Education to gain access to research sites and participants. The researcher further requested permission from the school principals. Upon permission being granted arrangements were made with research participants wherein time schedules were drawn and agreed upon. The purpose of the meeting was to explain the purpose of the visit and that of the research and how the data-collection process was going to take place. The principals were assured that there would be no disruptions to teaching and learning in the schools (Mudau, 2013). During the meeting teachers were asked to feel free to participate and were further assured that the information gathered was going to be used for research purposes only.

Qualitative data collection in this study includes two strategies. The first strategy consists of one-on-one semi-structured interviews with a set of pre-determined questions (Lombaard, 2015). Three Natural Science teachers from three selected schools were interviewed. Even though interviews are considered to be time wasting and costly (Creswell, 2007), this technique seemed to be the most relevant one to collect data, because of the small number of participants who participated in the study and because of the personalised nature of the interview data. Participants were interviewed for a period of 30 minutes maximum during their free time and after school. The interview responses were tape recorded for data collection and analysis purposes only (Lombaard, 2015). Post interview questions were drawn prior as they depended upon the responses from pre-interviews.

Classroom observation served as useful strategy for data collection for this study. Observations were conducted after the interviews. The strategy of classroom observations was chosen because the researcher wanted to gain an in-depth understanding of classroom practices of Natural Science teachers when teaching matter and material strand. The type of observation most suited for this study was observer as a participant because the researcher remains uninvolved and does not influence the dynamics of the setting.

3.7.3 Coding, analysis and interpretation

According to Cohen et al. (2000), data analysis involves making sense of collected data in terms of the participants' description of the situation, noting patterns, themes, categories, and consistencies. In addition, Saldana (2009) views data analysis as a process that requires the analyst to capture an understanding of the data in writing. Mudau (2013) further asserts that an alignment amongst themes, categories of research questions, theoretical frameworks, and literature reviewed as well as the researchers' personal experience must be ensured to organise data and enhance identification of patterns in analysis. Consequently, a typology approach was used in this study, wherein the themes and categories were developed from research questions, a literature review and personal experience (Hatch, 2002).

The collected data from three cases was analysed and interpreted separately as no case is similar to the others. The researcher analysed the collected data by listening to the audio interviews and transcribing them into word document, in the case of video recorded during classroom observations the researcher played the video and transcribed it into a word document as well. After transcribing the recorded interviews, the researcher listened to the audio again, which was done to verify if the transcribed words corresponded with the participant's responses. The same process was done with video, which was replayed to verify if what was written in the transcripts is what was on the video. Further to that the verification process was done to check if the event did answer the research questions of the study. The grammatical errors of the participants were not corrected by the researcher. In cases where the participants used English interchangeably with other languages the researcher did change the words. They were written exactly as said by the participants and the translation was placed in brackets. This was not done because the researcher would have tampered with the credibility of the data.

The transcripts for each participant were read by the researcher word for word while listening to the interview audio. The same process was repeated with recorded videos, this was done to ensure the accuracy of the observations and the interviews. Further to that the participants were given an opportunity to read their transcripts for the purpose of comments and corrections before they were considered as a final product.

The data analysis of this study was developed from the conceptual framework which is discussed in detail in chapter two. The data analysis scheme DAS (APPENDIX N) was used to analyse the data for this study. The researcher read the transcripts with one theme (Gall et al., 1996) in mind. Track changes and different text highlighting was used to code the categories and characteristics of each theme (APPENDIX O). The researcher went through the coded data to verify the transcripts. The coded data from three themes of this study was then used to interpret the classroom practices which enabled the researcher to answer the research questions of this study.

3.7.4 Data presentation, discussion and findings

After the coded data was analysed and sorted accorded to categories it was then presented and discussed in the form of paragraphs using one theme at a time (Gall et al., 1996). For each theme, categories and characteristics were presented and discussed in detail. The researcher presented the data using direct quotes, there after discussion followed. Triangulation was used during presentation and discussion of the collected data to check the credibility of the study (McMillan and Schumacher, 1993). Further to that, data from the interviews and observations was corroborated to check the correlation of what the teacher said they were going to do during the interviews to what they did in the classroom (Denzin, 1978). Visuals such as pictures captured during observations were incorporated in order to check if they assisted in attaining the findings of this study. After data presentations and discussions were made the researcher then presents the findings.

3.8. ETHICAL CONSIDERATIONS

When conducting research, ethical practices need to be taken into consideration. Hence it is crucial to adhere to universal ethics such as privacy, confidentiality, honesty and protecting the individual rights of the participants. Participation in this study was voluntary and participants were made aware that they were not obliged to take part in it. The participants were also informed of their right to decline or withdraw from the study at any time if they felt pressured and uncomfortable in answering the questions asked. The researcher also assured the participants of the confidentiality of the interviews, and that their identities were not to be disclosed to anyone, but will only be strictly used for the purposes of this study. Researchers claim that participants are anonymous when they cannot be identified from the information collected from them. In this study pseudonyms were used instead of participants' real names that assured the participants' confidentiality.

The researcher requested permission from the Nkangala district Department of Education in Mpumalanga before moving to the research sites. Circuit managers, principals and Natural Sciences teachers were also written letters which were

sent to the circuit requesting permission and giving a detailed purpose of the study. The permission was duly granted. The researcher then went to the research sites to collect the data, this was all done while observing the ethical considerations and practices.

3.9 SUMMARY

This chapter has outlined the research methodology used to collect data from the participants. It further outlined the following aspects, which were imperative for this chapter, namely: qualitative approach; case study approach; nature of research; research context; rigour; and data management. Furthermore, it examined the issue of validity and trustworthiness. The qualitative data collection techniques used were also discussed in detail, which are classroom observations and interviews. The next chapter presents the findings of the study.

CHAPTER 4:
DATA PRESENTATION, DISCUSSIONS AND FINDINGS

4.1. INTRODUCTION

This chapter presents the data collected for the purposes of this study. In addition, the data is discussed and findings are reported. The cases (participants) were exposed to the same questions and observation protocols and taught the same strand (Matter and Material). Moreover, the cases were interviewed and observed separately to get more insight into their classroom practices. Furthermore, it is only the elements that can assist in answering the following research question that is presented: the following question guided the study:

- *What are the classroom practices of teachers when teaching Matter and Material in the senior phase?*

And the following sub-questions:

- *What is the nature of the teacher's teacher knowledge when teaching Matter and Material strand in the senior phase?*

Here the researcher was interested in the teacher`s content knowledge when teaching Matter and Material strand, learner's understanding, and their knowledge of context for teaching the strand.

- *What is the nature of the teacher's instructional strategies when teaching Matter and Material strand in the senior phase?*

Here the researcher wanted to note the teaching route the teachers used, the teaching methods they chose, and the explanatory frameworks they employed to explain the content.

- *How does the teacher's teacher knowledge and instructional strategies shape the classroom interactions and discourse?*

The researcher wanted to understand the type of discourse of the teachers, their discourse patterns, communicative approach and the teacher questioning they used in the Natural Science classroom when teaching Matter and Material strand.

4.2 CASE ONE: KATE

In this section, the researcher presents data and discusses it per case.

4.2.1 Data presentation and discussion

According to the NS CAPS document grades 7-9 (DBE 2011a), Natural Sciences curriculum consists of four knowledge strands, namely: Life and Living, Matter and Material, Energy and Change and Planet Earth and Beyond. Since this study was based on one of the four strands, which is Matter and Material, all the observations and interviews were focused on this particular strand. During the pre-interview Kate indicated that she would teach Metals, Non-metals and Semi-metals and that these topics were a part of the Matter and Material strand content according to NS CAPS document grades 7-9 (DBE 2011a). From the onset Kate displayed a limited amount of content knowledge (CK) as she failed to explain the concepts she was going to teach during her lesson. This was evidenced by how she explained the concept she was going to teach as indicated below;

> “Non-metals are found on the periodic table, from our left-hand side those are the materials that cannot make a steel, example a wall. And semi-metals are found not exactly in the middle of the periodic table, we find them after the non-metals, and they can be a liquid or a metal. They are in between the metals and non-metals"

From the above description it is clear that she could not explain what non-metals entailed, only indicating where they are found on the periodic table. She did the same with metals and semi-metals, only describing their positions on the periodic table. It is not that she did not know what these aspects entail, but it shows that she had limited comprehension of those aspects. The limitation was further observed in the classroom because after she introduced a new topic on non-metals she then instructed learners to read from their textbooks about the properties of non-metals without explaining in detail. The observation is captured below;

> ”Kate: (reading from the textbook) non-metals do not stretch, are poor conductors of electricity, non-metals have a lower melting and boiling point”. “Kate: Let us read in our textbooks about semi-metals on page

(paging over the textbook) on page 118. Semi-metals have the same properties of metals and some of the non-metals. The green elements on the periodic table they are semi-metals, when it is heated it becomes a liquid. Semi-metals can be shiny or dull some of the properties are metals and some are non-metals, they are good electrical conductor, they conduct electricity only when they are heated".

From the above extracts it was evident that Kate had a limited subject matter knowledge (SMK) and content knowledge (CK) as indicated in the study by Usak et al (2011), that some of the Natural Science teachers show insufficient amounts of Content Knowledge (CK) and Subject Matter Knowledge (SMK). This was confirmed as Kate failed to explain the concepts she was teaching during her lesson. Kate did not even attempt to explain the properties of non-metals and semi-metals, all she did was read aloud their properties to learners without providing more understanding. However, she could have explained or given details on what each property means. Childs and McNicholl (2007) assert that limited subject matter knowledge (SMK) and content knowledge (CK) forces the teacher to resort to rote learning, which was evidenced during Kate's lesson as she was narrating the textbook to learners without explanation. This limitation in the content knowledge was also evident during the classroom observation when she was interacting with the leaners. The following was observed;

Kate: Non-metals are found on the right-hand side of the periodic table (reading from the textbook).
Kate: How many non-metals do we find on the right-hand side?
Thulani: 16
Kate: No they are not 16. They are 16 on the right-hand side plus one that is up on the left-hand side which sums up to 17.

Based on the learner's response, Kate only told learners that there are 17 non-metals on the periodic table and did not explain why there's one (Hydrogen) that is situated on the left hand-side of the periodic table and why it is classified as a non-metal. This could have been a learning opportunity that could have benefited not only the learner in question but the rest of the class. This was one

of Kate's shortcomings and a clear indication of a deficiency in her subject matter knowledge (SMK) and content knowledge (CK).

Even though Kate was teaching concepts that are in line with the curriculum according to Natural Sciences (DBE, 2011), the topics were not taught in a sequential order *(Acids, Bases and Neutrals; Arrangement of elements on the Periodic Table; and Some properties of Metals, Non-Metals and Semi-Metals)*. Moreover, during the interview Kate indicated that she was going to teach non-metals and semi-metals, however according to Natural Sciences (DBE, 2011), that topic should have been taught after acids, bases and neutrals and the arrangement of elements in the Periodic Table. When the question was posed to her on why she was not teaching the topics in sequential order. She indicated that:

> "The reason for that is that I swapped the two topics because for the past two weeks, I wasn't attending as frequent due to some other commitments so I decided to give them periodic table so they could familiarise themselves with it and periodic table is much simpler to learn by themselves than the acid, base and neutrals. I had to be there when they learn these substances as they are dangerous"

Learners were expected to learn the properties of acids, bases and neutrals before they could be introduced to the periodic table elements, however Kate did vice-versa and mixed up the topics. That indicated that her content knowledge was disorganised as the topic are linked in science. She further made assumptions that the periodic table of elements is simpler as learners can learn on their own than acids, bases and neutrals as she perceived them as dangerous. Irrespective of the challenges she had that made her unable to go to work she could have adhered to the CAPS document and taught the topics in a sequential order. Kate failed to achieve ***specific aim 2: "knowing the subject content and making connections"***. That means Kate did not take learners' understanding into consideration as she failed to link the two topics as per expectations in accordance to Natural Sciences (DBE, 2011).

It was imperative for the researcher to ask questions on the importance of learners learning the ideas of the concepts to be taught by the teacher. Kate indicated that:

> *"*At this stage they are at a stage of learning periodic table, so they have to differentiate between semi-metals and non-metals and metals"

From the extract above from the post-interview, the researcher was able to identify that Kate's content knowledge is (CK) disorganised. Kate indicated that she is teaching learner's properties of metals, non-metals and semi-metals in preparation for them to learn the periodic table, however according to the CAPS document learners are expected to learn the three main categories of the periodic table prior to learning about their properties. Kate's response in this regard was evident that she did not teach the topics in order of sequence.

According to the CAPS Natural Sciences document, resources in the science context can include tools, apparatus, materials, books, and consumables (DBE 2011a). However that is not the case with most rural schools as they lack adequate resources such as textbooks and other teaching aids as reported by Sethusha (2015). According to Starkey (2011) the availability of such resources can create a good context of learning. During the pre-interview, Kate indicated that she is going to use the textbook, chalkboard and chalk, she further indicated that only 50% of learners in her classroom have textbooks.

During observation, the researcher noticed that Kate's learners who did not have textbooks were not participating and were just seated doing nothing. Even though Kate knew and indicated that only 50% of learners had textbooks she did not make any provisions for those who did not by giving them handouts of the content she was going to teach on that day. Hence her teaching did not bear any fruit as other learners were spectators during the lesson.

Since Natural Science is a doing subject it consists of two components, which are theoretical and practical components, hence enough support is needed in terms of resources to get maximum results from teaching and learning. This implies that learners cannot learn the subject effectively without adequate

resources such as laboratory equipment because at any particular time learners need to do experiments and practicals in the lab. The importance of adequate and suitable resources in Natural Sciences teaching is further reiterated by Mudulia (2012), when he states that scientific discoveries are achieved by experiment, observation and not telling. This therefore highlights the dire need for the availability of laboratories to ensure effective teaching and learning of science as it is very difficult to teach science without these resources as indicated by Tshiredo (2013). During the interview Kate indicated that they do not have a laboratory in the school, but they do conduct experiments in the classroom. She further made a very dreadful statement and indicated that:

> "The ones that are possible I do, but the ones that needs fire and what not I don't do them I only explain how it is done, but the ones that need hot water I conduct them"

From the above extract it was clear that whether or not the school had adequate resources Kate would not have conducted all the experiments as per expectations since she made it clear during the interview that she only conducts experiments that are non-flammable, and the ones that are flammable she would not perform. Her statement concurs with Tshiredo's (2013) findings that most of the science activities that need to be done practically such as experiments are done in the classroom by using chalk and boards. Lack of both practical skill and knowledge could mainly be the reason why teachers avoid doing or be selective in practical activities Muzah (2011). This shows an in-adherence to curriculum and CAPS document and failure to utilise ***"****specific aim 1: Doing Science***"** according to NS CAPS document grades 7-9 (DBE 2011a).

According to Legotlo et al. (2002) socio-economic background of learners is very important as it has an influence in their education, predominantly their performance in the subject. In the course of the interview, the question was posed to Kate as to what impact does the socio-economic background of learners have on their performance in the subject? She indicated that:

> “Due the environment they come from, they do not prioritise education, they believe that since they come from poor backgrounds they cannot achieve in life”

Regardless of the fact that the majority of her learners are discouraged by their socio-economic background, it did not stand in Kate’s way in making provisions for her learners to learn.

Limited or inadequate resources encourage teachers to modify the curriculum by using hands-on experiences (Stern and Marcella, 2008). Even though the school did not have adequate resources, that did not stop Kate from conducting a practical activity of her preference, which is ”non-flammable”, to help learners to understand the content. According to Tobin (1992), it is a teacher’s responsibility to provide the best materials and learning situations to make learning meaningful for each and every learner. Besides the textbooks that were provided at school, Kate made provisions and brought materials that will help her during the lessons. She indicated that:

> “I have household things from our home as I have selected few, I am going to use, two litmus paper red and blue ones. We’ve got vinegar, bicarbonate of soda, dishwasher, sugar, coffee, water, lemon juice”.

Kate brought all of the liquids listed above to help her explain the concept of acidic, basic and neutral substances, as she was going to do an investigation with her learners during the lesson.

Keeley (2012) defines prior-knowledge as pre-conceived ideas that learners have and bring to the classroom about science topics and concepts. Prior-knowledge is regarded as a foundation to meaningful learning (Ausubel, 1961). In order for meaningful learning to take place, both the learner and the teacher must play equal roles wherein learners bring pre-conceived ideas and concepts about science and the teacher will then use the pre-conceived ideas to build and link new knowledge. Kate indicated that during the last lesson they had learned about the properties of metals, hence she started off by doing revision and asking learner's questions on the work previously learned before proceeding to the next topic. She did that to show a link between the previously learned concepts and the one to be introduced and to check how much learners know in regards to the new concept and make that the focus of her lesson as asserted by Mesa et.al (2014), that concepts are built from known to unknown. In some instances, Kate was observed stimulating learners' prior-knowledge by asking about "silicon".

> Kate said: we have four different types a Silicon, is it your first time hearing about Silicon?
> Learners responded: No…
> Kate said: Where have you heard about Silicon and what is it used for?
> One learner responded: (It is used to seal leaking corrugated irons)
> Kate said: It seals leaking corrugated irons right? How does it look like is shiny or dull?
> Learners said: it is dull
> Kate said: it is dull and white right

During her teaching as she was checking learner's prior knowledge there was a case where misconceptions were displayed. Where learners confused Silicone and Silicon.

> Kate said: the one we talking about here it is from the materials that are from the periodic table, it is an element (On its own are we clear)?

Kate was observed battling to address the misconceptions that learners had but due to the lack of her content knowledge (CK) and poor subject matter knowledge she failed. instead she created more misconceptions for learners Van Driel and Verloop (2002). Since she could not explain the difference between the “Silicone” that learners were referring to and the one she was talking about, which is the semi-metal. As if failing to address learner’s misconceptions was enough, she further worsened the situation by revealing misconceptions from her side as well. This is indicated from the below extract captured from the observation:

> Kate said: Where do we find semi-metals on the periodic table? From the left-hand side or the right-hand side or bottom or top?
> Learners: from the right-hand side.
> Kate: “explained that there are also non- metals on the right-hand side, but firstly there are non-metals, then comes semi-metals”.

Kate’s teaching was dominated by misconceptions, as every time she tried to explain a concept she created a misconception. From the extract above Kate knew that metals, non-metals and semi-metals are found on the periodic table but she did not know their exact position as she was observed confusing their positions. This could be evidence that she has a limited content knowledge (CK), hence the misconceptions. Kate’s limitation and misconceptions were evidenced in the post- interview transcript below. When she was asked about other resources she can use to teach the same concepts and how she would use them, Kate made indications that she:

> *“*would bring a concrete thing like silicon rocks or a silicon thing, it can be a glue as long as it’s a silicon”

The above transcript points out the reason why Kate failed to explain the difference between “Silicone” and “Silicon” during the lesson is because she cannot differentiate them even herself. This is an indication that not only her learners had misconceptions, but the teacher as well and in other cases she transferred them to her learners. This is just as Bayraktar (2009) claimed that misconceptions held by teachers are likely to be transferred to the learners.

During the observations Kate used isiNdebele interchangeably with English during her teaching to accommodate linguistic abilities, learner's differences and trying to assist learners to have a better understanding of the concepts she was trying to explain.

> Kate said: "Thabo (pseudonym) khengibuze wena ipuphu le ophekangayo ekhenu nawuyfaka I magnet iyabamba ku (**does a maize meal you use at home stick to a magnet**) magnet"?

Kate used isiNdebele and made an example using maize-meal and a magnet in trying to explain the properties of conductivity of non-metals. However, that could have been a downside of her teaching since not all of the learners in her classroom are Ndebele speaking or understand isiNdebele as some of them are Sepedi speaking. Regardless of whether learners are Sepedi or Ndebele speaking, the use of teaching science or explaining science in an alternative language could be a disadvantage to learners and further compromise the quality of science education as asserted by Msila (2013). Sanders (1993) further argues that unscientific everyday language use and code-switching may result in incorrect concept formation during formal learning. Teaching Natural Sciences in an alternative language may cause misconceptions as some concepts in English may have a different meaning in that language.

4.2.1. Table gives a summary of Kate's teacher knowledge

Content knowledge	*Unorganised content knowledge (CK) and limited subject matter knowledge (SMK)*
Context knowledge	*Under-utilisation of resources even if they were made available* *Socio economic background having a great impact in learners' performance*
Learner's understanding	*usage of prior knowledge* *Teaching that caused misconceptions* *language variation: English was used interchangeably with isiNdebele*

According to Conklin (2007:5), instructional strategies are those that are needed by a teacher to enhance learning for diverse learners. Instructional strategies include teaching methods such as: lecture, demonstrations, discussion and question and answer. Explanatory frameworks include illustrations, analogy, models and examples. Activities include projects, investigations/ experiments and classwork and homework. During the interview the question was posed to her as to which teaching methods she prefers using when teaching the matter and material strand. Kate said that she prefers interacting with learners by having a dialogue with them. This was observed by the researcher during the lesson as that she kick-started her lesson using a question and answer method of teaching to develop a lesson and to find the knowledge learners have regarding the topic. This is supported by the extract below:

Kate: Properties of metals they are what?
Lunga: they are shiny.
Kate: yes, what else?
Learners: they are strong
Kate: do they conduct electricity?.
Learners: yes

Kate did not use the question and answer method throughout the lesson even though it was the only method she indicated she would use during the pre-interview. Her response to the question was contradictory to Halai and Khan's (2011) arguments that a teacher cannot rely on only one method of teaching to facilitate a lesson. Kate was observed changing the method of teaching as she swiftly diverted to lecture method during her lesson which she did not mention as one of the alternative methods of teaching she would use, this could be because she is used to the method as Lombaard (2015) asserts that teachers tend to divert to traditional teaching methods because they are used to them. Traditional teaching methods are defined by Boumová (2008) as methods that are teacher-orientated and contradict with active learning strategies which are learner orientated (Nottingham & Verscheure, 2010). This trend was also observed during Kate's lessons as she reverted to a lecture method of teaching as the lesson proceeded, which she did not mention as

one of the teaching methods she prefers using when teaching matter and material strand during the pre-interview, This could possibly indicate that the lesson was not properly planned as Booyse and Du Plessis (2008) emphasise the significance of choosing the relevant strategies whenever planning lessons and adhering to them in order to create a meaningful learning environment. Kate was observed narrating the textbook and reading the properties of semi-metals to learners without giving any explanations to the information she was reading or what the concepts mean. During observations it was evident that Kate's content knowledge (CK) is in question, hence she failed to choose the appropriate instructional strategy and resorted to rote-learning, which in this case was lecture method of teaching, just as Childs and McNicholl (2007) assert. The Traditional methods that Kate resorted to are widely criticised as they are observed as passive forms of learning, where learners just sit and listen to the teacher without interrogating the content being taught to them (Kaddoura, 2011). Subsequently, the learners taught with this kind of method become "shallow, surface thinkers" who basically depend upon memorising instead of properly understanding the content (Kaddoura, 2011). Explanatory frameworks are intended to make learners understand concepts by describing what is to be learnt with the teacher using models, illustrations, analogies and examples (Tabulawa, 2004). During the interview Kate indicated that she was going to use examples to explain the concepts.

> Kate: I will be using examples
> Kate made an example of rusted metal and explained that if something is rusted it does not necessarily mean it is dull.
> Kate said: can stretch or bend a maize meal?
> Kate said: you cannot bend or stretch the maize because it is a non-metal

Kate made examples trying to explain properties of metals and non-metals, however they showed no connection between the two aspects (metal and non-metal) as maize meal is neither a metal nor a non-metal so the example is deemed inappropriate and it can create misconceptions.

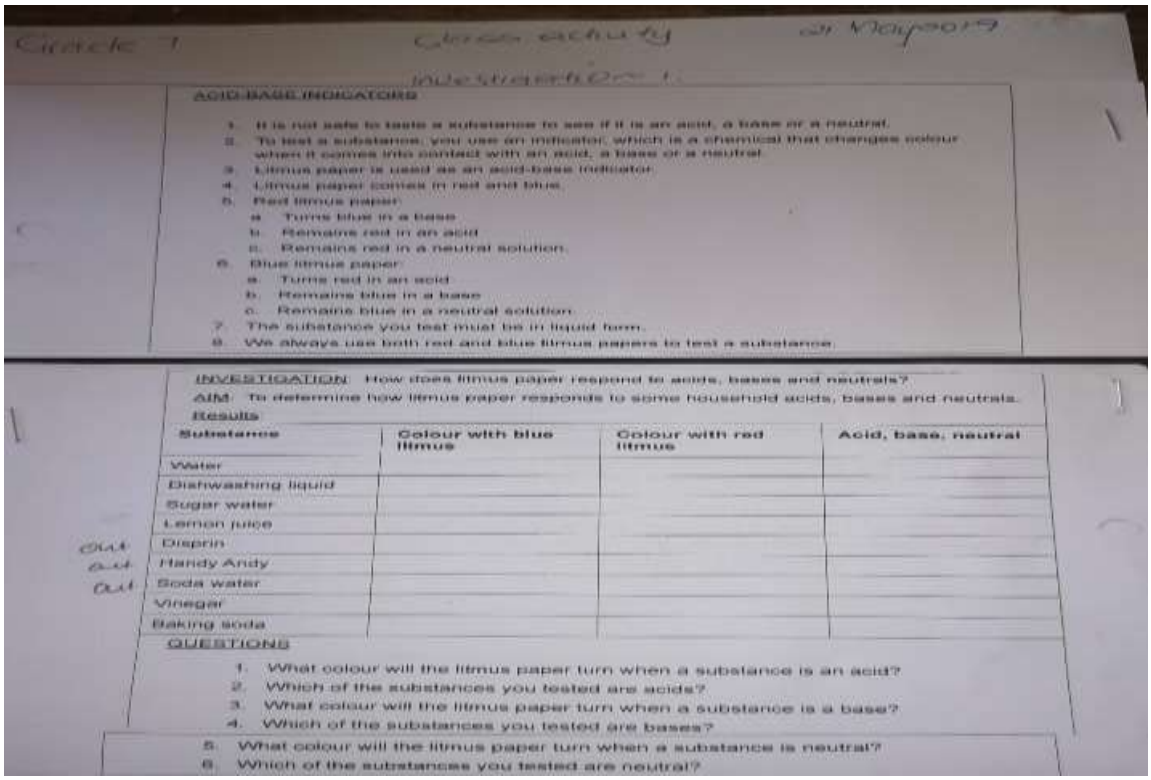
Kate also employed analogy as one of her explanatory frameworks, where she was making comparisons between the properties of non-metals and semi-metals, trying to help learners to have a better comprehension of how non-metals and semi-metals differ using the property of conductivity.

When she was interviewed prior to the lesson, a question was directed to her as to how she will know that learners had grasped a better understanding of what she has taught. Kate indicated that:

> "After teaching you have to assess, then see if they have grasp whatever you were teaching in a class, then fix before the end of the period". The above statement is supported by the extracts below:
> Kate explained how to complete the table given as a classwork using examples and said: we have got a Copper, and Copper is an element, symbol for Copper is Cu
> Kate said: Copper is a metals
> Kate gave another example: I have got a Boron (She wrote Boron on the board), the symbol for Boron is B, we find Boron is a Semi-metals.

After presenting the lesson she indicated to learners that she had a classwork for them, which she wrote on the board and explained to learners how to answer it using examples with two elements, Copper and Boron.

Science is a doing subject, hence practical work plays a vital role in explaining some concepts (Toplis, and Allen 2012. Kate utilised specific aim 1: "Doing Science" as stipulated in the NS CAPS document grades 7-9 (DBE 2011a).She conducted an investigation, where learners were using different substances to test for "Acid, Base and Neutrality". And gave them a task to complete based on their observations.



ACID-BASE INDICATORS

1. It is not safe to taste a substance to see if it is an acid, a base or a neutral.
2. To test a substance, you use an indicator, which is a chemical that changes colour when it comes into contact with an acid, a base or a neutral.
3. Litmus paper is used as an acid-base indicator.
4. Litmus paper comes in red and blue.
5. Red litmus paper:
   a. Turns blue in a base
   b. Remains red in an acid
   c. Remains red in a neutral solution.
6. Blue litmus paper:
   a. Turns red in an acid
   b. Remains blue in a base
   c. Remains blue in a neutral solution.
7. The substance you test must be in liquid form.
8. We always use both red and blue litmus papers to test a substance.

INVESTIGATION: How does litmus paper respond to acids, bases and neutrals?

AIM: To determine how litmus paper responds to some household acids, bases and neutrals.

Results

Substance	Colour with blue litmus	Colour with red litmus	Acid, base, neutral
Water			
Dishwashing liquid			
Sugar water			
Lemon juice			
Disprin			
Handy Andy			
Soda water			
Vinegar			
Baking soda			

QUESTIONS

1. What colour will the litmus paper turn when a substance is an acid?
2. Which of the substances you tested are acids?
3. What colour will the litmus paper turn when a substance is a base?
4. Which of the substances you tested are bases?
5. What colour will the litmus paper turn when a substance is neutral?
6. Which of the substances you tested are neutral?

Learners were hands-on and observing the colour change of Red and Blue litmus papers and recording their observations in a table. In so doing Kate developed and improved learners' skills as stipulated in the NS CAPS document grades 7-9 (DBE 2011a) e.g. observing skill and recording information skills. However, Kate's instructions on how to complete the task displayed a deficiency in content knowledge (CK). This is supported by the extract below:

> Kate said: if the paper turned blue or remained colour blue, you just write whether the colour turns red or blue.
> Kate said: you make a tick in a table depending whether the colour has changed or not, and in the last column you indicate whether the substance is an acid or a base okay.

Kate did not give clear instruction on how to complete the table. She only indicated that learners must tick whether the substance is an acid or a base and did not mention "neutrality" as this is part of the concepts she was investigating, and it was on the table learners were expected to complete. This could have possibly caused confusion to learners and limited them from knowing the concepts of acid, base and neutrality as one aspect was omitted.

4.2.2 Summary of Kate's instructional strategies

Teaching methods	*Lecture* *Questioning and Answer*
Explanatory frameworks	*Analogy* *Examples*
Activities	*Investigation/Experiments* *Classwork and Homework*

Classroom discourse is defined as different interactions between a teacher and learner, mostly in the form of discussions or debate in the classroom (Smart & Marshall, 2012). During the interview the question was posed as to which types of discourses she would be using during the lesson. Kate indicated that:

> "I prefer like having a dialogue with my learners".

Kate's response to the question was contradictory to what she actually did in the classroom as she was observed using authoritative instead of dialogic discourse. Kate employed authoritative discourses as she transmitted the information to learners using a question and answer method of teaching (Tytler & Aranda 2015). During the observations Kate used question and answer method for the better part of the lesson, as she was asking learner's questions about the properties of semi-metals. in cases where learners did not respond, Kate will tell them answers and instruct learners to chorus them. After she told the answer to the learners, she then posed the question "are we clear"? This question did not sound like a genuine question that learners could respond negatively to, so in all of the instances when this question was asked learners chorused "yes". Kate was observed using the question to proceed to the next aspect of the lesson. This is supported by the extract below:

> Kate: what are semi-metal is and where do we get the semi-metal?
> Learners: did not reply.
> Kate said: semi-metals are solids and they have properties of metals and non- metals **(Are we all clear)?**

Kate: Let us all say semi-metals are solids and they have the properties of metals and non-metals

Learners: semi- metals are solids and they have the properties of metals and non-metals (chorusing).

Kate: (reading from the textbook) they say here we have got semi-metals which can be a solid at room temperature meaning when it is in this room at this point it is a solid (isn't it)?

Learners responded with a yes.

Kate: when it is heated it becomes a liquid (Reading from the textbook), a semi-metals can be shiny or dull (Are we clear)?

A Few learners responded with a yes, most were quiet.

During her lessons, learners were not given a chance to engage and discuss, not even to ask questions or present their thoughts. Kate only conveyed the information directly from the textbook, and learners were the passive acceptors of information which caused her discourse to be authoritative (Chin, 2006). Dialogic discourse is defined by Chin (2006) as a type of discourse that inspires debate and challenges in the classroom. Kate failed to use a dialogic discourse as she indicated In the interview, as she dominated her lessons with questioning and lecture method and learners were not given a chance to share their views and ideas regarding the content being presented, hence it was an authoritative discourse.

The pattern of discourse that Kate employed in her class was Initiation Response Feedback (IRF) (Graesser et.al 2003). As she indicated in the interview:

"I will use IRF because it was a very short lesson and I could see they understood it better"

Kate was observed initiating questions about properties of non-metals, learners responded then she gave feedback.

"Kate: what are the states of matter of non-metals?

Learners: they are gases, liquids and solids".

Kate: solids, liquids and gases… right

Kate did not initiate the questions that will allow discussions or triggers learners' level of thinking, all of the questions asked were straight-forward and had a defined answer.

Although there was a lot of questioning used by Kate during her lesson, it is of paramount importance to examine the motivation behind the questions posed. Kate was asked if she asked questions to evaluate or to construct understanding. She indicated that:

> "I ask questions to evaluate on how far they are with the knowledge they are gaining".

Kate's focus on asking the questions during her lesson was only on evaluating and not on constructing understanding.
Kate used an interactive-authoritative approach during her teaching, however she indicated that she will be using an interactive dialogic approach during the pre-interview.

> "I could say interactive-dialogic approach"

This is so because even though there was interaction between the teacher and learners, there was minimal interaction amongst learners themselves. The authoritative nature of Kate is observed several times in the lesson as she dominated the lesson with lecture and question and answer methods of teaching and learners were not given an opportunity to interrogate nor ask questions on the content being taught to them. Even though she invited responses from learners she only credited the correct ones and discredited the incorrect ones. Moreover, Kate gave answers to questions which learners could not give answers to and her answers were regarded as final. The above statement is supported by the captured observation below:

> "Gugu: most solid mercury. Kate replied "most solid mercury" seriously? Of metal? Nooo…"
> "no they are not 16, they are 16 on the right-hand side plus one that is up on the left-hand side which sums up to 17"

The above extracts serve as evidence to the authoritative nature of Kate's communicative approach. Had Kate given her learners a chance to interact amongst themselves and the content being taught to them she could have granted the learners an opportunity to exercise different skills such as raising questions and communicating skills as the NS CAPS document grades 7-9 stipulates (DBE 2011a).

4.2.3 Summary of Kate's communicative approach

Types of discourses	Authoritative discourses
Patterns of discourses	IRF
Teacher questioning	Evaluate
Communicative approaches	Interactive-authoritative

4.3 FINDINGS

4.3.1 Teacher knowledge

The researcher discovered that Kate's content knowledge (CK) was limited as she failed to explain the content she was going to teach. Not only was her content knowledge (CK) and subject matter knowledge limited, it was not organised as well, which was depicted during the interviews and observations as she was teaching the topics not in accordance to the CAPS NS policy document (DBE 2011a). Daunting factors such as inadequate resources from the school and the socio-economic background of learners were brought to the attention of the researcher, however in some instances Kate motivated her learners to learn as she made provisions to conduct practical activities where possible. Even though that was done in all cases, Kate indicated her standing point as far as practical activities are concerned. Misconceptions were identified during her teaching and as she tried to solve them she created more instead, which was an indication that her content knowledge (CK) was not in order. Prior knowledge is important in the learning capabilities of learners (Staver, 2007 and Eryilmaz, 2002). The researcher noticed that Kate partially made use of learners' prior-knowledge to link the existing concepts with the new ones. Kate used English interchangeably with isiNdebele during her lessons. She did that to assist learners to learn or to gain a better understanding of the concepts being taught to them. Though it

seemed to be helpful, it was not reliable because the language used during teaching and learning can limit the comprehension of the subject matter. In this regard using isiNdebele to explain concepts will disadvantage learners because Natural Sciences is assessed in English and should be taught in English as well. Using languages other than English when teaching Natural Science may create misconceptions because other terms may not have the same meaning in isiNdebele as they are in English.

4.3.2 Instructional strategies

Kate employed traditional methods of teaching which was lecturing method and question and answer. Hence her teaching was one-way traffic or teacher-centred because learners were just seated and listening to her for the better part of the lesson. Learners were not given the opportunity to interact with the content and as such were regarded as information acceptors, hence the traditional methods used by Kate did not assist learners in understanding abstract concepts. Natural Science is a doing subject, hence the use different explanatory frameworks could be of great use, as they will assist in explaining the subject matter knowledge (SMK). Kate could have used more explanatory frameworks than just examples and analogies to explain the concepts as that could have given learners a better comprehension of the concepts being taught to them. Kate used activities as assessments, where learners were given classwork to write after lesson presentation. Furthermore, she utilises investigations/experiments where learners were testing acids, bases and neutrality using different substances.

4.3.3 Classroom interaction and discourses

During observation the researcher found no attempted discussion between Kate and the learners or amongst learners themselves. Hausfather (2001) asserts that knowledge develops through the interaction of people with one another, hence in the classroom the teacher should create an environment where learners will be able to interact with one another and with the information learned and further use it to solve problems. In Kate's classroom learners were not given an opportunity to interact or debate the concepts nor did they asked questions. Kate was feeding them information throughout the lesson using lecturing and question

and answer methods, hence resulting in her discourse being authoritative. The kind of discourse Kate employed could hinder meaningful learning and learners' interest in the subject. Furthermore, the patterns of discourse she employed, which is IRF, deprived learners an opportunity to utilise some of the skills such as raising questions and scientific process skills as stipulated in the CAPS NS policy document (DBE 2011a). Kate asked questions during her lesson only to evaluate and not to construct understanding. The researcher noticed that at the end of the lesson learners were not given a chance to comment on the topic learned or seek clarity, instead all they did was write the classwork as per instruction, therefore that resulted in Kate's communicative approach being interactive authoritative.

4.4 CASE TWO: JOHN

According to Shulman (1986), content knowledge is the amount and organisation of knowledge per se in the mind of the teacher. John displayed a limited content knowledge (CK) and poor subject matter knowledge (SMK) (Rohaan et al 2012) during the interviews as the question was posed on what was the periodic table was about as he had indicated that it was the topic he was going to teach. John said:

> Periodic table is nothing a way in which elements are ordered and grouped according to their behaviour.

Drawing from the above extract it shows that John had an idea of what the periodic table is, however his knowledge was partial and limited as he only indicated that the periodic table is about elements and their behaviour, however there is more to it than that. There are many concepts embedded within the periodic table as shown in the NS CAPS document (DBE 2011a) such as the three main categories in which elements are arranged and their properties.

John was observed starting his lesson by showing an organised content knowledge (CK) as he explained the terms of an element and matter to learners as per expectations, according NS CAPS document (DBE 2011a). John further explained to learners who devised the periodic table. This is evidenced by the extract below from the observation.

> There was this Russian by the name Dmitri Mendeleev, when you read this Dmitri Mendeleev he was a Russian, in 1820 that's when he discovered or that's when he come up with this periodic table in 1820 many many years ago. So he came up with this periodic table and who is this person Dmitri Mendeleev who was a Russian. But after him, there are so many scientist who wanted to come with new things new ideas on top of what this Russian Mendeleev has already discovered.

He further explained to learners that the periodic table is divided into three main categories and said:

> And so according to this periodic tables, we have metals, we have non-metals and we have semi-metals

This indicated that even though John did not mention these categories as concepts that are part of the periodic table during the interview, he did know about them. He further explained where these three categories are situated in the periodic table and said:

> Metals are situated on a periodic table on your left-hand side, the non-metals are on your right-hand side, that zigzag part, and those are the semi-metals.

As the lesson proceed John displayed a limited content knowledge (CK) and poor subject matter knowledge (SMK) as he was observed telling learners about the groups and periods found in the periodic table and what they are used for. He said:

> There are groups and also we have the periods. Periods and groups are there also to show us where is metal situated and where non-metal is situated and where are the semi-metals situated

From the extract above and utilising the study by Usak et al (2011), it was confirmed that some of the Natural Science teachers show a limited amount of Content Knowledge (CK) and Subject Matter Knowledge (SMK). John had an idea that there are groups and periods in the periodic table but due to his

limited content knowledge (CK) he failed to explain which ones are groups and which ones are periods and how to identify the two. Furthermore, this limitation hindered him from explaining the number of groups thereof.

> His content knowledge limitation was further observed as he was explaining the three main categories in the periodic table and the elements found in each category and said:
> Hydrogen it's with the metals but funny enough hydrogen is not a metal.

John was aware that Hydrogen is not a metal however it was grouped with metals. However, his awareness was not sufficient as he failed to explain why Hydrogen was not grouped with non-metals, however the comprehension of the concepts and how they are presented is what is deemed to be crucial (Gess-Newsome, 1999). John failing to explain was evidence that he has limited content knowledge (CK) and that his subject matter knowledge (SMK) was in question.

Yilmaz-Tuzun (2008) asserts that the limited content knowledge (CK) of the teacher influences what and how they teach in the classroom. Yilmaz-Tuzun's assertions were observed in John's presentation as he displayed a disorganised content knowledge (CK) and poor subject matter knowledge (SMK) during his teaching. While he was explaining the three main categories in the periodic table he diverted from the topic and said:

> For instance when you talk of water we say water is H2O (he writes on board), this is water, neh H2O Is water, so we are going to look at this combination. How two molecules oxygen plus oxygen they form Water. We have Sodium (he write on chalkboard Na+Cl2 and chlorine

From the above extract John was teaching the irrelevant content not only in the topic but in this grade as well. He was teaching formation of compounds however in this grade learners are not expected to learn about them. Compounds are only introduced in grade 8, hence this content was irrelevant and could possibly confuse learners and further create misconceptions (Rosenshine, 2012). John's 15 years of experience in teaching the subject did not count for anything as he

was teaching an irrelevant concept which was evident enough that he was not familiar with the concepts that needed to be taught at this grade as indicated in the NS CAPS document (DBE 2011a). As such John generally lacked subject matter knowledge (SMK), and understanding of the content that is specific for the topic of the periodic table (Rohaan et al 2012).

Various researchers (Christie & Gaganakis, 1989; Human Rights Watch, 2004; Maponya, 2010; Molokoe & Ndandani, 2014; Bantwini & Feza, 2017) note that the availability of adequate resources in schools and learner performance are directly proportional to each other. Resources in the science context can include tools, apparatus, materials, books, and consumables to the NS CAPS (DBE 2011a). According to the DBE (2012), for Natural Science teachers in senior phase to properly plan and execute their duties, schools must provide them with the right resources for each topic, however that is not the case in most of the rural schools. During the pre-interview the question was posed to John on the resources they have to support the teaching of Natural Sciences. John said:

> That's where our problem is! We do not have enough resources but the department has given us a small box, trying to put everything inside those apparatus but unfortunately they are not enough. But they are there

John indicated that they do have a small science kit, however it is not sufficient. He was further asked if they conduct the experiments and if yes, where. John said that:

> We do not have laboratory, we simple conduct it in the classroom. That's where the problem is, because some you need to burn something and that is what we fear the most and that's we cannot do experiments in the classroom but we conduct experiments because we do not have enough space

John indicated that even though they do not have a laboratory and adequate resources they do conduct experiments in the classroom. The issue of not having a laboratory was further stressed by John as he indicated that it hiders

the effective teaching of Natural Sciences, in particular the teaching of the periodic table. This is supported by the extract below from the interview:

> As you know we do not have laboratory that's where my problem lies, but am still going to try maybe as am going to explain to them that this type of elements you can find them at laboratories some you keep them under a liquid. Like for instance mercury and bromine and other elements, so it's just unfortunately we do not have laboratories but we are trying by all means to illustrate, maybe in their minds they will have something that like an element looks like this. It is just unfortunate.

From the above extract it is evident that the lack of availability of adequate resources in the school does impact on the effectiveness of teaching and learning of the subject as asserted by Idiaghe (2004). When John indicates that he explains the concept to learners and hopes that in their mind they will have an idea on what the elements would look like it concurs with Tshiredo's (2013) findings that most of the science activities that need to be done practically, such as experiments, are done in the classroom by using chalk and board. This is contrary to Mudulia's (2012) argument when he states that scientific discoveries are achieved by experiment and observation rather than telling. John related the lack of adequate resources as one of the challenges that contributes to the teaching of the subject as alluded to by Tshiredo (2013) that it is very difficult to teach science without adequate resources. This is supported by the extract below from the interview.

> Yes, I do have a challenge, remember if we talk about an elements our learners do not know what is an element and how does it look like because they cannot see it, unlike in advance schools were they have laboratories. They know Carbon, Phosphorus because they can see it with their naked eyes. It is unfortunate because we teach them things they cannot see.

From the above extract John acknowledged the challenges he has in teaching Natural Sciences, in particular the periodic table, for which a lack of availability of adequate resources was a main factor. He further made a comparison that

in advanced schools learners are privileged as they have better laboratories compared to rural schools, hence they stand a better chance of performing well since a better access to resources is directly proportional to good performance (Bantwini & Feza, 2017). This sentiment is supported by Idiaghe (2004), who discovered that learners from previously disadvantaged schools are performing poorer compared to those from well-resourced schools.

During the pre-interview John indicated that he was going to use a textbook, chalkboard, chalk and a periodic table. As he entered the classroom, he requested that the learners who have textbooks to take them out. Knowing the issue of teaching resources in his school John made handouts of periodic table for learners who did not have a textbook to make sure that they were not disadvantaged and would be a part of the lesson, as suggested by Vicente (2013) that regardless of the limited resources teachers needs to exercise creativity and source alternative resources to make meaningful learning. During the interview the question was posed to John whether the time allocated for teaching Natural Science is sufficient to complete or cover the intendent curriculum. John said:

> NO NO NO, the time is too little, you cannot complete the curriculum I must say. It is only now maybe second term that we have tried but in the first term you cannot finish that work during first term.

As John indicated, the difficulty of curriculum completion was a concerning factor. He was further asked what he does in cases where he cannot not complete the intended curriculum on time. John indicated that he usually conducts morning classes and comes in on Saturdays to finish up the intended work.
The socio-economic background of learners is very important as it has an impact on their education according to Legotlo et al. (2002). Baker and Jones (2005: 149) further agree that there is a direct relationship between socio-economic background and learners' performance. In the course of the interview, the question was posed to John as to what impact does the socio-economic background of learners have on their performance in the subject? He indicated that:

> Yes, looking at their backgrounds, where they come from you will see that some of their parents they are not educated, some they dropped out, some they are not interested in education that is where we having a problem with these learners. Because parents who are cooperative in our schools are those that are educated or professionals, we can work well with them. But coming to parents who dropped out instead of making their learners to love school and education they come and fight here at school. Their background does affect their performance hence they cannot perform well in the classroom, actually they are not interested in learning at all.

From the above extract it is clear that the socio-economic background such as uncooperative parents, due to possibly being illiterate or drop-outs, affects learner performance. The role of parents in the education of learners is vital to the development and progress of learners' performance. If parents are actively involved in their children's education, checking their work, helping with homework and generally showing interest and encouraging their children, learners are more likely to do well in school. Ashikia (2010) notes that it is both the responsibility of teachers and parents to work together in order for learners to perform well in their academic work.

Jonassen and Grabowski (1993) define prior knowledge as the knowledge that the learners bring to the classroom before the lessons. Prior knowledge is further argued by Bruner (1960) as the heart of successive learning, wherein knew knowledge is continually being built upon what is already known to learners. During the interview, John indicated that the prior-knowledge that is needed for learners to learn the periodic table is matter. He further said:

> You will find that matter is being taught from at an early grade in grade 4 and grade 5, they will tell you what matter is because Natural Science is matter on its own. You cannot teach Natural Science if you do not know matter because everything that we talk about in Natural Science is matter. So I want them to remember to say matter is something that has got mass, something that can occupy a space. So

> whatever that we teach in Natural Science it is a matter. So according to me that definition it must be repeated. I mean every teacher before you can teach to say what is a matter, so they must know that.

John was observed stimulating learners' prior knowledge as he asked learners what matter is during his lesson. This is supported by the extract below from observation:

> What is a matter? You don't know? From grade 6, a matter? Niyikhohliwe? Grade 6.

John stimulated learner's prior-knowledge on matter as he knew that matter is introduced from and learned in grade 6, so he was building the concepts from known to unknown and showing a link and connectedness of concepts (Bruner' 1960).

(Sanders et al., 1993) describes misconceptions as the results of utilising everyday usage of unscientific language which can lead to the formation incorrect concepts that reflect in formal learning. In his presentations of the concepts, John demonstrated the characteristics of an uninformed teacher as described by Gess-Newsome (1999). This is so because for the better part of the lesson he displayed a limited content knowledge as he had misconceptions. This is supported by the extract below from observation:

> Sodium (he wrote Na+Cl2 on the chalkboard) plus chlorine and chlorine is number 17. We are taking number 17+11 they form what? Salt. The salt that we use at home is sodium (pointing at the symbols written on the board) plus chlorine. Sodium chloride is salt.

> From the above extract John created a misconception as he was calculating the Molar mass (Mr) of sodium chloride (salt). This was an indication that not only learners have misconceptions but teachers as well (Gooding & Metz; 2011). Furthermore, the misconceptions of teachers are likely to be transferred to learners as stated by Bayraktar

(2009). In terms of language, John used English throughout his presentations

4.4.1. Summary of John's teacher knowledge

Content knowledge	*disorganised content knowledge (CK) and poor subject matter knowledge (SMK)* *Irrelevant content*
Context knowledge	*Challenges in completion of the intended curriculum* *Used resources (textbook, chalkboard and chalk) provisions made were necessary* *Socio-economic background that impacts on learners' performance*
Learner's understanding	*Limited usage of prior-knowledge* *Teaching that caused misconceptions* *No language variation: Only English was used*

During the interview the question was posed as to which teaching methods John was going to use during the presentation. John indicated that:

> I am going to use different methods, because we want to check whether if they going to understand. Question and answer will be used. Demonstrate also to come maybe.

Based on John's response to the question, he indicated that he is aware that the teacher cannot rely on only one teaching method (Halai and Khan, 2011), hence he mentioned two. However, he was not quite sure if he was going to use demonstration as well.

For the better part of the lesson John employed question and answer method as he indicted during the interview. This is supported by the extract below from the observation:

> Teacher: Then what else? B, this is our chemical symbol and then the last one is what? Chemical name. What is this chemical name?
> Learners: Boron

Teacher: Boron neh

Learners: Yes

John further utilised demonstration during his presentation as he was trying to show learners the groups in the periodic table handout. John said:

Am going to show you that one, we will be looking at the groups, different groups for instance (Showing the leaners the periodic table handout).

John was showing learners the groups on the periodic table, however what he was pointing out were not exactly the groups. There were instances where John used a lecturing method of teaching, where he was explaining the history of Dmitri Mendeleev as the deviser of the periodic table. This is supported by the extract below:

According to him, Dmitri Mendeleev, he said he saw this periodic table in a dream. I don't know can we believe that or not. He said he saw this periodic table in a dream. Remember before him there was no periodic table. Actually, he is the first person to come up with this periodic table. So he said he saw this periodic table in a dream. While he was sleeping he saw this periodic table. I don't know how true is that, but that's what the textbook is telling us.

Further to that, John devised a way of memorising 20 elements at once, as according to the NS CAPS (DBE 2011a) grade 7 learners are expected to know at least that many elements. This is supported by the extract below:

LiBeBCNOFNeNaMgAlSiPAr potassium calcium

John created the acronym so that it would be easier for learners to recall the first 20 elements on the periodic table, however his strategy is widely criticised by researchers such as Kaddoura (2011). They argue that this kind of teaching method makes learners shallow thinkers as they will only memorise the concepts as much as they can without understanding the content properly. That could be the case with John's learners as he taught them to memorise the symbols only, however according to CAPS they are expected to know the names and symbols of the first 20 elements, meaning that there are greater

chances of learners knowing the symbols of the elements without knowing their names because that is how they were taught. Further to that this kind of teaching method is in contrast with the principles of CAPS, which dejects “rote and uncritical” approaches to learning (DBE 2011a). John indicated that he will be using examples and illustrations as the explanatory tool when teaching the periodic table. This is supported by the extract below:

> Example is very important and illustration you must have examples in whatever you are doing because you cannot teach learners without giving examples, so they learn from these examples

Further to that he gave reasons as to why is he going to use such explanatory frameworks during his presentation. John was observed using examples to explain the concept of semi-metals. He said:

> These are what? Semi-metals. What do you understand by the term ‘semi-metals’? Boys, you are playing soccer. I think it’s not for the first time you hear ‘semi’.” “Semi-finals.” Yes. Semi-finals. What do you understand by ‘semi’? So you want to tell me that these are the finals and these are the semi-finals? What do you understand by the term ‘semi’? Or in mathematics we also have semi-circle. It is not a full circle but a semi-circle, neh? Ya. Mpumi, what do you understand? They are not full metals

There were instances where john used illustration as one of the frameworks as he indicated during the interview. John said:

> “There are those who are writing capital letters here. Who are saying (writes LI on the board). This is wrong. We do not have something like this in Science. Those who are saying (writes MG), this is not a magnesium. With capital ‘G’, this is not magnesium. Make sure that its capital letter ‘M’ and a small ‘g’. And then Argon?”

From the above extract John was explaining to learners about how to write the symbols of elements, in particular where the element is represented by more than one letter. The activities that were employed by John are classwork and

homework as indicated by John during the interview that after teaching a concept to learners he then assesses them using classwork or homework to check if they understood the concept that was taught to them or not. John marked the classwork with learners where learners were granted an opportunity to control their own work by means of marking their own books. This is supported by the extract below:

> Today, what we are going to do we will be correcting that classwork, meaning that we will be doing corrections. Make sure that you mark you can use your red pen to mark.

John granted the learners an opportunity to mark their books and is a good idea as he was able to observe learners as they mark and that helped him in identifying those who had challenges in answering the questions. He could also use that as a yardstick to measure how much knowledge learners have grasped regarding the concepts being taught to them.

4.4.2 Summary of John's instructional strategies

Teaching methods	*Lecture* *Demonstrations* *Question and Answer*
Explanatory frameworks	*Examples* *illustrations*
Activities	*Classwork and Homework*

Foy (2013) terms classroom discourse as the language that learners and teachers use in the classroom. Authoritative discourse is a type of discourse whereby a teacher conveys information using factual statements and instructional questions, while dialogic discourse is a type of discourse where in a teacher encourages debate and challenges in the classroom (Chin, 2006). John employed both types of discourse during his presentation. John was observed giving learners an opportunity to write 20 elements on the periodic table which he had drawn on the board. John said:

Can you do that, writing these elements from 1-20
Learner, tried to write the element
He tried, Didn't he? Anyone to finish?

John employed authoritative discourse as well, as he was observed conveying the information to learners using question and answer and lecturing method of teaching. In this instance learners were not given much opportunity to interact and engage with the concepts being taught to them, hence they were passive acceptors of information (Tytler & Aranda, 2015). Learners were only agreeing with what John was saying:

Teacher: Yes, so that's the example of that element, let us take the serious one. Let us take Boron number 5 (He writes B on the chalkboard) neh

Learners: Yes
Teacher: and then Boron is number 5
Learners: Yes

The type of discourse that was employed by John was Initiation Response Feedback (IRF) (Molinari et al, 2013). This was so because John, at a number of stages in his class, would ask a question, wait for learners` responses and ultimately give feedback by either dismissing or agreeing with the response (Molinari et al, 2013). This is supported by the below extract from observations

Teacher: Where was this periodic table worked out? in which year?
Yes
Learners: 18
Teacher: 1860 or 1816
Learners: 1860
Teacher: Yes in 1860, he devised, he worked out this periodic table.
By the way this Dmitri Mendeleev was a Russian, he was from Russia.

The reason why John was asking questions during his teaching was to construct understanding. This is supported by the extract below:

Teacher: Then C is in capital letter. Don't write a small C. Don't write small c. (b) Helium. The symbol?"
Learners: He
Teacher: He. And then what else, lithium. Lithium?
Leaners: Li
Teacher: Magnesium?
Learner: Mg
Teacher: There are those who are writing capital letters here. Who are saying (writes LI on the board). This is wrong. We do not have something like this in Science. Those who are saying (writes MG), this is not a magnesium. With capital 'G', this is not magnesium. Make sure that its capital letter 'M' and a small 'g'.

From the above extract John constructed understanding by explaining explicitly how symbols of elements are correctly written in the periodic table of elements. John employed an interactive-authoritative approach during his teaching, this is so because learners were not given an opportunity to interact with each other nor with the concepts being taught to them, the communication was one-sided from the teacher to the learners (Scott et al 2006). Further to that John discredited the incorrect answers and only credited the correct ones. This is supported by the below extract:

Teacher: Who can tell me, where are the non-metals on the periodic table?
Learners: At the right-hand side
Teacher: at the right-hand side, Let us clap please
Learners: *learners clapping hands*
Teacher: Thank you; also, they say where on the periodic table of elements are the semi-metals
Learners: the right-hand side

Further to that there was a particular stage were John asked questions and learners could not give responses John provided them instead and what he said was considered as final even though responses from learners were invited.

Teacher: What is a matter?

Learners: *silence*

Teacher: You don't know? From grade 6, a matter? Matter is anything that has got a mass to occupy.

Learners were not given a chance to ask questions during the lesson, hence that resulted in John's approach being interactive-authoritative.

4.4.3 Summary of John's communicative approach

Types of discourses	Authoritative discourses Dialogic discourses
Patterns of discourses	IRF
Teacher questioning	Construct understanding
Communicative approaches	Interactive-authoritative

4.5 FINDINGS

4.5.1 Teacher knowledge

The study discovered that the teacher had limited content knowledge (CK), which is referred from the response he gave when he was questioned about the concepts he was going to teach. The teacher defined the periodic table as the arrangement of elements according to their behaviour, leaving other aspects that are embedded within this concept such as three main categories which are found in the periodic table, which was a clear indication that his content knowledge is in question. Further to that he displayed a disorganised content knowledge as he was teaching compounds and how to calculate Molar masses of compounds, when the concept of compounds is not in line with the curriculum because it is only introduced in grade 8 and not in grade 7. His teaching of irrelevant content at this grade further resulted in his teaching having misconceptions as he was incorrectly calculating the molar masses of compounds. The issue of resources in the school was bought to the attention of the researcher. The teacher indicated that the schools does not have a laboratory, and so they must improvise and conduct experiments in the classroom. Further to that the teacher related to a

lack of resources as one of the challenges that hinders the effective teaching and learning of the subject, hence it also impacted badly in the performance of learners. The teacher also indicated how their socio-economic background negatively impacts on learners' performance as a result of illiterate and drops-out parents who do not have an interest in education and further instil such culture to their children.

4.5.2. Instructional strategies

This study revealed that John used traditional methods of teaching. He dominated his teaching by using question and answer and lecture methods of teaching. Learners were not given any opportunity to interact with the content nor to interact among themselves, ergo they were passive acceptors of information. All they did was answer questions that were asked and agreeing (chorusing) with what John was telling them. John used examples during his teaching as explanatory frameworks when trying to help learners understand the concepts he was teaching. Further to that John used classwork as a form of assessment, as after presenting the lesson he gave learners a classwork exercise to assess how much of the content they have grasped and to gain a better understanding of the content being taught to them.

4.5.3 Classroom interactions and discourses

John employed both authoritative and dialogic discourses during his teaching as he was observed challenging learners to go and write the first 20 elements on the board without referring to the textbook. The study further revealed that John employed Initiation Response Feedback (IRF), which limited learners from an opportunity to raise questions and trigger their level of thinking during the lesson. For the better part of the lesson John was asking questions to construct understanding of the taught concepts. The researcher noticed that John dominated the lesson, further to that what John said was considered as final and after asking questions limited time was given for learners to think about answers, which he would then provide for them. No chance was given to learners to engage with the content being taught to them nor amongst themselves, hence this resulted in his approach being interactive-authoritative**.**

4.6 CASE THREE: ROSE

According to Kind (2009), the level of Subject Matter Knowledge (SMK) greatly influences how the subject is taught. Rose demonstrated inadequate subject matter knowledge (SMK) as she failed to explain the content she was going to teach as she was asked during the interview. Rose said:

> Everything is an element, all matters are made up of elements, for an example: salt that we use at home in the kitchen is an element.

There was a failure on Rose's part to explain what an element is, which was a clear indication that she had inadequate subject matter knowledge (SMK) and that there is a possibility that she might be not confident in teaching the subject (Harlen & Holroyd, 1997). She further used salt an example of an element, which was an incorrect concept because salt is a compound and not an element. Rose not only displayed inadequate subject matter knowledge (SMK) for the better part of the lesson, but she also displayed a disorganised content knowledge (CK). Rose indicated that she would be teaching elements, however she was observed diverting from this and teaching compounds.

> If an element has two element on it, it is no longer an element but a compound because why, it has two elements in one at the same time.

Rose teaching irrelevant content (compounds) in grade 7 was evident that she was not familiar with the NS CAPS (DBE 2011a) which states clearly the concepts that need to be taught in grade 7 in regard to elements, that learners need to know the names and symbols of the first 20 elements of the periodic table. Rose was further asked during the post-interview about why she taught the compounds as she indicated that she will be teaching elements. Rose said:

> Yes, it just came, so I thought it is relevant for me to explain for them, yes we are going to study the compounds further, but least they will know a little bit the difference between the element and compound

Drawing from her response it was clear enough that Rose did not know what concepts she must teach according to the CAPS document, further to that could be that the lesson was not properly planned.

Rose was observed wasting time during her teaching as she requested learners to draw the periodic table on the chalkboard. Rose said:

> Table for elements, who knows the periodic table? Come and draw a periodic table so that we can place our element.

Learners took turns trying to draw the periodic table on the board but none of them got it right. What Rose actually did was irrelevant and is not required by the NS CAPS (DBE 2011a), as it clearly states that learners are expected to know the names and symbols of the first 20 elements in the periodic table and not how to draw the periodic table.

Further to that she asked learners questions on concepts such as elements and matter but she did not gave explanations as to what they are and how they link with the content she was teaching. This displayed her inadequate content knowledge and limited subject matter knowledge as alluded to by Usak et al (2011). Further to that she failed to achieve *specific aim 2: "knowing the subject content and making connections*", as she could have shown the link between elements and matter.

There were instances where Rose asked learners to go and write atomic numbers for elements on the board, however she did not explain what an atomic number is and what they are used for, she further referred to the atomic number as "numbers" without specifying which numbers she was referring to, whether atomic or mass numbers. This is supported by the below extract from observations.

> Msizi, has written atomic number, symbol, element and again atomic number, symbol and element. Meaning the element has the numbers. Come Sbonelo and write the number so that we see when you talk about the number what are you talking about.

Drawing from the observation, a question was posed to Rose if learners knew what an atomic number was as she was observed talking about it without any explanation made during the presentation? Rose said:

> I think they know, if they do not know when we continue I will emphasise its importance

Rose demonstrated disorganised content knowledge (CK) (Usak et al, 2011) as she was talking about concepts that she did not teach to learners, further to that she made assumptions that learners knew them. Mudulia (2012) emphasises the importance of adequate and suitable resources in Natural Sciences teaching when he states that scientific discoveries are achieved by experiment and observation rather than telling. This therefore highlights the dire need for the availability of laboratories to ensure effective teaching and learning of science. During the interview the question was posed to Rose as to whether they conduct experiments. Rose said:

> Yes we do, we are establishing a lab, which we will do our experiments for now we have that one.

Rose further indicated that since the laboratory is newly established it is not fully equipped, and in some instances they make provisions so as to meet the ultimate end, which is learners doing experiments as specified by specific aim number one, “doing science” from the NS CAPS (DBE 2011a). She further indicated that she would be using a chalkboard, chalk, charts and the textbook as teaching resources to teach elements. However, she was not observed using a chart. She was asked as to why she hadn’t used a chart as she indicated during the pre-interview. Rose said:

> It is a pity there, we are many in our school. Some of the teachers use the chart also. So we use to be put the chart on the same place so I did not find chart there. It means that another teacher is used it and put it somewhere. When asked the teacher the chart was nowhere to be found, usually we use the chart and put it back to the relevant place**.**

From the extract below the researcher could determine that Rose did not plan her lesson properly, knowing that they have limited resources and they use them interchangeably she could have organised all of the resources she was going to use during her lesson prior to it. The (DBE, 2012) policy document stipulates that it is within every learners' right to have learning materials such as textbooks, however the conditions make it impossible for that to happen, especially for schools in rural areas. It was also the case with Rose's school. This is supported by the extract below:

> Okay let's open our textbooks, open on 92, those who do not have the textbook look at it from your friend**.*learners moving around to share textbook***

Rose knew that not all learners in her classroom had textbooks, yet she did not make any provisions such as handouts for learners on the content she was going to teach. Hence, during her lesson learners were seated and doing nothing while others were moving around going to sit with the ones who had textbooks, however very few of them had the textbooks that resulted in her lesson not being productive. During the interview a question was posed to Rose as to whether the time allocated to teach Natural Sciences was enough, Rose said:

> Nope and it is not sufficient, like we were in the classroom now we need extra time. Because of time some of the points are not said. If maybe Natural Science can be given extra time or much time maybe the improvement of the results will be there

Rose further related the limited given time to teach Natural Science as a contributing factor to learner's performance, as she reiterated that if Natural Sciences could be given more time maybe there might also be an improvement in the results.

> Not only did she mention allocated time as a contributing factor to learners' performance but also the socio-economic background of

learners such as child-headed families (Legotlo et al, 2002). Rose indicated that:

> If the learner is having problems at home, they may have difficulties in concentrating in the classroom, hence their performance may drop. The learners cannot concentrate because after school they may need to do their parents' work as they represent them as heads of the household, so they do not have time to study.

What Rose has indicated has been further reiterated by Mwamwenda (1993) and Hamunyela (2008) as they note that these challenges make it difficult for the learners to concentrate or give it their all in class as their minds are elsewhere. Further to that many learners are forced to take the role of their parents and that negatively affects their education.

Sanders et al. (1993) describes misconceptions as the result of everyday usage of unscientific language which leads to the formation of incorrect concepts which reflect/ in formal learning. Keeley (2012) posits that learners do not come into the science classroom as clean slates, hence they come with pre-conceived ideas about science topics and concepts, which he refers to as prior knowledge. In some instances, Rose was observed checking learners prior knowledge, however she did that very minimally. This is supported by the extract below:

Teacher: Okay let us start by saying matter. What is the matter?
Learners: Matter is something that is make out of strong material
Teacher: Everything that occupies space that has mass and volume is a matter. Isn't
Learners: Yes

This is one of the few instances where Rose visited the learners' prior knowledge. She asked about matter because it is the concept that was embedded with elements, however she made no attempt to show how the two concepts (matter and elements) link. What she did was contrary to what Mesa et.al (2014) indicates, in that checking on learners` prior knowledge, allows them to match previous knowledge with their new, emerging learning.

During the interview a question was posed to Rose asking if her learners had misconceptions, and if yes how does she identify and correct them. Rose said:

> Teacher: Yes, I think so, I will see the learner by not responding to the question am asking or failing the assessment in the classroom. I can identify that there is a problem, how can identify it.
> Researcher: But there are learners who are passive naturally, even when they do understand, they do not respond.
> Teacher: Yes, I know them. I know my learners to say this one is passive, this one he/she doesn't understand.

Rose was observed identifying misconceptions from her learners during her teaching, but none of them were rectified as she indicated in the interview. This is supported by the extract from the observation below:

> Teacher: just give example of element that you know. Yes Thato…
> Learner: kettle
> Teacher: kettle, mmmmmmh not exactly Nokulunga

Rose was aware that the answer the learner gave was not correct, or rather the element the learner was referring to was not the one she was referring to. Instead of explaining exactly which one was she referring to or correcting learners' misconception she just made a note to say "not exactly" and continued with the lesson. However, she could have used the opportunity to correct the misconception that could have not only assisted the learner in the question but the whole class as well.

Not only did her learners reflect misconceptions, but Rose as well. Her teaching was dominated by misconceptions (Roseshine, 2012). As she requested learners to mention elements they know, one learner mentioned steel as an element and Rose said:

> Teacher: Just give example of element that you know. Yes John…
> Learner: Steel
> Teacher: Steel yes, where do we find the steel? Yes these butlers are made out of steel which is an Iron, yes another one.

From the above extract both Rose and her learners displayed misconceptions (Gooding & Metz, 2011) as Rose contended with her learners that steel is an element. Further to that she made an example of materials that made from steel. Rose continued to display more misconceptions from her side as she was observed diverting from what she was supposed to teach, which are elements, and teaching compounds instead, which are not part of the content that needs to be taught in grade 7 according to NS CAPS (DBE 2011a). These are the misconceptions she reflected:

> Teacher: We have talked about the element, we have the element and compound. Let us
> $H0_2$
> Learners: $H0_2$
> Teacher: What is this HO_2, it is hydrogen from our elements. We have Hydrogen (Rose wrote hydrogen on the board). Look at it, I have given you hydrogen.

As if teaching irrelevant concepts wasn't enough, Rose further transferred misconceptions to learners (Bayraktar, 2009) as she was trying to explain what a compound is and making an example using water. The created misconceptions could be the result of her limited content knowledge (CK) and inadequate subject matter knowledge (SMK) hence further hindering the effective teaching and learning of the subject (Burgoon et.al, 2011). Rose used English throughout her presentation.

4.6.1 Table gives a summary of Rose's teacher knowledge

Content knowledge	*disorganised content knowledge (CK) and in adequate subject matter knowledge (SMK)* *irrelevant content*
Context knowledge	*Inadequate resources* *Socio economic background having an great impact in leaners performance*

Learner's understanding	*Insufficient usage of prior knowledge* *Teaching that caused misconceptions* *language variation: only English used*

Rose employed a question and answer method throughout her presentation as she indicated during the interview. She further indicated why she prefers this kind of teaching method. She said:

> Researcher: Which teaching methods do you prefer using when teaching matter and material strand and why?
> Teacher: Question and answer, because when they answer I can see if they understand
> Researcher: If they do not answer?
> Teacher: I keep on asking them, changing the method of asking question. Changing the way am asking them or give them an opportunity to ask. I ask them and they don't understand, I ask them to ask questions

The teaching method that Rose employed, which is question and answer, is regarded by Lombaard (2015) as a traditional method and is criticised by the CAPS NS curriculum (DBE 2011a) as it does not promote critical thinking, and rather leaves learners to become shallow thinkers (Kaddoura, 2011).

> Teacher: *Teacher writes on chalkboard* Our topic for today is the history of Periodic table, let us say all of us
> Learners: The history of periodic table
> Teacher: Again
> Learners: history of periodic table
> Teacher: Again
> Learners: history of periodic table
> Teacher: again
> Learners: history of periodic table
> Teacher: again
> Learners: history of periodic table
> Teacher: History of

Learners: Periodic table

From the above extract Rose was observed using one method of teaching method throughout the lesson and that was contrary to what Halai & Khan (2011) argue in that the teacher cannot rely on one teaching method.

Teacher: Lets us all talk, Dimitri Mendeleev
Learners Dimitri Mendeleev
Teacher: again
Learners Dimitri Mendeleev
Teacher: again
Learners Dimitri Mendeleev

Further to that Rose was observed asking learners to narrate the answers in a repeated manner, that was evidenced by the response she gave during the interview in that she asks the questions repeatedly. Moreover, it was clear that the teacher wanted the learners to memorise the answer as much as they possibly could, subsequently leading them to be shallow thinkers instead (Kaddoura, 2011).
Kate used illustrations during her lesson as she indicated during the interview when she said:

> I am going to use illustration, when we draw the periodic table and when we compare the periodic table from the timetable from the classroom, I think those are the illustration. So am going to ask them to draw the periodic table on the board, ask few of them to do that.

Rose was observed using illustrations as she drew a template of the periodic table on the chalkboard together with learners. She further used classwork and homework to assess her learners and explained why she was using such activities. She said:

> From here, they are going to have an assessment I will be assessing them using classwork and homework, from the assessment, if they

have done it well I will pick up if they did not understand them well or have grasp what we have talked about or not

After presenting a lesson Rose indicated that she has a classwork exercise for learners to write, as a form of activity.

4.6.2 Summary of Rose's instructional strategies

Teaching methods	*Questioning and Answer*
Explanatory frameworks	*illustrations*
Activities	*Classwork and Homework*

Mortimer & Scott (2003) believe that the interactions between teachers and learners in class is very important as learners get to properly understand through questioning, discussions and debate. Rose was observed using authoritative discourse during her presentation as she dominated her lesson with instructions and factual statements (Chin, 2006).

Teacher: number 2 we have He, which is
Learners Helium
Teacher: Helium, let us say all of us,
Learners Helium

Further to that, her approach did not encourage any debate or challenges amongst learners because for the better part of her lesson she conveyed information to learners in the form of questioning (Lemke, 1990 in Smart & Marshall, 2012). Moreover, learners were not given a chance to discuss nor add ideas to the lesson. In so doing Rose deprived learners of an opportunity to exercise their communicative and thinking skills according to the CAPS NS curriculum (DBE, 2011a) by discussing and debating amongst themselves. The pattern of discourse that Rose used was IRF (Initiation Response Feedback). Rose asked instructional questions. This is supported by the extract below from observations.

Teacher: Atomic number 7?
Learners: "N."

Teacher: "Symbol for?"

Learners: "Nitrogen."

Teacher: Nitrogen

Rose asked questions and learners gave responses. She further made emphasis by agreeing to learner's responses (Molinari et al, 2013). She further asked questions to evaluate, and not to construct understanding. The approach that was used by Rose was interactive-authoritative in a way that she dominated her lessons through questioning and giving learners less opportunity to interact with nor engage with the content taught to them, hence learners were passive acceptors of information (Tytler & Aranda, 2015).

Teacher: "Don't you know what a symbol is? Let us name the symbol for iron. Raise up your hand. Yes Lebo?"

Learner: "i."

Teacher: "Nope. Not exactly. Yes Msizi?"

Learner: "IR."

Teacher: "iR. Not exactly. Yes Amogelang?"

Learner: "iN."

Teacher: "iN, Nope. The last one. Eh, Mfuki?"

Teacher: "iO. Not exactly. But the symbol for Iron is Fe. Fe is the symbol for?"

Learners: "Iron."

Rose's interactive-authoritative approach was further observed from the above extract as she was observed discrediting the incorrect answers from learners, further to that her answers were considered to be final.

4.6.3 Summary of Rose's communicative approach

Types of discourses	Authoritative discourses
Patterns of discourses	IRF
Teacher questioning	Evaluate
Communicative approaches	Interactive-authoritative

4.7 FINDINGS

4.7.1 Teacher's teacher knowledge

The study discovered that Rose displayed inadequate subject matter knowledge (SMK) and disorganised content knowledge (CK), as she failed to explain the concepts she was going to teach, further to that she was observed teaching irrelevant content as she diverted from the topic and started teaching compounds. However, compounds are not a part of the topic that she should be teaching in grade 7 as they are introduced in grade 8, hence it was irrelevant content. Rose reiterated that the minimal time given to complete the expected content and her learners' socio-economic background as some of the factors that negatively impact learners; performance in the subject. This study further discovered that the school has recently established a laboratory, and even though it is not well equipped, she indicated that in some instances they improvise in order to conduct experiments since they do not have all of the resources required. During her presentations Rose used prior knowledge, though it was minimal. Her teaching displayed many misconceptions, not only from her learners but largely from herself. Rose used English during her presentation.

4.7.2 Instructional strategies

This study discovered that Rose used traditional methods of teaching such as question and answer, and further to that it was the only method she relied on and used throughout her presentation. Rose was observed using this kind of teaching method as she would ask learners a question and make them narrate the answers in a repeated manner, which was a clear indication that she wanted leaners to memorise the content without fail. The teacher employed one explanatory framework, which is illustration, where she was observed letting learners draw the periodic table template on the chalkboard with her assistance. Rose used classwork and homework as forms of activities to assess learners.

4.7.3.Classroom interactions and discourses

Even though there were interactions in Rose's classroom, it was minimal, to

such an extent that learners were not given an opportunity to interact with each other nor to interrogate the content that was taught to them, hence they were passive acceptors of information as Rose was transferring the knowledge to them through questioning. Further to that, Rose asked questions and when she realised that learners were struggling to find answers or were taking too long to respond she then gave learners the answers and her answers were regarded as final. She also employed initiation response feedback (IRF) during her presentation and her questioning was only focused on evaluating rather than constructing understanding. She further used classwork as a form of activity to assess learners**.**

4.8 SUMMARY

In this chapter the classroom practices of each teacher was analysed according to three themes, which are: teacher knowledge, instructional strategies, and classroom interactions and discourses. The findings of this study are presented and discussed for each case. The next chapter will present the answers for the research questions and the recommendations of the study.

CHAPTER 5
SUMMARY OF FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the answers to research questions, summaries of findings, research contributions and recommendations.

5.2 RESEARCH QUESTIONS

This study is aimed at unpacking the classroom practices of senior phase teachers when teaching matter and material strand in some schools of the Siyabuswa circuit in the Mpumalanga province. They focus on teacher's teacher knowledge, instructional strategies and classroom interactions and discourses.

This was the main question:

- What are the classroom practices of teachers when teaching Matter and Material in the senior phase?

Which led to the following sub-questions which guided the study**:**

- What is the nature of the teacher's teacher knowledge when teaching Matter and Material strand in the senior phase?
- What is the nature of the teacher's instructional strategies when teaching Matter and Material strand in the senior phase?
- How does the teacher's teacher knowledge and instructional strategies shape the classroom interactions and discourse?

Below are the answers for each research question presented per case.

What is the nature of the teacher's teacher knowledge when teaching Matter and Material strand in the senior phase?

CASE 1: KATE

The study discovered that Kate had limited content knowledge (CK) as she was found to be unfamiliar with the content she was going to teach such as failing to explain the concepts during the interview. Not only was her content knowledge (CK) limited but it was disorganised as well, in that Kate was teaching the topics

not in accordance to the CAPS document. Further to that her teaching was dominated with misconceptions, not only from her learners but from her as well. Furthermore, Kate failed to address most of her learners' misconceptions and in instances where she tried to, she created more misconceptions while addressing them. Kate's usage of prior knowledge was very minimal. In some instances, Kate used isiNdebele interchangeably with English while trying to explain the concepts, however that could have caused the birth of more misconceptions for learners.

CASE 2: JOHN

The study revealed that John has a lot of teaching experience, however he is not qualified to teach Natural Sciences as he holds a Secondary Teachers Diploma where he is specialised in Mathematics and Physical Sciences. This was diagnosed during the interviews. The study found that John had a weak subject matter knowledge (SMK) and disorganised content knowledge (CK), as he was not familiar with the content that he was supposed to teach, hence he ended up teaching irrelevant content to the grade he was teaching, however the content was embedded within Matter and Material strand. The study revealed that John teaching irrelevant content resulted in the formation of misconceptions and he was observed transferring them to his learners. The study further discovered that in some instances John revisited the relevant prior knowledge which learners had learned from previous grades in relation to the topic he was presenting.

CASE 3: ROSE

The study has shown Rose's content knowledge to be limited, as she failed to explain the concepts she was going to teach. Not only was her content knowledge (CK) limited, but her subject matter knowledge (SMK) was inadequate in that Rose was not aware of the content she was supposed to teach, as she was observed teaching irrelevant content knowledge to her learners. Teaching irrelevant knowledge resulted in her creating more misconceptions and transferring them to learners. The study revealed that Rose used minimal prior knowledge; further to that Rose's teaching displayed more misconceptions from her that she then transferred to her learners.

What is the nature of the teacher's instructional strategies when teaching Matter and Material strand in the senior phase?

CASE 1: KATE

The study revealed that Kate used traditional methods of teaching which are question and answer and lecture method. The kind of teaching methods that were used by Kate were teacher-centred and promoted uncritical and rote learning. Kate relied more on examples and analogies as her explanatory frameworks, however her examples were inappropriate and irrelevant, as they did not promote understanding in learners, hence creating misconceptions instead. The study has further shown that Kate utilised specific aim 1: "doing science", as learners were given an opportunity to conduct an investigation where they tested for acid, base and neutrality, moreover she utilised classwork as an activity to assessment learners.

CASE 2: JOHN

The study showed poor consciousness from John as to which teaching methods to use when teaching science. John mentioned and used question and answer and demonstration, further to that he used a lecture method of teaching. John used different types of teaching methods, however all of them were traditional methods of teaching and were teacher-centred, and hence promoted rote learning. John relied more upon examples than any other explanatory frameworks as he was explaining concepts such as "semi" in the context of semi-metal. He further used illustration as he explained to learners about how to represent elements on the periodic table. Further to that John employed classwork as an activity.

CASE 3: ROSE

The study discovered that Rose mentioned and used question and answer method as her teaching method. This was evidenced through interviews and classroom observations. Rose relied on one teaching method, which is question and answer, throughout her presentation. Further to that she was observed making learners narrate answers repeatedly, which was an indication that she wanted learners to memorise the answers without fail, hence the teaching

method she employed did not promote critical thinking, but rather shallow thinkers because learners would memorise content without understanding. Rose employed illustration only as an explanatory framework whereby she requested learners to draw a periodic table template on the board under her guidance. Further to that she used and mentioned using classwork as an activity.

How does the teacher's teacher knowledge and instructional strategies shape the classroom interactions and discourse?

CASE 1: KATE

The study revealed that the knowledge and instructional strategies that Kate used did not grant learners opportunities to interact amongst themselves nor with the content being taught to them. In some instances, Kate utilised learner's prior knowledge to try and connect the previously learned knowledge with the new knowledge. However, the activity that Kate used, which was an investigation was for acid, base and neutrality allowed learners to be hands-on and they developed skills such as observing and doing investigations. Furthermore, she utilised specific aim 1: "doing science". The knowledge and instruction that Kate used created interactions between her and her learners. This is so because she interacted with learners as she was asking questions and learners responded.

CASE 2: JOHN

The study discovered that the knowledge and instructional strategies that John employed deprived learners an opportunity to voice their thoughts and ideas about the content that was taught to them. Hence, they were passive acceptors of information as John dominated the lesson. Further to that, learners did not ask questions during the lesson, which supressed skills such as raising questions. Moreover John did not utilise much of the learners' prior knowledge during his presentation, which could possibly deprive learners of an opportunity to make connections between the existing and new information. Consequently, John's knowledge influenced the choice of his instructional strategies resulting in his approach being interactive-authoritative.

CASE 3: ROSE

The knowledge and instruction that Rose employed was authoritative in that there were no instances were learners were given a chance to debate or challenge the content that was taught to them or interact amongst themselves. All that was expected from them was to listen and absorb the information that was taught to them in the form of memorising without understanding. In some instances, Rose attempted to create interaction, but it was between her and learners only and not amongst learners themselves because she requested that they draw the periodic table on the board. Further to that she interacted with learners through asking questions and learners gave responses.

5.3 CONTRIBUTION OF THE STUDY

The classroom practice diagnostic framework (CPDF) played an imperative role in this study as it was the conceptual framework for this study. The CPDF focused on classroom practices which are: teacher's teacher knowledge, instructional strategies, classroom interactions and discourses. The idea behind this framework is that a Natural Sciences teacher with adequate content and context knowledge will have a better leverage of choosing appropriate instructional strategies when teaching matter and material strand. Further to that their choice of instructional strategies will further determine the types of discourse in the classroom. The remarkable part about this framework is that if the chosen discourse does not yield desired results the teacher could go back and choose another instructional strategy that will be more effective.

Previous studies have been conducted on classroom practices in Natural Sciences, but none, according to the researcher's knowledge, looked at the classroom practices from the NS Matter and Material strand perspective.

The findings of this study revealed that Natural Sciences teachers have limited content knowledge (CK) and weak subject matter knowledge (SMK). This was observed during the classroom observations when they were teaching Matter and Material strand. This could be because they are not qualified to teach Natural Sciences as they do not specialise in Natural Sciences, hence they are teaching out of their specialisation. Further to that the study revealed that Natural Sciences

teachers have misconceptions and they transfer these to their learners which could be caused by limited content knowledge (CK) and inadequate subject matter knowledge (SMK) as far as Matter and Material is concerned. An issue concerning adequate teaching and learning resources was further discovered by this study, which must be brought to the attention of the Department of Basic Education (DBE), as it is one of the major contributing factors that influences the classroom practices of the teacher and hinders the quality of teaching and learning of this strand and learners' performance in the subject thereof. Teachers were observed conducting practical activities in the classroom with improvised materials, however the activities could have been done in the laboratory instead.

Further to that the study revealed that Natural Sciences teachers still have difficulties in choosing appropriate instructional strategies and relevant approaches to use when teaching Matter and Material strand. They still using traditional methods of teaching, which are teacher-centred, as they still see themselves as authorities in the classroom, hence their teaching promotes rote-learning as it is one-way. The kind of instructional methods they employ do not promote active learning, but rather create learners who are shallow thinkers and passive participants instead. More-over the teachers are not aware of the specific aim of Natural Sciences and the cognitive and practical process skills that learners should acquire while learning Matter and Material strand because they still use traditional methods of teaching, which does not promote any of the skills and specific aims, but rote-learning only.

This study has therefore been able to reveal the classroom practices of Natural Sciences teachers when teaching matter and material strand. It has also been able to add to the previous knowledge base in that no study of this nature in the context of matter and material strand has been undertaken and as such it paves the way for further research in Natural Sciences.

5.4 LIMITATIONS OF THE STUDY

- The study focused only on three teachers from three senior phase schools which are located in the Siyabuswa circuit. Hence the findings of this study cannot be generalised because it was based on a sample and not the entire

population of the Siyabuswa circuit. This was done as it allowed the study to be feasible and cost effective.

- The study was done only on participants who fulfilled the requirements of the study design and criteria to avoid generalisation as it was a case study. Hence the sampled participants were deemed to be information rich who would assist in answering the research questions of this study. The study design and criteria were explained in chapter three.
- Classroom observations were done in the classroom where learners were also present, however the focus of the study was not on learners but of the classroom practices of teachers. Though other challenges were depicted from learners, the scope of research restricted the researcher from entertaining them as that could have diverted the main focus of the study.

5.5 RECOMMENDATIONS OF THE STUDY

The study recommends the following:

- It is recommended that curriculum planners revise the topics in Matter and Material strand as there are misnomers that have been discovered by the study as far as topics are concerned in this strand.
- It is recommended that the Department of Basic Education (DBE), together with the government make it a priority to ensure that adequate teaching and learning resources are made available in schools, in particular schools that are positioned in rural areas, so that there can be effective teaching and learning of Matter and Material strand as it forms a basic foundation for Chemistry in FET phase. Further to that teachers should be educated on how to use the resources since that is a challenge as well.
- It is recommended that more content enrichment workshops be conducted frequently to discuss and unpack Matter and Material strand topics as the findings of this study revealed a gap in teaching this strand.
- It is recommended that more time be allocated to Natural Sciences as there's more content to be covered and less time given compared to other subjects.

- It is recommended that Natural Sciences teachers familiarise themselves with the NS CAPS document so as to know the content to be taught and as well as the depth of the content.
- It is recommended that the Department of Basic Education (DBE) educates teachers on the importance of teaching the curriculum as prescribed by NS CAPS document.
- It is recommended that more workshops be conducted in training teachers on different methods of teaching that promote active learning so that they can do away with traditional methods of teaching.

5.6 CONCLUSION

This chapter presented the summary of findings. Furthermore, the research questions were answered, followed by a presentation of the contributions and limitations of the study. The study finally recommended further research and advice to the Department of Education.

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APPENDICES

APPENDIX A: INTERVIEW PROTOCOL

THE TEACHER INTERVIEW PROTOCOL

Pre-observation Semi-structured interview questions for Natural Science teachers

A. Context

1. How long have you been teaching natural sciences in the senior phase?
2. What teaching qualification do you have?
3. What are your major subjects?
4. How many periods are allocated for natural sciences?
5. How long is each period?
6. What are you going to teach today?
7. What resources do you have in your school to support the teaching of natural sciences?
8. Do you have a laboratory were you conduct sciences experiments in your school? If not where do you conduct experiments if ever you do?
9. What resources are you going to use today during your lesson?
10. What is the performance of natural sciences in your school, if (good or bad) what contributes to it being like that?

B. Content and prior-knowledge

1. What prior-knowledge do learners need to learn matter and material strand in senior phase?
2. Do your learners have misconceptions, if yes how will you identify and correct them?
3. Do your learners have any interest in learning natural sciences?
4. How will you know that your learners has grasp a better understanding of what you thought?

C. Instructional strategies

1. Which teaching methods you prefer using when teaching matter and material strand, and why?
2. When teaching matter and material strand, the use of examples, models, analogies and illustrations can be of great use when explaining concepts, which ones will you use and why?
3. Investigations, experiments, projects and demonstrations are done when teaching matter and material strand, which ones will you use and why?
4. The activity mentioned above will it assist in attaining the aims of the lesson, if not why?

D. Interactions and discourse

1. When presenting a lesson, do you ask questions to evaluate or to construct concepts?
2. Given this type of commutative approaches dialogic-authoritative and interactive-non-interactive which one are you going use and why?
3. Given this types of discourses (IRF/ IRFRF) which one are you going to use and explain why?

APPENDIX B:

OBSERVATIONAL TOOL

THE TEACHER OBSERVATIONAL TOOL

Lesson observation schedule for Natural Science teachers on classroom practice

School: _____
Date: _____
Grade: _____
Number of learners in natural sciences classroom: Boys: ____Girls:____Total:____
Teacher:_____
Researcher:_____
Role of Researcher: _____
Time of observation:_____
Length of observation: _____

A. TEACHING AND LEARNING ENVIRONMENT

1. Description of teaching learning environment

   _____
   _____

2. Classroom arrangement and appearance

   _____
   _____

3. Physical appearance of the learners

   _____
   _____

4. Is the teaching and learning environment welcoming or conducive for teaching and learning to take place?

   _____
   _____

5. What implications that classroom environment could have in the teaching and learning?

   _____
   _____

B. INSTRUCTIONAL LEARNING

a) Lesson topic

_____

_____

b) Lesson introduction

_____

_____

c) Prior-knowledge

_____

_____

d) Presentation of lesson

_____

_____

e) Teaching methods and activities

_____

_____

f) Learners' participation

_____

_____

g) Misconceptions

_____

_____

h) The types of interactions and discourses used by the teacher and learners during the lessons

_____

_____

i) Conclusion of lesson

_____

_____

j) Reflection

_____

_____

C. CONTENT KNOWLEDGE

a) The sequencing and organisation of the topics/ideas/concepts

_____

_____

b) Development of the main ideas

_____

_____

c) Teachers understanding of concepts and presentation

_____

_____

d) The link between prior knowledge and new concepts

_____

_____

APPENDIX: C
LETTER TO THE DISTRICT MANAGER

College of education
Department of science and technology education
Request for permission to conduct research at schools

Title: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit"

Date: 10 march 2019

The District Manager
Nkangala Region Department of Education

Dear Sir/ Madam

I, Ntuli Thuli Gladys, am doing research under the supervision of A. V. Mudau, a professor in the Department of Science and Technology Education. I am working towards my Master's Degree in education with specialisation in Natural Sciences at the University of South Africa. There is no funding involved in this study. I am requesting a written permission to use the schools that will be interested to participate in ta study entitled: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit"

The aim of the study is to explore the classroom practices of Natural Sciences teachers when teaching Matter and Material strand in the senior phase schools. The study will also investigate factors that hinders the teaching effectiveness of Natural Sciences in the Siyabuswa circuit. Your department has been selected because the main objective of the study is to investigate the classroom practices on Natural Sciences teachers in the senior phase schools and this objective can only be realised within your department. The study will request consent from Natural Sciences teachers of the Siyabuswa circuit to participate in this study, prior to interviews and observations, participants permission will be requested, a recording device will be used. Up on the granted permission from the participants to take park in the study, I will then work with

them through-out the research process. In this study three schools will be selected to participate, one teacher from each school will be observed and interviewed.

The benefits of this study will be for all schools situated in Siyabuswa circuit even the neighbouring ones. The study will bring an insight on challenges faced by teacher s in teaching practice and further provide solutions thereof. There are no known risks associated with this study. Confidentiality will be maintained by not disclosing the names of schools and participants. The data that will be collected form the participants will be kept confidential and will be strictly used for research purpose. Participants will not be reimbursed or receive any incentives for participating in this study. Up on request participants will receive the summary of the research findings.

For more information regarding the study, please contact me on: 078 209 1017 or email: ntulithuli.gladys@yahoo.com and my supervisor Prof Awelani.V. Mudau can be reached at: 012 429 6353 or email: mudauav@unisa.ac.za

Yours sincerely

Ntuli T.G (Researcher)

APPENDIX: D
LETTER TO CIRCUIT MANAGER

College of education
Department of science and technology education
Request for permission to conduct research at schools

Title: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit"

Date: 10 March 2019

The Circuit Manager
Nkangala Region Department of Education

Dear Sir/ Madam

I, Ntuli Thuli Gladys, am doing research under the supervision of A. V. Mudau, a professor in the Department of Science and Technology Education. I am working towards my Master's Degree in education with specialisation in Natural Sciences at the University of South Africa. There is no funding involved in this study. I am requesting a written permission to use the schools that will be interested to participate in ta study entitled: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit"

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participants permission will be requested, a recording device will be used. Up on the granted permission from the participants to take park in the study, I will then work with them through-out the research process. In this study three schools will be selected to participate, one teacher from each school will be observed and interviewed.

The benefits of this study will be for all schools situated in Siyabuswa circuit even the neighbouring ones. The study will bring an insight on challenges faced by teacher s in teaching practice and further provide solutions thereof. There are no known risks associated with this study. Confidentiality will be maintained by not disclosing the names of schools and participants. The data that will be collected form the participants will be kept confidential and will be strictly used for research purpose. Participants will not be reimbursed or receive any incentives for participating in this study. Up on request participants will receive the summary of the research findings.

For more information regarding the study, please contact me on: 078 209 1017 or email: ntulithuli.gladys@yahoo.com and my supervisor professor A.V. Mudau can be reached at: 012 429 6353 or email: mudauav@unisa.ac.za

Yours sincerely

Ntuli T.G (Researcher)

APPENDIX: E
LETTER TO PRINCIPAL

College of education
Department of science and technology education
Request for permission to conduct research at schools

Title: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit"

Date: 10 march 2019

The Principal
Nkangala Region Department of Education

Dear Sir/ Madam

I, Ntuli Thuli Gladys, am doing research under the supervision of A. V. Mudau, a professor in the Department of Science and Technology Education. I am working towards my Master's Degree in education with specialisation in Natural Sciences at the University of South Africa. There is no funding involved in this study. I am requesting a written permission to use the schools that will be interested to participate in ta study entitled: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit"

The aim of the study is to explore the classroom practices of Natural Sciences teachers when teaching Matter and Material strand in the senior phase schools. The study will also investigate factors that hinders the teaching effectiveness of Natural Sciences in the Siyabuswa circuit. Your department has been selected because the main objective of the study is to investigate the classroom practices on Natural Sciences teachers in the senior phase schools and this objective can only be realised within your department. The study will request consent from Natural Sciences teachers of the Siyabuswa circuit to participate in this study, prior to interviews and observations, participants permission will be requested, a recording device will be used. Up on the granted permission from the participants to take park in the study, I will then work with

them through-out the research process. In this study three schools will be selected to participate, one teacher from each school will be observed and interviewed.

The benefits of this study will be for all schools situated in Siyabuswa circuit even the neighbouring ones. The study will bring an insight on challenges faced by teacher s in teaching practice and further provide solutions thereof. There are no known risks associated with this study. Confidentiality will be maintained by not disclosing the names of schools and participants. The data that will be collected form the participants will be kept confidential and will be strictly used for research purpose. Participants will not be reimbursed or receive any incentives for participating in this study. Up on request participants will receive the summary of the research findings.

For more information regarding the study, please contact me on: 078 209 1017 or email: ntulithuli.gladys@yahoo.com and my supervisor professor A.V. Mudau can be reached at: 012 429 6353 or email: mudauav@unisa.ac.za

Yours sincerely

Ntuli T.G (Researcher)

APPENDIX: F
LETTER TO NATURAL SCIENCES TEACHER

College of education
Department of science and technology education

Title: "Classroom practices of senior phase teachers when teaching matter and material strand in some of the schools in the Siyabuswa circuit"

DEAR PROSPECTIVE PARTICIPANT

I, Ntuli Thuli Gladys, am doing research under the supervision of A. V. Mudau, a professor in the Department of Science and Technology Education. I am working towards my Master's Degree in education with specialisation in Natural Sciences at the University of South Africa. There is no funding involved in this study. I am inviting you to participate in ta study entitled: "Classroom practices of senior phase teachers when teaching matter and material strand some of the schools in the Siyabuswa circuit". The main objective of this study is to explore the classroom practices of Natural Sciences when teaching Matter and Material strand in some of the senior phase schools in the Siyabuswa circuit. You are requested to participate in this study because you are a suitable candidate as you are teaching Natural Sciences in one of the schools situated in Siyabuswa circuit where the study will be undertaken. I do not have your details.

I hereby request your permission to observe you while teaching Matter and Material strand in your classroom and ma use of audio recording during interviews. The time allocation for every interview will be 30 minutes maximum and research will be conducted for a period of three months.

Participating in this study is voluntary and you are under no obligation to consent to participation. If you decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason. In this study there are no potential benefits for taking part.

There are no negative consequences for any participant if they participate in this study. The information that you provide will not be disclosed to your colleagues or seniors your identity will be kept confidential. Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard/filling cabinet at the researcher's workplace for future research or academic purposes: electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further research ethics review and proposal. The researcher will destroy the information two years after the completion of study by shredding the hard copies and by permanently deleting the soft copies using software applications. In this study there will be no incentives and no receipt of payment for participation. Up on request participants will be provided with the summary of the research findings.

For more information regarding the study, please contact me on: 078 209 1017 or email: ntulithuli.gladys@yahoo.com and my supervisor professor A.V. Mudau can be reached at: 012 429 6353 or email: mudauav@unisa.ac.za

Thank you for taking the time reading this information sheet

Kind regards

NTULI THULI GLADYS

APPENDIX: G
CONSENT FORM FOR NATURAL SCIENCES TEACHERS

I,_____ , confirm that the researcher asking for my
(participant name),
consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconveniences of participation.

I have read and (or had explained to me) and understand the study as explained in the information sheet.

I have had sufficient opportunities to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into research report, journal publications and/or conference proceedings, butt that my participation will be kept confidential unless otherwise specified.

I agree to be recorded in the interviews and observations

I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print)	Participant Signature	Date
NTULI THULI GLADYS		30 March 2019
Reseacher Name & Surname (please print)	Participant Signature	Date

APPENDIX: H
KATE INTERVIEW TRANSCRIPT

Line	Description
1.	**Day one pre- interview**
2.	**Researcher**
3.	Okay Ma'am shall we start?
4.	Uhhmm…How long have you been teaching Natural Sciences in the
5.	senior phase?
6.	**participant**
8.	Hmmm… I have been teaching Natural Science from 2015 as a volunteer
9.	up until 2017
10.	From 2018 I was a permanent member still teaching Natural Science in
11.	the senior phase
12.	So in total is 4 years
13.	**Researcher**
14.	Okay
15.	What teaching qualifications do you have?
16.	**participant**
17.	Mnxa… I have got a Diploma in teaching my majors are Maths, Natural
18.	Science, Social Science and Geography
19.	**Researcher**
20.	Okay…uhm….
21.	What are your major subjects?
22.	**participant**
23.	Already as I said, they are Maths, Natural Science, Social Science and
24.	Geography
25.	**Researcher**
26.	Okay….
27.	How many periods are allocated for Natural Sciences?
28.	**participant**
29.	Per- class, you saying per-class or per se… semester?
30.	**Researcher**
31.	Per week

32.	No…per week
33.	**participant**
34.	Per –week? Natural Science?
35.	Reacher
36.	Yes
37.	**Participant**
38.	Awodwa?
39.	(Only?)
40.	**Researcher**
41.	Yes
42.	**Participant**
43.	I don't know let me see…errrr, okay asiybali I NST neh…
44.	(Excluding NST right?)
45.	**Researcher**
46.	Yes
47.	**Participant**
48.	Errr… they are…. 3, 6, 9…
49.	**Researcher**
50.	No, not the total, hmm…. per- class
51.	**Participant**
52.	Oh…. Per class?
53.	**Researcher**
54.	How many times do you go to the class to teach Natural Science per
55.	week?
56.	**Participant**
57.	In grade 7 fourth times in a week, grade 8 its three times and grade 9 its
58.	three times
59.	**Researcher**
60.	So it means in grade 7 they have allocated four?
61.	**Participant**
62.	One extra
63.	**Researcher**
64.	Periods?

65.	**Participant**
66.	Yes,
67.	**Researcher**
68.	Okay
69.	**Participant**
70.	One extra, because its 3periods per week
71.	**Researcher**
72.	Okay, so do you maybe know why did you allocate four instead of three?
73.	Because according to CAPS we have three periods
74.	**Participant**
75.	They have this transaction from err Natural Science and Technology
76.	Now they are doing Natural Science alone
77.	So I ask for that transaction between the two that it has to be four
78.	**Researcher**
79.	So it's only four in grade 7?
80.	**Participant**
81.	Grade 7 only
82.	**Researcher**
83.	Okay. How long is each period?
84.	**Teacher**
85.	One hour
86.	**Participant**
87.	An hour
88.	And… what are you going to teach today?
89.	**Teacher**
90.	Today we are talking about properties non- metals and semi-metals
91.	**Researcher**
92.	Okay. That's the topic you going to teach today?
93.	**Participant**
94.	Yes **Researcher**
95.	What is matter and material according to you?
96.	**Participant**
97.	

98.	Is everything that we are doing, examples window, cars, wall, desks and
99.	chair
100.	**Researcher**
101.	What are metals?
102.	**Participant**
103.	We find metals in the periodic table of elements, they are those elements
104.	that are made out of metals. They show properties like they are dull**.**
105.	**Researcher**
106.	What are non-metals?
107.	**Participant**
108.	Still we find them on the periodic table, from our left hand side those are
109.	the materials that cannot make a still, example a wall.
110.	**Researcher:**
111.	What are semi-metals?
112.	**Participant**
113.	We find them not exactly in the middle of the periodic table, we find them
114.	after the non-metals, and they can be a liquid or a metal. They are in
115.	between the metals amd non-metals**.**
116.	**Researcher**
117.	Do you have any challenges in teaching the matter and material strand?
118.	**Participant**
119.	Yes, because in this topic we have to have most elements in class, in our
120.	school we do not have resources so there's so much little, sometimes I
121.	have to compromise and bring other things from home.
122.	**Researcher**
123.	Which elements can you bring to class?
124.	**Participant**
125.	Vinegar or carbon
126.	**Researcher**
127.	Alright. What resources do you have in your school to support the
128.	teaching of Natural Sciences?
129.	**Participant**
130.	We have a science kit, but it's not like a full pack it's just samples

131.	Then we have got some posters, two posters for this term, that will be
132.	like allocated in this term
133.	**Researcher**
134.	Only?
135.	**Participant**
136.	Yes
137.	**Researcher**
138.	You do not have textbooks?
139.	**Participant**
140.	We do have textbooks, but uhmm I can say, I have 50% of the textbook
141.	allocated in the class.
142.	**Researcher**
143.	Okay
144.	**Participant**
145.	And the 50 they are so sharing
146.	**Researcher**
147.	So you only have posters for second term work?
148.	**Participant**
149.	I do have, I take them off, this term I paste those then I take them off
150.	**Researcher**
151.	Meaning uhmm, for term one you did not use any posters?
152.	**Participant**
153.	I did, I did take them off because they are tearing it apart
154.	**Researcher**
155.	Oh… okay… okay
156.	**Participant**
157.	Yes
158.	**Researche**r
159.	Uhhh… do you conduct experiments?
160.	**Participant**
161.	Yes
162.	**Researcher**
163.	Where?

164.	**Participant**
165.	In the class, those…Those…ngthini lezi ezi possible, I conduct them but
166.	lezi ezidinga umlilo nah nah I don't
167.	(**the ones that are possible I do, but the ones that needs fire fighters**
168.	**and what not I don't)**
169.	**Researcher**
170.	Oh…those ones that they need the lab you don't conduct them?
171.	**Participant**
172.	Yes I don't
173.	**Researcher**
174.	At all?
175.	**Participant**
176.	Yah, lezi edidinga I fire I don't conduct them, but lezi maybe la
177.	ngisebenzisa khona amanzi atjhisako I conduct them, but lezi eziding
178.	umlilo serious kuthi… I have to, I don't
180.	(**yes the ones that needs fire I don't conduct them, but the ones that**
181.	**need hot water I conduct them)**
182.	I mix chemicals in the class but uyaz kunezi…. Hai I don't
183.	**(you know)….**nah
184.	**Researcher**
185.	The ones that are flammable?
186.	So if you have to do or conduct an experiment that is flammable, or
187.	includes flammable chemicals, so you don't do it at all?
188.	**Participant**
189.	I don't, I explain how it is done, I don't do it
190.	**Researcher**
191.	Practically?
192.	**Participant**
193.	Yes
194.	**Researcher**
195.	Okay… alright
196.	Uhm…what resources are you going to use today during your lesson?
197.	**participant**

198.	It is gonna be a textbook, after a textbook it is gonna be a periodic table…
199.	uhmmm probably it is those
200.	**Researcher**
201.	Okay. Uhm… how is the performance of Natural Sciences in your school?
202.	**Participant**
203.	Okay, it depends on the grades, grade 7 they are so low, grade 8 I could
204.	say 50%
205.	**Researcher**
206.	So meaning grade 7 is below 50%?
207.	**Participant**
208.	Grade 7 is below, because of the transaction
209.	**Researcher**
210.	Uh… the transaction could be the only reason for the low mark or
211.	percentage in grade 7?
212.	**Participant**
213.	For my side I can say so, for my side
214.	**Researcher**
215.	Can you explain maybe why?
216.	**Participant**
217.	Hmmm. Okay in grade 6 most of the things are combined with
218.	technology, now they are still having that method of what combining
219.	things, some of the things they don't easily separate from technology to
220.	the science ones.
221.	So they write technology where they are not supposed to write what
222.	technology
223.	**Researcher**
224.	So the thinks you saying are combined what are those things exactly?
225.	**Participant**
226.	Uhmm…we do have some structures in technology neh, then even in
227.	science we do have them but they are not well detailed. But they use
228.	those structures to answer with that mind of what technology in science.
229.	**Researcher**
230.	Okay

231.	**Participant**
232.	My problem is that one
233.	**Researcher**
234.	Can you maybe give an example of those structures? What kind of
235.	structures exactly?
236.	**participant**
237.	Okay. In grade 6 we have got errr… hmmm… what do we call, this we
238.	are doing this term we are doing purifying of water? There are ways of
239.	purifying water, and in that ways we have got structures that are build.
240.	So they took those methods of structures the set of structures in
241.	answering when you asking the questions maybe how do you purify
242.	water? They would give you the steps, those steps you have to go to the
243.	municipality, they are not you a straight answer. They are giving those
244.	steps
245.	**Researcher**
246.	So they apply those structures in N.S? While they should not be?
247.	participant
248.	They are not giving, yaz kwa grade 6, angithi siya explaner neh, u
249.	explaine uze ngama steps, kwa grade 7 they have to kuba ne mind leya
250.	e clear kuthi nawubuza into it has to be straight forward ungalandeleli
251.	those steps steps, ngoba azikabuzwa
252.	(**you know in grade 6, isn't that we explain, you will explain the**
253.	**steps so that when get to grade 7 they will have in mind that when**
254.	**you ask something they need to give a straight forward answer and**
255.	**not following those steps because they were not asked)**
256.	**Researcher**
257.	Okay
258.	**Participant**
259.	So I problem iba lapho most of the time
260.	(**so that's where the problem lies most if the time**)
261.	**Researcher**
262.	Does the socio-economic background affect the learne's performance in
263.	the subject? If yes, please elaborate?

264.	**participant**
265.	Yes it does, due the environment they come from, they do not prioritize
266.	education, they believe that since they come from poor backgrounds they
267.	cannot achieve in life.
268.	Alright. What prior- knowledge do your learners need to learn matter and
269.	material strand in the senior phase? Remember this term we doing matter
270.	and material strand right?
271.	**Participant**
272.	Hmmm grade 7?
273.	**Researcher**
274.	Yes…throughout the grades 7-9
275.	**Participant**
276.	Hmmm… materials, we first the prior knowledge, let me see. Okay first
277.	of all from my side. I can say if you have different types of materials neh.
278.	You first come up with those different types of materials ask what the
280.	materials that are been used in that materials then you take it from there.
281.	Huh…telling you what are materials they have been used there and the
282.	knowledge of what ngithini? The materials, matter, state of matters, the
283.	gas the ice it is … its ice, water and gas. Those taking from the lesson
284.	you are teaching first of all iti s gonna be the materials you bring to class
285.	uqalabantwana ukuthi what do they know about the materials that you
286.	are taking then you take it from there. (**Huh…telling you what are**
287.	**materials they have been used there and the knowledge of what can**
288.	**I say)? (Those taking from the lesson you are teaching first of all its**
289.	**gonna be the materials you bring to class looking at the kids what**
290.	**do they know about the materials that you are taking then you take**
291.	**it from there).**
292.	**Researcher**
293.	Okay.do your learners have misconceptions? If yes how will you identify
294.	and correct them?
295.	**Participant**
296.	It all depends
297.	**Researcher**

298.	On what maybe?
300.	**Participant**
301.	It all depends, because ehh… you maybe find, we have got three different
302.	learners, you may find that abanyabantwana they know what you talking
303.	about it's gonna be clear for them. But others they know a few knowledge
304.	so you have to clarify kuthi what materials are used or isebenziselwam
305.	into leyo
306.	(**It all depends, because ehh… you maybe find, we have got three**
307.	**different learners, you may find that other kids they know what you**
308.	**talking about it's gonna be clear for them. But others they know a**
309.	**few knowledge so you have to clarify in details what materials are**
310.	**used or what is that material used for)**
311.	**Researcher**
312.	Okay
313.	**Participant**
314.	Uhmm so you really have to explain kulabanaye
315.	(**Uhmm so you really have to explain to others)**
16.	**Researcher**
317.	So your answer is partially yes and partially no?
318.	**Participant**
319.	Yes its 50/50
320.	**Researcher**
321.	Okay, but you have only explained I think one scenario where they know,
322.	meaning they don't have misconceptions because they know what you
323.	talking about.
324.	**Participant**
325.	You can say 50% of the learners they know like a full, but they need a
326.	fewer explanation. Then you come up with those learners that they only
327.	know that it's a box, they don't know
328.	What itis used for and what is made out off, so you really have to explain
329.	what the box is made out off and the use of the box, why we need the
330.	box. Yes…
331.	**Researcher**

332.	Yes… do your leaners have an interest in learning natural sciences?
333.	**Participant**
334.	70 % yes and 30% no
334.	**Researcher**
335.	Can you explain maybe…the 70 how do you tell that the 70 have the
336.	interest and the 30 does no
337.	**Participant**
338.	Uhmmmm, I can say the participation in the class of that 70% you know
340.	that okay, now they are starting to train their mind that they are going to
341.	choose science or they are not going to choose science. So you going to
342.	know from that ukuthi oh… lo uzizmisele with this subject. Then you find
343.	those they don't even care or akakabhali uyabona
344.	(**So you going to know from that weather oh… not the learner is**
345.	**serious with this subject. Then** you find those they don't even care if
346.	they wrote the work or not you see)
347.	**Researcher**
348.	Okay. And how will you know that learners has grasp a better
349.	understanding of what you have taught?
350.	**Participant**
351.	Okay… after teaching you have to assess, then see if they have grasp
352.	whatever you were teaching in a class, then fix before the end of the
353.	period, them fix where you see they made a mistake from.
354.	**Researcher**
355.	Okay. Which teaching methods you prefer using when teaching matter
356.	and material strand and why?
357.	**Participant**
358.	Hmmmm… its interacting with the learners… uhmm … first of all you
359.	come up with the materials and let them like, give them a task first with
360.	the material, let them… ngithini bayeke benze that task after wards you
361.	can tell them where they did make mistakes then you take it from there.
362.	**(Let them… what can I say? Let them do that task after wards you**
363.	**can tell them where they did make mistakes then you take it from**
364.	**there)**

365.	**Researcher**
366.	Alright. When teaching matter and material strand, the use of examples,
367.	models, analogies and illustrations can be of great use when explaining
368.	concepts, which ones will you use and why?
369.	**Participant**
370.	Hmmmm…
371.	**Researcher**
372.	We have examples, models, analogies and illustrations
373.	**Participant**
374.	Okay…with the particular learners I can say first you can explain a
375.	particular thing but without giving a model in front of them, they will not
376.	take it….ukuyifakengqondwen it is better if nabayibona bona I model,
377.	they understand more quicker from my side. Into nabayenza
378.	ubakhombisa yon angamehlo bayi understander much faster than kuthi
379.	uzoyi explainer eclasini uyiqhuba.. ai ngbona ngathi basasela emuva or
380.	uyabalahla somewhere in a way mara nawuythethe wabakhombisa kuthi
381.	oh… into engikhuluma ngauo ngile then they understand much quicker
382.	and nabo still nawubabuza imibuzo uyakgona ukuzwisisisa cause
383.	baybonile they understand.
384.	**(They will not take it….it will be difficult for them to understand, it**
385.	**is better if they see a model, they understand more quickly from my**
386.	**side. If they do something practical and they tend to see it they**
387.	**understand much faster than when you just explain without**
388.	**showing them what you talking about, they learn and understand**
389.	**much quicker by seeing, they can even answer better when seeing**
390.	**things because they know what you talking about).**
391.	**Researcher**
382.	Alright. Investigations, experiments, projects and demonstration are done
393.	when teaching matter and material strand, which ones will you use and
394.	why?
395.	**Participant**
396.	Uhmmmm… from my side I prefer investigation, if you investigate, you
397.	get more knowledge than you have from the textbook that is given from…

398.	ngithini into abankunikeza yona ku textbook if they giving you a task from
399.	the textbook uyenze practical, you only know that, but if you go and
400.	investigate you know more cause you know that oh…this thing doesn't
401.	asisyisebenziseli lokhu abasinikezekhona ku task but ukgona ukwenza
402.	okhunye ngayo.
403.	(**Uhmmmm… from my side I prefer investigation, if you investigate,**
404.	**you get more knowledge than you have from the textbook that is**
405.	**given to you, if they giving you a task from the textbook to do**
406.	**practical, you only know that, but if you go and investigate you**
407.	**know more cause you know that oh…this thing doesn't only apply**
408.	**in this instance it can only be used in other thing).**
409.	**Researcher**
410.	Okay. The activity mentioned above will it assist in attaining the aims of
411.	the lesson, if not why?
412.	**Participant**
413.	Yes… because of not all the schools have, isikolo sethu asinayo that
414.	materials esiyidingako la esikolweni but if they go and investigate
415.	emakhaya they would know and see different things, they will come up
416.	with lokhu abakubonile emakhaya esbhallelwe kukubalethela khona
417.	eskolweni.
418.	**(Yes… because of not all the schools have, our school does not**
419.	**have materials that we need but if they go and investigate at home**
420.	**they would know and see different things, they will come up with all**
421.	**the material that thy school has failed to provide for them).**
422.	**Researcher**
423.	So you saying investigation is giving them more opportunity to go and
424.	find more information particularly at home?
425.	**Participant**
426.	Yes, at home angibasi ema clinics, it's going back at home, because now
427.	its matter and materials yonke I product esinayo ekhaya ampur you can
428.	find it at home.**(Yes, at home I don't take them to clinics it's going**
429.	**back at home, because now its matter and materials every product**
430.	**you can find it at home)**

431.	**Researcher**
432.	Okay. When presenting a lesson, do you ask questions to evaluate or to
433.	construct concepts?
434.	**Participant**
435.	Hmmmm. It all depends because some of the lessons they would say
436.	you take two hours then maybe in this one you don't ask ukuthi, ngiba
437.	assesile neh I have given corrections ngabafundisa ukuthi bayenze kuphi
438.	I problem then the next one I would say before bangena they give me
439.	that concepts abafunde ngawo last.
440.	**Researcher**
441.	**(Hmmmm. It all depends because some of the lessons they would**
442.	**say you take two hours then maybe in this one I have assessed them**
443.	**and have given corrections, and rectified their mistakes then the**
444.	**next one I would say before starting with the lesson they give me**
445.	**that concepts have learned about during the first period).**
446.	Okay. So you saying when you are given two periods you use both, you
447.	ask questions to evaluate and construct concepts. So if you are given
448.	one?
449.	**Participant**
450.	When I am given one, uku explainer kwami has to be short and evaluate
451.	and at the same time see, and ask questions about the concepts that
452.	they have learned to date.
453.	(**When I am given one, my explanations has to be short and evaluate**
454.	**and at the same time see, and ask questions about the concepts**
456.	**that they have learned to date)**
457.	**Researcher**
458.	So if you are given one period you only ask questions to evaluate?
469.	**Participants**
470.	Yes.
471.	**Researcher**
472.	Given this type of commutative approaches we have dialogic-
473.	authoritative I will explain first then you choose, and we have interactive
478.	–non-interactive which one are you going to use and why?

479.	The interactive authoritative approach: only the correct answers are
480.	credited and incorrect ones are not credited, and in interactive dialogic
481.	approach: all the responses are welcomed but only the relevant ones are
482.	credited. So between the two approaches which one are you going to
483.	use?
484.	**Participant**
485.	I would prefer the second one where all the answers are welcomed
486.	**Researcher**
487.	So you will use the interactive- dialogic approach?
488.	**Participant**
489.	Yes
490.	**Researcher**
491.	Why that one maybe?
492.	**participant**
493.	Eh….it's because you are giving the learners the opportunity to speak
494.	what they know and you correcting them, into abayaziko ukuthi okay mina
495.	bengiyazi ukuthi isebenza for lokhu uyamtjela ukuthi no, simane
496.	siyaysebenzisa for lokhu but kahle kahle umsebenzi wayo ngilokhu.
497.	(**Eh….it's because you are giving the learners the opportunity to**
498.	**speak what they know and you correcting them, teaching from**
499.	**known to unknown).**
500.	**Researcher**
501.	Alright. We having interactive –non-interactive. The non-interactive-
502.	authoritative approach it is whereby all the answers are one sided and
503.	are presented in a formal setting. And we have a non- interactive-dialogic
504.	approach it is whereby no alternative views and responses allowed but
505.	during teaching process point of views are clarified.
506.	**Participant**
507.	I would prefer explaining and clarifying everything so that learners would
508.	not have questions left unanswered on their side.
509.	**Researcher**
510.	Meaning you will use non- interactive-dialogic approach?
511.	**Participant**

512.	Yes
513.	**Researcher**
514.	Okay. Given this types of discourses (IRF/IRFRF) which one are you
515.	going to use and explain why? Discourses those are written and spoken
516.	communications in the classroom between the teacher and learners and
517.	between learners themselves. We having (IRF) Initiation Response
518.	Feedback, what is happening in (IRF) the teacher will initiate questions
519.	or pose questions to learners then the learners will respond to the
520.	question then the teacher will give a feedback. Then we have the (IRFRF)
521.	Initiation Response Feedback Response Feedback, what is happening
522.	in (IRFRF) is that the teacher will initiate or pose questions to learners
523.	then learners will respond then then teacher will give a feedback that will
524.	prompt others questions that will require learners to respond again then
525.	he gives them a final feedback.
526.	**Researcher**
527.	Iya dependa, you can do them both at the same time you know..because
528.	ungabanikeza I question lokhu ogade ufuna ukuku evaluate ukuthi
529.	ufunukbona ukuthi bafunde lokhu ogade ukfuna na? baku answer at the
530.	same time but bukenalokhu okuthi uyaba assessor, mawuzob evaluater
531.	ukuthi the point or the knowledge ogade ufunukuthi bayo gainer that day
532.	kukwenzan, lokhu ofuna ukuthi baku gainer abakakubambi to that point
533.	le wena oyifunako, so ubapha enye I question.
534.	**(you can do both at the same time because you can give them a**
535.	**question to check if they have grasp what you wanted them to, and**
536.	**you can assess them as well to check their level of understanding**
537.	**and knowledge of what they have learned, if they have not**
538.	**understood you can give them other questions to answer).**
539.	**Researcher**
540.	So what you basically saying is (IRFRF) because you give them a
541.	feedback and then you ask another question that is linked to the first
542.	question, then they give a response you were prompting again the first
543.	question then you will give another feedback because it is more like you
544.	were asking two questions

545.	**Participant**
546.	Yes at the same time angithi wokuqala umbuzo uzowuqala ukuthi
547.	bawuphendule njan, and ngayiphi indlela, and uzokgona ukubona ukuthi
548.	abakafiki to that level le egade ufuna ukuthi bayibambe , then you ask
549.	another question ubaphe I feedback clarifying ukuthi bowufuna ba
550.	answer this way.
551.	(yes at the same time, isn't that you will check how they have answered
552.	the first question, their responses will be an indication or a point of
553.	reference to you that they have not gained a better understanding of what
554.	you have taught, then you ca ask another question and clarify how you
555.	expected them to answer).
556.	**Researcher**
557.	Eh…Ma'am this brings us to the end of our pre- interview, shall we head
558.	to the classroom please
559.	**Participant**
560.	Oh…yes.
561.	**Day one post interview**
562.	**Researcher**
563.	Besides the resources you use, what other teaching resources do you
564.	use to teach the same concepts and how will you use those resources?
565.	**Participant**
566.	Hmm ngingathi ngimaphi mara because I use what engiyithole
567.	ngeclasini like izinto abazibonako and ngingathini mara. Ukungenela
568.	too much netextbook, ungaqali ngithini ungaqali lokhu abakubonako
569.	kuphela. Ngiyisebenzisile itextbook ne but like nabaphenyaphenya
570.	ngaphakathi kwetextbook they could find okhunye ngaphakathi…yha.
571.	**(I use almost all resources available to me. I also try and make**
572.	**examples so that learners can understand better). I also go beyond**
573.	**some of the resources provided like textbooks like delving deeper**
574.	**into a subject).**
575.	**Researcher**
576.	In our pre-interviews, you said you were going to use periodic table and
577.	textbook, you did not mention chalkboard; however you used it, why?

578.	**Participant**
579.	It's because it's there thana benginganayo…ngithini mara, yiresource
580.	esiphiwe yona.
581.	**(I used it because it's one of the resources provided to us).** I can
582.	say it's there, I know it's my resource and I can use it freely but it
583.	slipped my mind.
584.	**Researcher**
585.	Do you think the interest of learners towards in natural sciences affect
586.	their performance, if yes why?
587.	**Participant**
588.	Buyelela godu
589.	(**Please repeat the question**)
590.	**Researcher**
591.	Do you think the interest of learners towards in natural sciences affect
592.	their performance, if yes why?
593.	**Participant**
594.	Not really, it depends on a child. Those who are interested in natural
595.	science perform the highest and those who are not perform at their level
596.	best. it does
597.	**Researcher**
598.	How will you improve your learner's interest in learning natural
599.	sciences, remember you said those who are interested are 70% and
600.	those who are not are 30% according to your observations, so how will
601.	you make the 30% take interest in natural science?
602.	**Participant**
603.	More or less, natural science deals more with practical activities. So
604.	doing more practical work makes learners develops interest in learning
605.	more about science.
606.	**Researcher**
607.	So meaning you do more practical work?
608.	**Participant**
609.	Yes
610.	**Researcher**

611.	What support is given to you as natural science teacher, if any please
612.	give a practical example, maybe from school, HOD or CI?
613.	**Participant**
614.	We get support once a term by our CI visiting us, giving us support
615.	where I lack. I usually call my CI whenever I need help. I also get
616.	support from my principal as he is the head of science.
617.	**Researcher**
618.	Do you think the time allocated for natural science teaching is sufficient
619.	to complete the ATP or curriculum?
620.	**Participant**
621.	For my side I can say yes.
622.	**Researcher**
623.	Can you explain why?
624.	**Participant**
625.	On my side, from this life esiyiphilako, this life we are living, you need to
626.	like type lot of things in the child's mind. The little that you have given
627.	and doing a practical, then they much understand more faster. For
628.	example if you take Maths, if i Maths beyifundwa ingapractiswa
629.	uyabona kuthi it was going to be a pact kibo because they don't want to
630.	read all the time. They prefer like izinto maba…if they could see it
631.	**(In the life that we are living, you don't need to bombard learners**
632.	**with lots of theory. The combination of theory and practical work**
633.	**makes them understand more quickly. For an example, if Maths**
634.	**was taught through theory instead of doing it practically, it was**
635.	**going to be too much for the learners. So learners prefer hands on**
636.	**activities.)**
637.	**Researcher**
638.	So meaning with this with these three hours, you are able to complete
639.	the intended curriculum?
340.	**Participant**
341.	For mina yes
342.	**(For me yes)**
343.	**Researcher**

344.	Earlier on during our pre-interview, you said you were going to teach
345.	metals, semi-metals and **non-metals, why?**
346.	**Participant**
347.	Because on our ATP, it's 3 hours, so I already started with metals,
348.	today I was doing the non-metal and, the next time I will be doing the
349.	semi-metals due to the allocation of the time.
350.	**Researcher**
351.	I thought you were going to teach everything today.
352.	**Researcher**
353.	You said when you teach metal material you use modes, but I did not
354.	see you using any models, why?
355.	**Participant**
356.	The models I was using in class ngithini were the room itself.
357.	**(The models I was using in clan, what can I say were things they**
358.	**could see like window frames, walls to try and explain the**
359.	**difference.)**
360.	**Researcher**
361.	On your activity assessment that you wrote in the board, i saw you
362.	assessing them on noble gases
363.	**Participant**
364.	Yes because the first period I taught about the gases and all the
365.	different types of gases for metals, semi-metals and non-metals with
366.	that five minutes. Then I started with parties. So I just wanted to know if
367.	they remember.
368.	**Researcher**
369.	After presenting the lesson, how do you know that learners have
370.	learned or have gained better understanding of what you taught?
371.	**Participant**
372.	I give them activity to do to see where are with they are with their
373.	knowledge that I have taught them. So I just give them an activity to
374.	see.
375.	**Researcher**
376.	So if a learner does not get a total, what does that mean?

377.	**Participant**
378.	It means ukuthi he or she didn't get a better understanding on that
379.	concept.
380.	**Researcher**
381.	So you will be revisiting?
382.	**Participant**
383.	Yes we did corrections after you left and after marking we were doing
384.	corrections before they left because it's only for ten minutes, we do
385.	corrections and clarifies the knowledge.
386.	**Researcher**
387.	What ideas did you expect your learners to learn today?
388.	**Participant**
389.	To differentiate between metal and non-metal
390.	**Researcher**
391.	Why was it important for learners to learn this?
392.	**Participant**
393.	I would say It is important because they now can tell the difference
394.	between aluminum and helium. They would say that this is a metal and
395.	this is a non-metal one.
396.	**Researcher**
397.	You mean their different elements?
398.	**Participant**
399	Yes elements
400.	**Researcher**
401.	What prior knowledge do your learners need to have to learn these
402.	ideas?
403.	**Participant**
404.	Periodic table, they have to know the first 20 elements. They also have
405.	to know tell the difference between semi non-metals and metal.
406.	**Researcher**
407.	What teaching method do you prefer with material strand and why?
408.	**Participant**
409.	

410.	For me if I talk and talk and talk and see that they don't understand, I
411.	prefer like having a dialogue with my learners.
412.	**Researcher**
413.	Meaning it could be a lecture demonstration or discussion?
414.	**Participant**
415.	Discussion
416.	**Researcher**
417.	When teaching metal material strand, what did you use between
418.	examples, models, analogue or demonstrations, which one did you
419.	use?
420.	**Participant**
421.	I used examples and models. I was giving examples of things they
422.	could see in the classroom.
423.	**Researcher**
424.	Investigation, experiments, projects are done when teaching metal and
425.	material strands, which ones did you use and why?
426.	**Participant**
427.	Today I did not use any today.
428.	**Researcher**
429.	Interaction and discourse, the lesson that you presented today, did you
430.	ask questions to evaluate learners or to construct concepts?
431.	**Participant**
432.	I gave them an activity so I would see if they understand much better
433.	**Researcher**
434.	So which one were you assessing exactly, constructing concepts or
435.	evaluating?
436.	**Participant**
437.	I was evaluating
438.	**Researcher**
439.	The type of communicative approaches, authoritative, dialogic or
440.	interactive or non-interactive?
441.	**Participant**
442.	

443.	I could say dialogic to see how far or what knowledge do they have on
444.	matter and materials.
445.	**Researcher**
446.	The type of discourses you used, was it initiation response feedback or
447.	initiation response feedback response feedback, in other words did you
448.	ask questions and then learners responded and you give them a
449.	feedback or you ask and thy responded, you gave a feedback and gave
450.	them another question that will make them to respond?
551.	**Participant**
552.	I gave questions and they responded and i gave feedback.
553.	**Researcher**
554.	So you were using IRF?
555.	**Participant**
556.	Yes
557.	**Researcher**
558.	But in a pre you said you were going to use IRFRF
559.	**Participant**
560.561.	They didn’t want to submit on time because they were struggling with
562.	the books
563.	**Researcher**
564.	Thank you very much for your time, this brings us to the end of our post-
565.	interview
566.	**Day two pre-interview**
567.	**Researcher**
568.	Good morning Ma’am
569.	**Participant**
570.	Good morning
571.	**Researcher**
572.	How are you?
573	**Participant**
574.	I am good, how are you
575.	**Researcher**
576.	Shall we start with our pre-interview?

577.	**Participant**
578.	Yes
579.	**Researcher**
580.	What are you going to be teaching today?
581.	**Participant**
582.	Today I will be teaching the semi metals, from the table from our
583.	previous lesson. We were discussing the non-metals. Today we are
584.	discussing semi-metals.
585.	**Researcher**
586.	What resources are going to use for your lesson?
587.	**participant**
588.	The resources I am using is the textbook, which is the platinum and the
589.	chalkboard and chalk
590.	**Researcher**
591.	Which teaching methods you prefer when teaching a metal and material
592.	standard why?
593.	**Participant**
594.	I will be interacting with the learners to find the knowledge they have.
595.	But mostly It's interacting with the learners in a class having a dialogue.
596.	**Researcher**
597.	Why were you using the method?
598.	**Participant**
599.	Mostly is to find their knowledge, to see how far they are with
600.	knowledge and then extent their knowledge to the next level.
601.	**Researcher**
602.	When teaching metal and material strand, we use examples, models
603.	and analogies and illustrations to explain concepts, which one will you
604.	use today?
605.	**participant**
606.	I will be using examples because I could not find semi metals I can use
607.	in my science kit.
608.	**Researcher**
609.	

610.	Investigations, projects, experiments and demonstrations are done
611.	when teaching metal and material strand, which ones are going to use
612.	today?
613.	**participant**
614.	I will not be using any, I will be giving them activity and evaluate them
615.	based on the activities
616.	**Researcher**
617.	When a presenting a lesson, are you going to ask questions to evaluate
618.	or to construct concepts?
619.	**Participant**
620.	I will be doing both because I have an activity and I have an oral activity
621.	where learners will have to engage verbally.
622.	**Researcher**
623.	Given the type of commutative e approaches, we have interactive and
624.	dialogic, which are you going to use today, should I explain them again?
625.	The interactive authoritative is whereby approach is whereby you'll be
626.	crediting the correct answers and discrediting the incorrect and the
627.	interactive dialogic is where by all the answers are welcomed by you
628.	will only be crediting the correct ones?
629.	**Participant**
630.	I will be using the interactive dialogic, because this chapter there is no
631.	wrong answers, it only clarifies the right answers to the learners.
632.	**Researcher**
633.	Between interactive and non-interactive, which one are you going to
634.	use?. The non-interactive is whereby all the answers are one sided and
635.	are presented in a formal setting and in non-interactive dialogic nor any
636.	other answers are welcome but during the teaching process you are
637.	explaining and clarifying the point of views.
638.	**participant**
639.	Non-interactive dialogic because some learners think they know more,
640.	but if you credit them then next time they won't raise up their hands
641.	because you are only taking the right answers and not telling them the
642.	correct way of saying the right answers.

643.	**Researcher**
644.	Given the types of discourses, we have the IRF and the IRFRF, which
645.	one are you going to use and why?, The IRF is whereby as a teacher
646.	you will be initiating a question and learners will respond and then you
647.	give them a feedback but the IRFRF is whereby you initiate a question
648.	and learners respond and you give feedback that will prompt another
649.	question that will lead to learners responding again and then you give
650.	the final feedback.
651.	**Participant**
652.	I will be using IRF because they already have knowledge of metals and
653.	non-metals so this was just going to be a wrap up.
654.	**Researcher**
655.	Thank you so much Ma'am
656.	**Post- interview day 2**
657.	**Researcher**
658.	Shall we start with our post-interview?
659.	**Participant**
670.	Ok
671.	**Researcher**
672.	Besides the resources you used, what other teaching resources can
673.	you use to teach the same concept and how will you use them?
674.	**Participant**
675.	Every models or having a concrete thing.
676.	**Researcher**
677.	Concrete thing like?
678.	**Participant**
679.	Those rocks of….like silicon rocks or a silicon thing, it can be a glue as
680.	long as it's a silicon.
681.	**Researcher**
682.	I realised that some of the learners do not have textbooks, by the time
683.	you were asking them to read what non-metals are?
684.	**Participant**
685.	

686.	As I say 50 percent of the learners have books, in my class I have 41
687.	leaners and I had 15 books, so a group of three and four learners.
688.	**Researcher**
689.	And the ones that do not have because there was a certain group that
690.	was not reading from anywhere?
691.	**Participant**
692.	It means ukuthi kukhona oyitjhiyileko phakathi kwabo because each
693.	and every desk has to have a textbook
694.	**(It means there are learners who left their textbooks at home**
695.	**because every desk has to have a textbook)**
696.	**Researcher**
697.	If ever you give them homework, how do they manage because some
698.	do not have the books?
699.	**participant**
700.	They do it in groups and some borrow each other. Some have time, so
701.	immediately nakufika omunye ekhaya uyayithatha bese omunye
702.	uzoyithatha ngesikhathi esiso .
703.	**(The either do it in groups or borrow each other)**
704.	**Researcher**
705.	So they use interchangeably using their time frame?
706.	**Participant**
707.	Yes
708.	**Researcher**
709.	After presenting a lesson, how do you know that learners have learned
710.	and have a better understanding of what you have taught them?
711.	**Participant**
712.	I evaluated them by giving them an activity by writing it on the
713.	chalkboard and then I could see from there if they understood and 80
714.	percent of them did well showing that they did understand.
715.	**Researcher**
716.	What ideas do you expect your learners to learn?
717.	**Participant**
718.	

719.	To identify the semi-metals from the non-metals and to have clear mind
720.	of physical things of semi-metals and non-metals
721.	**Researcher**
722.	Why is it important for learner to know these ideas, to be able to
723.	differentiate between non-metals and metals and semi-metals?
724.	**Participant**
725.	At this stage they are at a stage of learning periodic table, so they have
726.	to differentiate between semi-metals and non-metals and metals
727.	**Researcher**
728.	What prior knowledge do your learners need to have to learn these
729.	ideas, to be able to differentiate between semi-metals and non-metals
730.	and metals?
731.	**Participant**
732.	It's applying the properties of material.
733.	**Researcher**
734.	Only?
735.	**Participant**
736.	Yes
737.	From your assessment, you said your topic was on semi-metals, but I
738.	realised that you also assessed them on metals and non-metals, why
739.	was that?
740.	**Participant**
741.	This period was to map up all the three properties of metal and non-
742.	metal that's what you see on the chalkboard that I wrote so they can
743.	differentiate because with semi-metals, there are few elements that they
744.	have to know. So I wanted to see if they could still remember the other
745.	ones which are non-metals and metals.
746.	**Researcher**
747.	Which teaching method did you use to teach the topic and why were
748.	you using it?
749.	**Participant**
750.	I would say I was interacting with the learners. I was asking them from
751.	the textbook they were reading to me and then giving them explanation

752.	on what was the textbook saying. And referring to the periodic table on
753.	what they know about the semi-metals in the periodic table.
734.	**Researcher**
755.	Did you use any examples to teach, because you said you were going
756.	to use examples?
757.	**Participant**
758.	Yes I did use examples on the chalkboard giving them an idea of the
759.	class works and how it is done.
560.	**Researcher**
761.	So the examples you were referring to were examples of how to answer
762.	the assessment?
763.	**Participant**
764.	Not only on that, the examples were the silicon, which one they know
765.	and I was telling them how we have different types of silicon.
766.	**Researcher**
767.	When presenting the lesson, did you ask questions to evaluate ask
768.	question to evaluate or to construct concepts?
769.	**Participant**
770.	I asked questions to evaluate. I asked questions in the classroom and
771.	they answered verbally.
772.	**Researcher**
773.	The kind of approach you used, commutative approach, was it an
774.	interactive or dialogic, interactive authoritative or interactive dialogic?
775.	**Participant**
776.	Amagama la kumele ngiwabambe serious
777.	**(I seriously have to grasp these concepts)**
778.	I would say interactive dialogic because I explained, asked questions
779.	and they were telling me what they know.
780.	**Researcher**
781.	Did you credit the relevant answers?
782.	**Participant**
783.	Yes I did because they did tell me about me silicon of the ceiling that
784.	they know, and then it’s one of the types of silicon.

785.	**Researcher**
786.	Did you use a non-interactive authoritative or non-interactive dialogic,
787.	did you explain in the process and not allow answers in the process and
788.	did you teach and all the answers are one-sided?
789.	**Participant**
790.	Asibuyelele amagama la is it non-interactive authoritative or non-
791.	interactive dialogic.
792.	**(Please let's repeat these these concepts, is it non-interactive**
793.	**authoritative or non-interactive dialogic)**
794.	I used non-interactive dialogic because they were answering me and I
795.	was correcting the mistakes they were making when answering.
796.	**Researcher**
797.	The type of discourses, we have IRF, IRFR, which one did you use and
798.	why?
799.	**Participant**
800.	I used the IRF because it was a very short and I could see they
801.	understood it better.
802.	**Researcher**
803.	So you did not have the leading questions that will prompt them to
804.	respond to you?
805.	**Participant**
806.	I did have and from the answers I got from them, I could that they did
807.	understand.
808.	**Researcher**
809.	This brings us to the end of our post-interview, thanks again for your time
810.	**Day 3 pre-interview Researcher**
811.	Good morning Ma'am
812.	**Participant**
813.	Good morning
814.	**Researcher**
815.	How are you?
816.	**Participant**
817.	I am fine and you

818.	**Researcher**
819.	I'm great
820.	**Researcher**
821.	Shall we start with our pre-interview?
822.	**Participant**
823.	Yes we may start
824.	**Researcher**
825.	What are you going to teach today?
826.	**Participant**
827.	Acid base indicators. The sub-topic is Lithium papers testing
828.	**Researcher**
829.	What resources are you going to use during your lesson?
830.	**Participant**
831.	I have a number of things I am going to use, namely acid, stanza base,
832.	neutral and two litmus papers, red and blue ones.
833.	**Researcher**
834.	You have two litmus papers, red and blue only?
835.	**participant**
836.	Then we have got the product that we are going to test whether it's acid
837.	or base and a textbook.
838.	**Researcher**
839.	Which teaching method are you going to use today during your lesson?
840.	**Participant**
841.	We are just going to do an investigation. I will give out things and
842.	learners will do an investigation on their own. Then afterwards I will
843.	correct them where they didn't do right
844.	**Researcher**
845.	Which things are you going to give out?
846.	**Participant**
847.	We've got vinegar, carbon dioxide, dishwasher, sugar, coffee, water,
848.	lemon juice.
849.	**Researcher**
850.	So those are the resources that you are going to give them?

851.	**Participant**
852	Yes
	Researcher
854.	When teaching metal and material strand, models, analogies, and
855.	illustrations can be of great use to your concepts, which one are you
856.	going to use?
857.	**Participant**
858.	We will use illustrations because we will be doing a practical work
859.	investigating lithium papers.
860.	**Researcher**
861.	Are you going to use investigation experiment projects or
862.	demonstration?
863.	**Participant**
864.	I will be using investigation experiment project. When we are doing acid
865.	base, learners do it practically and they see what acid is and was base
866.	is
867.	**Researcher**
868.	Do you think investigation will help you attain your objectives or aims of
869.	the lesson today?
670.	**Participant**
871.	It will because it’s more or less practically as we are doing it.
872.	**Researcher**
873.	So do you think using an investigation will help you to attain aims?
874.	**Participant**
875.	Yes
876.	**Researcher**
877.	Are you going to ask questions to evaluate or construct concepts?
878.	**Participant**
879.	We have got some questions at the end of the lesson that they should
880.	answer and I will be evaluating their answers.
881.	**Researcher**
882.	
883.	

884.	Given the type of approaches, commutative, interactive authoritative
885.	approach and interactive dialogic approach, which one are you going to
886.	use today, or do you need me to explain them to you?
887.	**Participant**
889.	Buyelela futhi
890.	(Please explain them to me again
891.	**Reseacher**
892.	Interactive authoritative approach is whereby you only credit the correct
893.	answer and you discredit the wrong answer.
894.	**Participant**
895.	I will be using the interactive authoritative approach because it's a
896.	straight forward answer, you can't accept all the answers. They have to
897.	know the difference between acid and base.
898.	**Researcher**
899.	So you will be using an Interactive authoritative approach?
900	**Participant**
901	Yes
902	**Researcher**
903	Between non-interactive authoritative approach whereby the answers
904	are one sided and are presented in a formal setting. And non-interactive
905	dialogic approach is whereby no other answers are welcome but you
906	will be explaining during the process of teaching, which one are you
907	going to be using?
908	**Participant**
909	Non-Interactive dialogic approach to test each and every learner's level
910	of understanding.
911	**Researcher**
912	Given the type of discourses, we have the IRF that is Initiation
913	Responsive Feedback and IRFRF, which is Initiation Responsive
914	Feedback Response Feedback. In the IRF is whereby you initiate
915	questions and learners will be responding and you give feedback. And
916	in the IRFRF is whereby you initiate questions and learners will respond
917	and you give a feedback and while you give a feedback you will be

918	prompting other questions, where learners will be able to respond again
919	and you will give a final feedback.
920	
921	I will be using the IRF because whatever we are going to observe, it's
922	going to give us a straight answer.
923	**participant**
924	This brings us to the end of our pre-interview. Shall we head to the
925	classroom?.
926	**Teacher**
927	Okay
928	**Day 3 post interview**
929	**Researcher**
930	Ma'am shall we start with our post-interview?
931	**Teacher**
932	Yes
933	**Researcher**
934	Besides the resources you used, what other teaching resources can
935	you use to teach the same concepts and how will you use them?
936	**Participant**
937	It's having more household things from our home as I have selected
938	few. So I need to have more resources from our home products.
939	**Researcher**
940	Do you think the interest of learners towards natural science affects
941	their performance, if not why?
942	**Participant**
943	I would say no, it depends on a child on how much he or she likes the
944	science subject. Seventy percent of the learners would like the subject
945	and 30 percent more or less are not into it.
946	**Researcher**
947	After presenting the lesson, how do you know that learners have
948	grasped a better understanding of what you taught?
949	**Participant**
950	

951	I have given them questions after we've done an investigation to see
952	how much they have understood what they have been taught.
953	**Researcher**
954	What ideas did you expect your learners to learn?
955	**participant**
956	To differentiate between acid and base because before they couldn't tell
957	the difference between the two.
958	**Researcher**
959	What ideas did you expect your learners to learn?
960	**Participant**
961	How to use lithium paper and how to differentiate using a lithium paper
962	**Participant**
963	Why is it important for learners to know these ideas?
964	**participant**
965	To differentiate because to them everything was the same, they couldn't
966	tell what is acid and what is base.
967	**Researcher**
968	What prior knowledge do your learners need to have to learn these
969	ideas?
970	**Participant**
971	They needed to know about the testing of substance, how it feels and
972	taste.
973	**Researcher**
974	You mentioned that you will be using the chalkboard, but I didn't see
975	you using it, why?
976	**Participant**
977	It's because learners where not asking questions. That to me indicated
978	that they understood what I was teaching.
979	**Researcher**
980	I saw learner answering with the tick on the paper instead of writing,
981	was it because they did not understand or the question itself was
982	ambiguous?
983	**Participant**

984	In the paper we have three columns, the first was using the colour with
985	the red lithium, the second was using the blue one and the last was
986	when you have to say acid basin and one learner asked if they have to
987	tick or write and I said they have to tick because that will indicate
988	whether it falls on the red or blue lithium and then at the end it was then
989	they had to write specific answer.
990	**Researcher**
991	Before you assess them or gave them questionnaires to answer, I did
992	not see you explaining these terms, what is the acid or base or neutral,
993	why?
994	**Participant**
995	I explain the concepts in our previous lesson. Today was just about
996	testing them as they know what they are.
997	**Researcher**
998	You explained the terms in your previous class?
999	**Participant**
1000	Yes because yesterday was about a short lesson of testing things. It
1001	took about 30 minutes.
1002	**Researcher**
1003	So the aim for this lesson was for them to test but they do know what
1004	the acid or base is?
1005	**participant**
1006	Yes
1007	Why did you only use household material or substances?
1008	**Teacher**
1009	I decided to use the household substances as learners are used to
1010	them from home. I did not want to endanger them because some of
1011	them suffer from sinuses.
1012	**Researcher**
1013	The investigation that you did, is it going to be formally recorded, is it a
1014	formal task or is it an investigation for them to experiment?
1015	**Participant**
1016	

1017	It was for them to understand more about acid, base or neutral, it's not
1018	going to be a formal investigation.
1019	Researcher
1020	Do you think that this investigation has attained the aims of your
1021	lesson?
1022	**participant**
1023	Very much because it was practical and they did observe the acid and
1024	the base from the investigation.
1025	**Researcher**
1026	Checking with the CAPS document, this you were supposed to teach
1027	the acid, base and neutrals but you are teaching periodic table of
1028	elements, what could be reason
1029	**Participant**
1030	The reason for that is that I swapped the two topics because for the
1031	past two weeks, I wasn't attending as frequent due to some other
1032	commitments so I decided to give them periodic so they could
1033	familiarise themselves with it and periodic table is much simpler to learn
1034	by themselves than the acid, base and neutral. I had to be there when
1035	they learn these substances as they are dangerous.
1036	**Researcher**
1037	What was the aim of you posing the questions to the learners regarding
1038	the investigations, were you doing that to evaluate or construct
1039	concepts?
1040	**participant**
1041	I was evaluating how far they are with the knowledge they are gaining.
1042	**Researcher**
1043	That's brings an end to our post-interview. Thank you very much
1044	Ma'am.

APPENDIX: I
JOHN INTERVIEW TRANSCRIPTS

DAY ONE: PRE-INTERVIEW

Sir, can we have our pre interview,

Yes, Ma'am

How long have you been teaching natural science in the senior phase?

Ma'am I can say, now it more than 15 years, even if I do have accurate years

What teaching qualification do you have?

I've got secondary teacher's diploma and also further teacher's diploma in management, with university of Potchefstroom and also BTech degree in education management with the university of Technology.

What are your major subjects?

It is maths and physical science

How many periods are allocated for Natural sciences per week?

6 periods, yes

How long is each period?

Each period is 30 minutes, so I do have double period which is one hour on Monday and on Friday also I have singles on Tuesday and Wednesday

So in total, they could be?

They are 6

What are you going to teach today?

Today, I will be introducing periodic table

What is a periodic table?

Periodic table is nothing a way in which elements are ordered and grouped according to their behaviour.

Do you gave a challenge in teaching the topic (periodic table)?

Yes, I do have a challenge, remember if we talk about an elements our learners do not know what is an element and how does it look like because they cannot see it, unlike in advance schools were they have laboratories. They know Carbon, Phosphorus because they can see it with their baked eyes.it is unfortunate because we teach them things they cannot see.

Do you think the socio-economic background of learners affects their performance in the subject? Please elaborate

Yes, Remember in the intermediate phase they don't talk about the periodic table it is only introduced in grade 7. Besides that looking at their backgrounds, where they come from you will see that some of their parents they are not educated, some they dropped out, some they are not interested in education that is where we having a problem with these learners. Because parents who are cooperative in our schools are those that are educated or professionals, we can work well with them. but coming to parents who dropped out instead of making their learners to love school and education they come and fight here at school. Their background does affect their performance hence they cannot perform well in the classroom actually they are not interested in learning at all.

So what do you do to encourage them to be interested in the subject?

As you know that I am a pastor, I am also a motivational speaker. What I normally do I invite my former students who are in varsities and those that are working who are professional to come and motivate them.

What resources to teach support natural science

That's where our problem is! We do not have enough resources but the department has given us a small box, trying to put everything inside those apparatus but unfortunately they are not enough. But they are there

Do you conduct experiments?

Yes, we do conduct experiments

Where

We do not have laboratory, we simple conduct it in the classroom. That's where the problem is, because some you need to burn something and that is what we fear the most and that's we cannot do experiments in the classroom but we conduct experiments because we do not have enough space

When you conduct flammable experiments, you do not do them in class?

We do conduct them in class, like the other where we burnt spirit, yes they were doing it in the classroom.

What resources are you going to use today during your lesson?

Today, am going to use textbook as well as the handout on periodic table, yes

Alright, what is the performance in natural science in your school?

The performance of natural science I can say, is not good so much that at least they are passing. Ya, they do perform.

What contributes to that, performance maybe

The performance being not good is that, these learners they are new because of these transition, they are from Intermediate phase they are new in the senior phase. You will find that, that transition, they don't cope, ya they don't cope with what we are doing in the senior phase but this problem is general in all the schools, if you check, grade 7 they don't perform the way we want. But ultimately they do perform

What prior knowledge do your learners need to learn matter and material in the senior phase

Matter and material neh

Yes

Yeey, because matter and material is everything because when we talk of material even the clothes we are wearing. so prior knowledge actually is something they know its just that, ive bee known to them these are the materials, for instance the prior knowledge what we are teaching in grade 4 & 5 we are teaching them about raw material, we have raw material, we also have manufactured material so when they come to grade 7 they exactly raw material and manufactured material. Raw material I can say wood. They can see wood, tree it is a raw material, but out of that wood now we can have manufactured material, you find papers, you find so many things that are made from this wood, so manufactured and raw material

Do your learners have misconceptions?

Yes, they do have misconceptions, because these learners are, remember we are talking about grade 7 and their age is 13 and some 12, 13, 14, and very very young and some u'll find that they are confusing the concepts. The conception is there for instance when I teach them in the first term, I was teaching them eduosperms and chinosperms, you find now that they confuse the two. Monocord and diocord you, they don't understand exactly which one is this one or the other.

How then identify them and correct them?

Yes, for instance under diocorse

Particularly in matter and material

Especially in matter and material, ya yes, the misconceptions there you find that they don't understand when you talk of a property, properties, what are these properties of a material. Also to say properties are not maybe made of matter and material. Omunye will say this brick, for instance this brick is made out of mixing what you call water and soil and cement, you see and they are confusing the properties of the brick. You will find that the brick is strong is very hard. When you say give me the properties, sand and water, that's where you find that they are confused but you want to tell them the strength, when we talk of the properties, but then we say the strength of that property. When you talk of the properties I mean this material is made out of then you mention, maybe a paper is made from wood and glass is made from sand and those are not the properties. The properties is hard, strong, light, heavy, waterproof, water resistant and so on.

And how do you correct them?

Yes I do correct them, show them the difference to say maybe a stone, is this soft or hard and they will say the stone is very hard and you tell them that those are properties. You take a cloth, how is your shirt is the shirt soft or hard. No my shirt is soft and those are the properties you see. You find now, they can differentiate between the two and they will say oh these are the properties and not the characteristics of matter and material and properties of material and so on

Do your learners have interest in learning natural sciences?

Yes they have interest. I think every leaner have interest its just that where we come from maybe you find a teach you was never trained to teach natural science but teaching natural science and that teacher does no interest in that. But if you find a teacher who has trained in natural science but definitely am telling you every learner will enjoy the period. Because they want to work practically and do things practically because if you going to teach them and with notes, classwork they will end up hating that subject.

How will you know, your learner has grasp a better understanding of what you taught

After some practical work, and after I taught them I make sure that I give them a classwork and homework and they will write it down of what I've taught them

Which teaching methods do you prefer using when teaching matter and material strand and why

I think we have so many methods but I think this one of, demonstrating. Yes I think it's the best, because now we talking about something they see, something that they know, something they can touch, something they use in their daily lives situation so demonstration is the best.

When teaching matter and material strand the use of examples, models, analogies and illustration can be of great use when explaining the concepts. Which one are going to use and why?

Example is very important and illustration you must have examples in whatever you are doing because you cant teach learners without giving examples so they learn from these examples. My example will be simple, very simple and straightforward. I will tell them to go outside and pick up stones, when they come with that stone it will be an illustration, am going to illustrate, am going to demonstrate, all those you have mentions they will also fit in that. They will say this is a stone, so this is just a raw material but out of this stone, we are able to make so many things. What can we make from a stone, they will mention you find this beautiful stone, cemetery rock and other stones are so beautiful, which are used in our daily lives situation. I will say is it soft or hard and they will say it was hard you see. Those are examples, those are the illustrations

Investigations, experiments projects and demonstrations are done when teaching matter and material strand, which one will you use and why

Investigations are the best ma'am, what kind of material do I want them to go and investigate about. If the I want them to investigate clothes so they will have to look at the label of a clothing, to say okay my shirt cotton whatever, cylicon or whatever, you see now and they will also look at the percentage and where do we call cylicon and where do we get wool all those things are manufactured material and they are deriving from raw material so investigation they will be learning so many things. Okay, they will be saying this paper is made out of ahh wood. Wood is very hard but

funny enough it can make paper, so they have that idea and they want to learn more. How this wood turns into a paper, it is a process, you see its another process of making a paper. How dowe make a paper

The activity mention above, how will it help in attaining the aims of the lesson, if yes why

Exactly ma'am the lesson because you must teach about these materials. What are these material, what is material so that now, they will know that they are very much important and will know exactly why should we protect our environment. That's where environment comes in, that we must protect our environment. Because why in that we find some of the materials, we find wood, we find stone, you find sand all those things are important to make seramac, to make glass. So to protect the environment is very much important because we get a lot from that environment

When presenting a lesson today, are you going to ask questions, to evaluate or construct concepts?

It depends ma'am sometimes you have to ask, remember you must take a leaner from known to unknown, simple to complex. You cannot just simple ask them questions if they do not know anything, so you ask them because they know something. You cannot ask them something they do not know you see. So questions are something that is very much important but on something they know because you take them from known to unknown, from simple to complex and also when you construct you will find out that, there is no need for you to ask question, you simple construct

Okay, given the type of commentator approaches, am going to explain them first. we have the interactive, authoritative approach, An Interactive authoritative approach is, crediting correct answer and discredit the incorrect ones. We have interactive dialogic approach, whereby all answers are accepted but only credit the relevant ones. Which one are you going to use today?

I like the second one,

Interactive approach

Yes, these are the little children that we are teaching, sometimes give them a chance to voice their views. To allow all of them, then after that you reconcile maybe you come up with correct answer, to say no this one is wrong because of this and this one is right because of this

Alright, and we have the interactive and non-interactive approach. The non-interactive approach authoritative one, the answers are one sided and they presented in a formal setting but the non-interactive dialogic approach will welcome other responses but you are explaining during your teaching process the point of views

I don't welcome the?

The other responses, but you explain during the teaching process the point of views

Yes, the first one

The first one, the answers are one sided

I think the second one is correct because we trying to be one sided, we want to hear their views, opinions, so that they become broad in everything that they do. Because this one of one sided, it seems as if you are channelling them towards a certain thing but yes of which is also good but then now you are channelling them but then now let them explain the way they want, they are ask so that at the end you come up with a correct answer

Given, the type of discourses, I will explain again. We are having we are having IRF that is the initiation response feedback. Whereby as the teacher initiate the questions and learners will be responding then you give feedback. and then the IRIF is whereby you initiate a question and they give you response, then you give feedback. What is happening the teacher is asking the question and learners will be responding while you are giving feedback as the teacher, you will propt other question to leaners and they will respond again and you give final feedback. Which one are you going to use

I like the second one because its continuous. Actually if you can look it very well you keep on saying FRI waya waya , it is continuous because we do not stop learning. So even you sure your learners understand, the will also come with another question so I think the second one is good because it also helps the teacher to study because they will come up with questions that you cannot be able to answer in the classroom, now that you allow these kind of question and answer, it also develops a teacher. I like this one

Thank you very much, this brings us to the end of our interview shall we head to the classroom.

Thank you ma'am lets head to the class grade 7

DAY ONE: POST INTERVIEW

Sir, shall we begin with our post observation interview? Besides the resources you've used, what other teaching resources can use to teach the same concepts? How would you use such resources?

The same concepts? Matter and material?

No, the periodic table

The periodic table, exactly beside what am doing now. I would love to take my learners to a laboratory, where I can show them these elements so that they can see them practically that this element you cannot store, you can only store it in paraffin something like that, because there are other elements that you cannot expose them, they are always under certain liquid. So, I wish I can take them to laboratory so they can see, you see, some you can touch with your bare hands and some you must use clove because you cannot touch them

Do you think, the interest of learners towards Natural science affect their performance in the subject?

Yes, exactly because if a child does have not interest, that child will perform badly, poorly because of the interest. So the more you have interest in the subject, there are those possibilities that you may perform better

How will you improve your leaner's interest in learning Natural science?

Exactly, we improve them by showing them the careers, you see that if you want to become a doctor you will never become a doctor having done Natural science, you will never become a nurse if you do not do natural sciences, a pilot you see and other careers that we have. We talking about Michael' Schumacher the one who went to see beyond our planet. The person went to see beyond our planet you see. He went to the space there, you see the very same experience of Natural science. The idea, why what is it that is in the space, you see is there any life outside our planet, and

that is Natural science. So interest you tell them if you want to become very very rich an earn lot of money Natural science is the key

What support is provided to you as a natural science teacher, if any please specify? From your HoD, Natural science HoD and the principal and CIs?

I am the one who is responsible for Natural science, here at my school so I do have teachers who are teaching natural science whom am working with, whom am working with and supporting but basically I have this good relationship with my CI, Daphiny Mogopa, of which whatever problem we come across with she is ready to support us

Do you think the time allocated for teaching Natural science is sufficient to complete, or cover the intendent curriculum

NO NO NO, the time is too little you cannot complete the curriculum I must say. It is only now maybe second term that we have tried but in the first term you cannot finish that work during first term,

If the work is not finished, what do you do?

Yes, as usually I conduct morning start and I come on Saturday to finish up the work.

During our pre-interview, you mention you will be using the textbook and periodic table and you did not mention the chalkboard but I saw you writing on chalkboard

Yes, I took it for granted, but also the chalkboard is very important, because that was only our only resource that we had in the past, where you find that now we don't have enough textbooks everything is explained on the chalkboard. Yes Ma'a sorry for that.

After presenting a lesson, how do you know learners learnt or gained better understanding of what you have taught?

Yes, for instance today as I was introducing periodic table I wanted them to count or to mention all the elements from 1, Nitrogen until calcium number 20, of which I cannot say all of them managed to do that. But few of them managed to go to the chalkboard and managed to write those elements even though they did not manage to write them all but now they can try. Because now it was the first time for them to learn about this periodic table

What, Ideas did you expect your learners to learn today, particularly in the periodic table

Yes, you know we have people, like Dmitri Ivanovich Mendeleev who was a Russian; this person was so intelligent he was a scientist. I wanted them to know they can also invent and they must never undermine themselves we have people who have invented so many things. And why now today elements, they must know what is this element, so at the end of the day we want to see them when they talk of elements like water, I mean water is made from H2O, its hydrogen 2 molecules of hydrogen plus oxygen when you form the two comes water, so water is made from sodium, cloren it makes what, it makes salt, so at the end of the day they must know this elements are so much important. Without elements, actually there is nothing

Why is important for your learners to know this ideas

Yes, like I've said they must know that they are much important that in their daily lives situation. Food that they eat, whatever that they do they are originally from these elements

What prior knowledge do your learners need to have to learn these ideas?

Ya, not necessarily they need to know exactly but teaching element it becomes like something is new to everyone but they must know that things are not like the way they are but there is something that made those things to be, what they are. For instance like I said if you look into everything, even things that we eat. Elements that are being included, chemicals that are being included even th soap that we use to wash/bath with there are elements that are being included there. So the prior knowledge is to say, in whatever that we eat, in whatever we do. Elements are all over even in those materials you'll find that there are elements that contributed in making that manufactured material

During your lesson I heard you explaining or touching on matter, what was the link between periodic table and the matter?

So that is why, you will find that matter is being taught from at an early grade in grade 4 and grade 5, they will tell you what is matter because natural science is matter on its own. You cannot teach natural science if you do not know matter because everything that we talk about in natural science is matter. So I wanted them to remember to say matter is something that has got mass, something that can occupy a space. So

whatever that we teach in natural science it is a matter. So according to me that definition it must be repeated. I mean every teacher before you can teach to say what is a matter, so they must know what. Because, like you teach maths, when you come to class you start with, maybe multiplication everyday, you want them to, that mental you see.

What were you trying to attain, when you talked about matter while teaching periodic table? Was there a link?

Exactly, the link is there.

What was the link?

Because matter, they must know that, this there something that any substance or anything that we say is a matter there are elements that have contributed in making that matter. Anything, when I say anything but in that anything there are some elements in that anything

Did you use any examples, maybe today in your lesson, models or analogies or illustrations?

Not necessarily that, because it was just my introduction. Actually am still going to go deeper on that to say, when you talk of hydrogen. What is this hydrogen you see. Today it was just a skeleton that, they must know this periodic table even if they cannot know all the elements but at least if they can know 20 of them. It was just a skeleton today, introduction

Did you use any investigations, experiments, projects and demonstrations?

What I've used there, at the end of the lesson they must go home and investigate what are these elements. So am expecting them tomorrow when they come here, some thy will say, mina I've seen this and I've seen this, I've learnt this. Now that's where we will try to explain the correct thing

When presenting, whenever you were asking questions, where you evaluating or you were constructing concepts? Particular on this lesson

Especially today, I was just evaluating to see, want to see whether they have managed to grasp 20 elements at that short period of time. So they are still young so it's a new concept but, I've seen they are trying. So I can say yes, I was evaluating

And the commentative approach you used, was it a interactive authoritative or interactive dialogic approach

Yes, it was interactive because I allowed them to come on chalkboard to interact with what I was saying

And the type of discourse was it IRF or IRFIF

Ah presently I cannot say both of them because actually there no so many questions that were asked but we will see tomorrow, as we will be now embarking on this now to teach them and also to ask them but today with the knowledge they have, tomorrow we will be able to answer the very same question that you are asking

This is because, earlier on, you opted for IRFIF because you said you will ask them and they give a feedback, or they give a response and you feedback and probe questions. But while in a classroom, I realize you used an IRF whereby you initiated a question they answered correctly, some incorrectly but some gave a feedback

Like I've said ma'am the second one you will see them tomorrow, because now tomorrow we will be going deeper trying to understand this and they will ask you so many questions and we try to answer them, they will come up. hence I've said yes both of them are correct but sometimes we must not channel them we must not limit them because there are so many things that we going to even as a teacher you will be surprised that some of the question they give a teacher a problem. Ya because these are learners that are using technology you see. Even they google, they do so many things

This brings us to the end of our post interview. Thank you very much for your time. We will continue tomorrow

Thank you ma'am, yes we will continue, I believe today its enough.

DAY TWO: PRE- INTERVIEW

Sir, can we have our pre interview,

Yes, Ma'am

What are going to teach today?

Like I've said, yesterday in a previous lesson, we are going to continue with our periodic table so what we will be looking at actually we are going to unpack the periodic table. As you all know that it is made up of three different types of metals. So that is what we are going to look at today

Okay, what resources are you going to use?

I'm still going to use the handout of periodic table, the textbook as well as the chalkboard

Okay, which teaching method during your presentation?

I am going to use different methods, because we want to check whether if they going to understand. Question and answer will be used. Demonstrate also to come maybe, what can we say that one, where they will be come on their own and write the names on the chalkboard there. So meaning that everyone is going to be involved together

Okay, when teaching matter and materials, when we use examples, models, analogies and illustrations to explain concepts. Which one are you going to use today and why maybe?

Ma'am, actually I want to use full demonstrations or full illustration but unfortunately, as you know we do not have laboratory that's where my problem lies, but am still going to try maybe as am going to explain to them that this type of elements you can find them at laboratories some you keep them under a liquid. Like for instance mercury an bromine and other elements, so it's just unfortunately we do not have laboratories but we are trying by all means to illustrate, maybe in their minds they will have something that like an element looks like this. Its just unfortunate

Okay, investigations, experiments projects and demonstrations are done when teaching matter and material strand, which one will you use and why

We are interested in investigation but at the end, they can now go and do a project you see. But now we are interested in investigation. For instance we learn yesterday that demintry mendaleph, came up with periodic table in 1860 and then by then he discovered there were 63 elements. But now they are so many, they are so many many in such a way that they are more than 100, you see they are more than 100 elements but he discovered only 63. so it is up to us as learners to investigate where does other elements come from, you see, why 63 and why now they are more than 100 you see

Okay

Yes

Do you think the investigation you going to use will assist in attaining the aims of the lesson?

Exactly ma'am even if we are not finishing with our investigation today, but as times goes on maybe as they will be going out and research, as they will be going out maybe and google they will come up with that. So at the end of the day, even if its not today but definitely it is going to assist them a lot

Alright**!**

Yes

When presenting a lesson today, are you going to ask questions, to evaluate or construct concepts?

Both, am going to ask question to evaluate the work we did yesterday and also to construct to continue where we ended yesterday.

Okay, given the type of commentator approaches, we have the interactive, authoritative approach, am going to explain it to you. An Interactive authoritative approach is, crediting correct answer and discredit the incorrect ones. We have interactive dialogic approach, whereby all answers are accepted but only credit the relevant ones. Which one are you going to use today?

I will use the first one, because for instance yesterday we managed to mention 20 elements, from 1-20 hydrogen until calcium. so we can never say to allow them even the wrong answer to say maybe we will come up with the answer at the end, no immediately when you ask what is number 6, element number six, obvious it is carbon so if the answer will be nitrogen no you see. At that time you will be saying no because it is not nitrogen but it is carbon, why carbon because carbon has got 6 attoms that is why it is in number 6 and 6 protons as well

Alright, and we have interactive and non-interactive approaches, the non-interactive authoritative is whereby the answers are one sided and are presented in a formal setting. Non-interactive dialogic approach is whereby you do not allow other responses, but you are explaining the point of view I the process

Yes, the second one ma'am, because…

The dialogic?

Yes, we must allow them to ask whatever question they may have and that is going to help us a lot, because especially this chapter on elements, matter and materials you learn a lot. So we cannot discredit them, everyone is going to be allowed

Okay, given, the type of discourses we are having we are having IRF that is the initiation response feedback. Whereby as the teacher you will be giving out the questions and learners will be responding then you give feedback. and then the IRIF is whereby you initiate a question and they give you response, then you give feedback., whereby they can still trigger the question or give them a new question all together and they give you response and you give them a feedback

Yes, I think today we will be looking at the first one, but I believe tomorrow, as we will be finishing the chapter, we are going to use the second one. Meaning that, they will have more information, which need to be answered

So you will be using the IRF

Yes, the first one

Why maybe?

Today, I'm only interested in answers that are on their textbooks, so I don't think they will come up with other questions because now, if I say where is matter is situated on the periodic table, the answer will be on my right hand side and where are my non matter, on the left hand side and semi-matters are in the middle. Those are types of questions we are going to ask today

Ok, That bring us the end of our pre interview, shall we head to the class

Thank you so much ma'am

DAY TWO: POST INTERVIEW

Researcher: shall we begin with our post observation interview?

Teacher: Yes,ma'am

Researcher: Besides the resources you've used, what other teaching resources can use to teach the same concepts? How would you use such resources?

Teacher: Unfortunelty ma'am, we do not have but I would like for instance, ive seen this programme on TV, Edu, Edu what what they were busy with this periodic table. Wow I must say was great so I think maybe if we can organise such tapes and play for this kids, learners. I believe they can understand it better. Because the issue of laboratory

seemingly is failing because we do not have a laboratory you see.

Researcher: After presenting a lesson, how do you know that learners have learnt or gained a better understanding of what you taught?

Teacher: I have tried asking questions, like where is the metals situated on the periodic table, they have to managed to answer correctly and I also gave them classwork to write on what we learn today

Research: What Ideas, did you expect the learners to learn during the lesson?

Teacher: The ideas from the see the symbols from periodic table they must never think that those symbols are all the elements that with those symbols. For instance sodium the letter for sodium is Na which is the latin word or latin name which so they must never confuse themselves when the see that name latrium and automatically element will start with that symbol you see!

Researcher: Why is it important for your learners to learn these ideas?

Teacher: Ja, because if they fail to understand now it will be difficult for them because they will learn about this element through their lives.

Researcher: What prior knowledge do your learners need to have to learn these ideas?

Teacher: The prior knowledge is amazing the food that we eat has got those chemicals or element like water, we mention water, that water is made out from two molecule of hydrogen plus oxygen to form water. The knowledge is there but they are not aware that elements form part of daily life situation

Researcher: In your lesson today, you touched on metals, non-metals and semi-metals, I did not see neither hearing you explaining, what semi-metals are, metals are and non-metal, what was the purpose for you to mention them?

Teacher: Exactly here, I actually wanted to bring something practical

Researcher: Something practical like what

Teacher: **Maybe a metal, so they can see this is a metal and something that is not a metal and something that is semi-metal. So I must go look after those things so that tomorrow when I explain what metal I must have it in my hand, when I explain what semi-metal I must have it in my hand also a metal. So explaining these terms without seeing it, its difficult its confusing because now when you explain those things are metal what do you mean you see. A metal can be steel, iron something like that is metal. So what does that mean, so you want to tell me all those element are metals so you must prove that. So I think tomorrow I must come with good examples, if I fail to bring tangible things I must have good examples from the textbook or maybe picture that this is a metal, maybe we will have to go and google see semi-metals pictures on semi-metals, pictures on non-metal so that they must not confuse these, I could not explain this to without the practical or the illustration**

Researcher: so what was the purpose for bringing it up, during a periodic table lesson?

Teacher: **Bringing up the?**

Researcher: the Terms, because we do not have periodic table

Teacher: **The terms, meaning we do not have the periodic table if we do not mention this. So a periodic table to be a periodic table it must have metals, semi-metals and non-metals so but the now we have homework, so that we can explain to learners what are these things, maybe to show pictures**

Researcher: and you also mention water, sodium chloride during the lesson what was the purpose of that

Teacher: **the learners for grade 7 are still very very young to learn those things, those are at matric level, but now it is very very important to understand that these elements are there. Maybe you can see a periodic table as a picture it is not a picture, we find reality on that periodic table. They must understand very very important, information of water,**

information of salt, information of everything that we come across in our daily live situation that is why I included that in my presentation however their capacity thy are still very very young as time goes on they are going to learn and when they arrive at matric they will remember these things or by the way Mr jiyale once said when I was doing grade 7

Research: you also mentioned that, you were going to use illustrations but I did not see any illustration during the presentation

Teacher: **Ya, maybe the resources that I have but I think ive tried to use my handout periodic table, also to say, on this periodic table we find metal and other staff though it was not an illustration but at least something of that nature we have touched it**

Researcher: This brings us to the end of our post interview sir,

Teacher: **Thank you ma'am**

Researcher: Thank you sir for your time, I will see then tomorrow

Teacher: Actually I have requested learners bring item stuff, Though it is not in their level but it will help us that they know these elements that, these elements are so much important in our daily lives situation. Yes, thank you ma'am

Researcher: Thank you

DAY THREE: PRE-INTERVIEW

Shall we start with our pre-interview.

Thank you ma'am, let us start

What are you going to teach today

Today ma'am, I just want to finalize, the chapter we started a day before yesterday n periodic table. Today as you were seeing in the past two days. Introducing periodic table, we look at the one who device this period table and Also we looked at the number of elements that are on the periodic table. So yesterday, they were writing a classwork. Today, what we are going doing we will be correcting that classwork, meaning that we will be doing correction then as well as trying to look at the where do these

elements where are being used in our daily lives situation, for instance particular in food that we eat we going to whether they have chemicals or do they element in those foods. That's what we will be looking at do today

Okay, what resources are you going to use today during your lesson?

We are going to use a textbook, chalkboard, as well as that handout but today I also have some, what you call plastic. Can I say plastics that carry what bread, sugar? The containers, so to say, can I say the containers, the bottle of water, and then plastic for bread, plastic for sugar. And I believe even in the classroom we will be having other containers, therefore we will be looking at hose containers do they contain elements included in those food or not

What is the purpose for bringing the plastics, sugar plastics and bread?

The purpose ma'am, is to connect what we learn in the classroom with what we do or what we eat. These learners must know this education is their life. When we talk of natural science, we are talking about their life. If we remove life, there is no natural science. So they must know, that these elements, they are reading about in the classroom, they are there in our daily life, for instance in the morning we wash ourselves. They must also look at that soap, do they have elements you see. Hence we are talking of a matter, when we talk of matter ma'am everything everything so you must also check, do we have elements even the *cent/sand* outside remember a cent has got aluminium has got other stuff minerals and so on

Which teaching methods are you doing to use to day

Demonstration Question and answer, ya,

Are you going to any models, analogies and illustrate to explain concepts

Yes, am going to use illustrations, am going to illustrate using the very same resources that I have, they will be looking at the different containers that we have. Each and every one will have that moment or opportunity to say what is written in his resource. Therefore in that way, we will be able to see what is being illustrated in those resources

Are you going to use any investigations, experiments and projects demonstrations today?.

Yes ma'am, we tried to use investigations, even with myself when I deal with this topic I keep on investigating, I keep on researching because you

must know exactly, eh right now they are saying there is this food that is causing maybe sugar diabetes, causes what. We must know all those food and then we must also check why this food, what are the elements, wat are the chemicals that are being used, or the mineral that are being used, in that particular food. When there's, when they talk of fats you know exactly what are the consequences of eating too much fats, of eating too much carbohydrates, of eating too much sugar, you see. You must know that, so investigation continues as we teach these very same subjects we are going to investigate

Do you think, investigation will help you in attaining the aims of the lesson?

Definitely, I believe even if the investigation that they are busy with now is continuous. Isn't these learners are in grade 7 as they go to grade 8, this periodic table on its own is unfolding now. Meaning that, it becomes the level it's also growing when now, they are combining elements, they combing two elements to get the product, they combine three elements you see, so it is continuous but I believe ultimately they are going to get what they want to know as far as the periodic table is concerned

Are you going to ask questions to evaluate or construct concepts today, during your lesson?

Both, we are going to evaluate for instance yesterday we were looking at the symbols as well as the names. Where when we talk of sodium derives from a Latin word natrium that is why the symbol of sodium is NA, because it is from a Latin word natrium. So we must always keep on asking them what is the symbol for potassium maybe someone will say its P, of which it is not P. P is phosphorus and potassium is K. We are going to evaluate asking them question and also we are going to construct at the end

The type of commutative you going to use is it an authoritative, interactive authoritative or it will be an interactive dialogic

Can you explain them again, as I have forgotten them?

An Interactive authoritative approach is whereby you crediting correct answer and discredit the incorrect ones. We have interactive dialogic approach, all answers are welcome but only credit the relevant ones

The first one, because we must look at the periodic table so I don't think other answers except the ones from the periodic table are going to be

welcome but however it is important to hear their views, but today we will be just looking at the one will be concentrating on that particular topic or subject

So you will be using the interactive authoritative approach. We have the interactive and non-interactive approach, non-interactive authoritative approach its whereby, answers are one sided and are presented in a formal setting and the non-interactive dialogic approach, its whereby no alternative answers are allowed but you are explaining the views during your teaching process. Which one will you be using today?

The second one, does not allow

Yes, but you are explaining during your teaching process

Yes, that one is correct because , I keep on explaining so well when they bring their view opinion, it will depend on how relevant are their views. Then if they are not, they are not allowed

So you will be using non-interactive dialogic approach

Yes

given type of discourses we are having we are having IRF that is the initiation response feedback. Its whereby you pose a questions to the learners and they respond back then you give feedback then it end there. But then the IRIF is whereby you initiate a question and they give you response, then during your teaching while you give feedback, you still probing other question, that they might be responding then or give them final feedback.

Today, lets look at the second one. I so wish my class was so active, the second one was going to be more relevant today because everyone will be interested and then to say why this kind of element is being included isn't some they are acids, some they are basers and you find them now being included in our foods. You see, some are metals how can a metal can be included. It's so interesting, so but then now they must understand, they must try to understand. You have elements such as, for instance if you can look at this one. Actually I was looking at this one, the bread you see we were looking at the minerals that are being used there, iron zinc you see so in bread. If the question may say is it iron a still or whatever you must be able to answer that. Zinc you see, how are they look like because with you

see we do not know how do they look like, we do not have laboratory. We do not have this element, they do not see them practically that's where the problem lies, so hence am saying the question can be continuous but this is just our learners, they will never ask you those questions. But if they were so active to ask you question, even if the teacher will not be in a position to answer, for instance that one of acid, is acid included in our daily lives food. We have folic acid, we find it in bread it is included. Those are questions that are continuous but they do occur in an very very active classroom. So I so wish I would have that kind of a classroom where by the learners they keep on asking many questions and in that regard we learn both of us, both the teacher and the learner you see. Maybe in those high grades, grade 9 I think maybe they can come up with many questions, but now

So you will be using the IRFRF,

Yes

Thank you very much sir, lets head to the classroom.

Okay ma'am we can go to the classroom thank you

DAY THREE- POST INTERVIEW

Sir, shall we begin with our post observation interview? Besides the resources you've used, what other teaching resources can use to teach the very same concepts? How would you use such resources?

Yes, after I have used those, material I mean those resources I believe ma'am, if we can a have a repeat again if we can have a laboratory ma'am. If maybe we do have a laboratory maybe one per municipality or one per district, it will be much better. Because I still maintain what I have been saying in these two past days. That if I can go to a laboratory and teach these learners, it will be much better to understand the elements and all these things we've been teaching about in these past two days

Are there any issues that, you'd like to add? If yes please give a detail.

Yes Ma'am, issues are there and are so many pertaining periodic table. There are so many I must say because these elements. They form major role in our daily lives situation. The food that we eat. The water that we

drink and everything that we eat, as got these elements. The issues am interested to add is that, these learners must be always aware that, these elements we must do without them they are important

After presenting a lesson, how do you know that learners have learnt or gained a better understanding of what you taught?

Wow, ma'am today the learners amazed me actually because two of them, did have some questions for instance in that, in mealie meal do we have elements, and other questions that were raise today. So it shows they understand what I was teaching about

What Ideas, did you expect the learners to learn? Particularly regarding the topic for today?

Yes, the ideas teacher when you say food that we eat has got elements. Is chicken has got elements, that was you see it shows that now they understand what we ae talking about and they are interested they want to know. So the answer was so simple to say, you must go check that packet of mix portions or whatever chicken portion so that they can see whether they have elements or not.

Why is it important for your learners to learn these ideas?

Yes, it is very important ma'am, the importance of it is that what we do I the classroom it van be taken to whatever we are doing outside. You see learning must not end in the classroom but they must take what we are learning in the classroom outside and must apply outside of which, that what they've been asking today about mealie meal and the chicken portions and so on

What prior knowledge do your learners need to have to learn these ideas?

First of all, periodic table is being introduced in grade 7 and they don't have prior knowledge regarding periodic table, however all these substances that we are using they do contain elements. The prior knowledge maybe I was supposed to ask them, does water have element but it was going to be difficult for them to answer because they didn't even know what we are talking about when we are saying elements. So prior knowledge in these grade 7, I do not think they did have that before

Did you use any illustrations because we talked about illustrations?

Yes ma'am, iv tried to go to classroom with some packet of sugar, packet of salt and other stuff to illustrate and to demonstrate to them what is this all about, so they have learnt a lot from our illustration

With the illustrations, did u attain the aims of the lesson?

Yes, because I wanted them to come rea on their own what is written o those packet of salt, packet of sugar. So they manage to read to say in this bottle of water there is calcium, okay the calcium that teacher is talking about is also included in this water, so I've manage to achieve that

This brings us to the end of our post interview.

Yes, thank you much really it was nice to be with you. Ngiyabonga ma'am I believe I'v gained a lot from what we have been talking about especially your questions they take me, to I must go back and continue with my studies

APPENDIX: J
ROSE INTERVIEW TRANSCRIPTS

Researcher: Ma'am how long have you been teaching natural science in the senior phase?

Teacher: It is about 9 years now

Researcher: 9 years

Teacher: 9 years from this school and 6 years from another school, its 15 years, I can say

Researcher: What teaching qualification do you have?

Teacher: I have a senior certificate Grade 12, where it include biology, I have a diploma SPTD for mathematics and natural science, general maths and general science and other subject like professional skills, education, didactics subjects and others

Researcher: What are your major subjects?

Teacher: general maths and general science

Researcher: How many periods are allocated for Natural sciences per week?

Teacher: I can say 4 hours 30 minutes

Researcher: How long is each period?

Teacher: 30 minutes

Researcher: What resources to teach support natural science

Teacher: We are establishing a lab, which we will do our experiments for now we have that one and other teaching resources like chart

Researcher: what are other things?

Teacher: the thermometers, benzene and others

Researcher: Do you conduct experiment?

Teacher: Yes we do, if we have those equipment's without experiment

Researcher: Where do you conduct them?

Teacher: at the Lab, that I have just told you we have recently establish

Researcher: So if you do not have resources

Teacher: **We improvise, to make the ends meet**

Researcher: what are you going to teach today?

Teacher: Elements.

Researcher: What resources are you going to use today during your lesson?

Teacher: **Charts, chalkboard, chalk, book, textbooks**

Researcher: Alright, how is the performance in natural science in your school?

Teacher: **I can say 75%**

Researcher: So it is good?

Teacher: **Very**

Researcher: why is it that

Teacher: **I think they understand natural science, I can say its those chapters they do not understand but they understand most**

Researcher: which are those chapters maybe can you elaborate

Teacher: **for now I can say base and the acid for now , ya its that one**

Researcher: So particularly, they have challenges in bases and acid in the matter and material stream

Teacher: **Yes**

Researcher: What prior knowledge do your learners need to learn matter and material in the senior phase, remember this term we are teaching matter and material, so what prior knowledge do they need in order to learn in matter and material

Teacher: **Yes, the acidic things that they use in their daily live at home, like vinegar, the salt, the sugar those things**

Researcher: Do your learners have misconceptions?

Teacher: **Yes, I think so**

Researcher: if so why, how then identify them and correct them?

Teacher: **I will see the learner by not responding to the question am asking or failing the assessment in the classroom. I can identify that there is a problem, how can identify it**

Researcher: But there are leaners who are passive naturally, even when they do understand, they do not respond

Teacher: **Yes, I know them. I know my learners to say this one is passive, this one he/she doesn't understand**

Researcher: Oh okay

Teacher: Yes

Researcher: Do your learners have interest in learning natural sciences?

Teacher: Very, especially when going to the lab, they enjoy, they are the ones who remind me that ma'am this day is for going to the lab because you have said yesterday we going to do experiment

Researcher: What make them have such interest?

Teacher: I think by touching, seeing doing the experiments themselves

Researcher: How will you know, your learner has grasp a better understanding of what you taught

Teacher: By doing the experiments themselves, following the steps, the method, using the apparatus

Researcher: Which teaching methods do you prefer using when teaching matter and material strand and why

Teacher: Question and answer, because when they answer I can see if they understand

Researcher: If they do not answer?

Teacher: I keep on asking them, changing the method of asking question. Changing the way am asking them or give them an opportunity to ask. I ask them and they don't understand, I ask them to ask questions

Researcher: When teaching matter and material strand the use of examples, models, analogies and illustration can be of great use when explaining the concepts. Which one are going to use and why?

Teacher: I will use all of them, because we use illustration and it will depend which topic are you talking about, for example now am gonna talk about the element which needs illustration so I will use a diagram, when it comes to atoms I will use models it depends

Researcher: Investigations, experiments projects and demonstrations are done when teaching matter and material strand, which one will you use and why

Teacher: **I think all of them, because they go hand in hand, which topic as I have already said it depends on the topic. Sometimes you give them assignment, sometimes a project. It depends which topic you want to tackle sometimes you give them classwork or homework**

Researcher: So particularly today, which one are you going to use? Illustration, experiment or demonstration

Teacher: **Demonstration**

Researcher: Why demonstration

Teacher: **I want to see if they can know at least 20 elements in the periodic table**

Researcher: The activity mention above, how will it help in attaining the aims of the lesson, if No why, you said you will use demonstration

Teacher: **Yes, they will know how to draw the periodic tables, how to name them, number 1 up to number 20, yes they are 118 but at least they can name the 20**

Researcher: When presenting a lesson today, are you going to ask questions, to evaluate or construct concepts?

Teacher: **to evaluate their knowledge**

Researcher: Why, maybe you use evaluation

Teacher: **to see whether they understand or not**

Researcher: Okay, given the type of commentator approaches, am going to explain them first. we have the interactive, authoritative approach, An Interactive authoritative approach is, crediting correct answer and discredit the incorrect ones. We have interactive dialogic approach, whereby all answers are accepted but only credit the relevant ones. Which one are you going to use today?

Teacher: **The one that credit the correct answer and discredit the incorrect one**

Researcher: The interactive authoritative

Teacher: **I think, it is authoritative if I heard you well**

Researcher: Alright, and we have the interactive and non-interactive approach. The non-interactive approach authoritative one, the

answers are one sided and they presented in a formal setting but the non-interactive dialogic approach will welcome other responses but you are explaining during your teaching process the point of views. Which one are going to use

Teacher: **As I have already said, the non-authoritative, the non-interactive dialogic credit the correct response and discredit the non-correct one**

Researcher: But in the non-interactive do not welcome different responses and the non-authoritative the answers are one sided and are presented formally meaning the answers will be from you, in the non-authoritative. There won't be point of view or other responses. But in a non-interactive dialogic, its whereby there is no opinions and views but during the teaching process you will be clarifying the point of views

Teacher: **Okay, it means in other words, am going to the one that give the learners an opportunity to come up with their view**

Researcher: come up with their views? Wena will you be clarifying

Teacher: we will be interacting, I will be clarifying some of the things or the view or come up with what they have understood

Researcher: Because we have two, we have dialogic and authoritative

Teacher: **Yes, I can hear that**

Researcher: We will move to non-interactive authoritative and non-interactive dialogic, so between the non are you going to use a authoritative where by the responses are one sided

Teacher: **I think now by understanding you I can change, I can say am gonna use the dialogic**

Researcher: The non

Teacher: **The non one is directive it is just like that, the teacher can explain and the learner will understand, no am not going to use that one am going to use the one the teacher will explain, the learners will come up with their views, interaction like I have said the learners will come up with their views and the teacher lay a base line and leaners will add their views**

Researcher: I think, you will be using the non dialogic, because you will be explaining during the process, or will you be allowing the responses

Teacher: Yes. We will be interacting

Researcher: Given, the type of discourses, I will explain again. We are having we are having IRF that is the initiation response feedback. In this instant the teacher initiate the questions and learners will be responding then you give feedback. and then the IRIF is which is the initiate a question and they give you response, then you give feedback. What is happening the teacher is asking the question and learners will be responding while you are giving feedback as the teacher, you will prompt other question to leaners and they will respond again and you give final feedback. Which one are you going to use

Teacher: RF if I have heard you well

Researcher: Explain why,

Teacher: Because we will be interacting

Researcher: which one are you going to use, the IRF whereby you will initiate the question and learners giver response and you give feedback? Or you going to IRIF whereby you initiate the question and you will give feedback that will prompt other questions that will make the learner to respond again the you give final feedback again

Teacher: I think I will use the RF, but it will depend

Researcher: You going to use IRF, we have…

Teacher: Let me say so, because you can give them the question and answer and they respond and give them the feedback and hoping they will respond again and only to find out they don't but we will see as the process

Researcher: So you will go with IRF

Teacher: Let me say so, because the more we talk the more I think of my leaners

Researcher: Okay,

Teacher: Yes

Researcher: Okay ma'am, this bring us to the end of our pre interview.

Teacher: Okay

Researcher: may we head

Teacher Classroom

DAY ONE: POST INTERVIEW

Researcher: Ma'am, shall we have our post interview?

Teacher: Mmmmh

Researcher: Besides the resources you used, what other teaching resources can use to teach the very same concepts? How would you use such resources?

Teacher: Is the periodic table as I have said, the chart the one I didn't use

Researcher: Only Periodic table chart

Teacher: No and other things, like the overhead projector but we do not have those resources in our school but if we have it, it is the other thing we can use

Researcher: Do you think the interest of learners towards natural science affect their performance in natural sciences.

Teacher: Yes

Researcher: can you maybe elaborate why or explain

Teacher: If they have the love for natural sciences they will pass it with high marks but if they lack interest they wont pass it the marks will be low

Researcher: How will you improve your leaners interest in natural science?

Teacher: Having the relevant resources so that they can have interest and make our lab to be a resourceful, lab have relevant equipment

Researcher: What support as a natural sciences do you get if any, please specify it could be a support from your school, from your HoD or from your principal or from your CI

Teacher: I get very much support from my principal, that labs we created it because he gave us the opportunity to do that, he gave us the room, it was a computer lab but because she supports all she catered even the natural science teachers

department to use it that is why we are having the lab. Secondly I am an HoD for natural science, maths, science and technology, ja I support the teachers by encouraging them to use the lab, by supporting when I check their work, when I see there is a lack of something, I go to the teacher one on one, I talk to the teacher and encourage him or her in any way that I can

Researcher: The lack of something, maybe it could be what?

Teacher: **Equipment to encourage the teacher to extra mile, if there is no equipment improvise, use his or her own money to buy some of the things like maybe, like for a example the experiment need the balloons you can buy them they are affordable unlike the one that need more money the school when the budget are there**

Researcher: So the only support you get it is from the principal, you don't get support from your CI

Teacher: **Ya, I get my support from my CI because there are workshops even though when you lack something the CI will complain instead of giving us the method and way to get those materials. Instead of the CI are here for support and develop as the circular says when it comes it say support and develop but some of the like the natural science I don't get that support**

Researcher: Do you think the time allocated for teaching Natural science is sufficient to complete, or cover the intendent curriculum

Teacher: **nope and it is not sufficient, like we were in the classroom now we need extra time. Because of time some of the points are not said**

Researcher: are there any other issues you would like to add, if yes you can add the details

Teacher: **As we have already said, time if maybe natural science can be given extra time or much time maybe the improvement of the results will be there**

Researcher: During our pre-interview you said you will be using a chart to explain the periodic table but I did not see uma'am using a chart

Teacher: **it's a pity there, we are many in our school. Some of the teachers use the chart also. So we use to be put the chart on the same place so I did not find chart there. It means that another teacher is used it and put it somewhere. When asked the teacher the chart was nowhere to be found, usually we use the chart and put it back to the relevant place.**

Researcher: You said today you will be teaching elements, but I saw you diverting a bit to compounds

Teacher: **Elements, you must explain to learners the difference between an element and a compound. This one is a element and this is a compound. I will be saying what is a element and what is a compound because if you don't explain to them they will say all of the are the same and they are not the same**

Researcher: I thought you will be doing elements only and on the next lesson, that's when you will include the compounds

Teacher: **Yes, it just came, so I thought it is relevant for me to explain for them, yes we are going to study the compounds further, but least they will know a little bit the difference between the element and compound**

Researcher: After presenting a lesson, how do you know learners learnt or gained better understanding of what you have taught?

Teacher: **From here, they are going to have an assessment, from the assessment, if they have done it well I will pick up if they did not understand them well or have grasp what we have talked about or not**

Researcher: What, Ideas did you expect your learners to learn today, particularly on the topic today on element

Teacher: **I wanted them to draw the periodic table on their own, put in the symbol, the atomic numbers the way they are. Unfortunatly the time did not allow us**

Researcher: and why is important for your learners to know this ideas, was it to draw periodic table, atomic numbers

Teacher: It is very much important, because the elements are put on a periodic table for a purpose, is to know the atomic numbers, metal non-metal and semi-metal so just like that so they can differentiate element

Researcher: What prior knowledge do your learners need to have to learn these ideas?

Teacher: They need to know how to use these elements in their daily lives. Did they have them in their daily life they need to know that, they do have elements in their daily lives its just they don't know this the element. Like we have talked about the toothpaste, a chlorine is the element and they use them everyday but they do not know that a chlorine is an element

Researcher: Which teaching method, do you prefer using when teaching matter and material strand and why

Teacher: The one we were using, question and answer so we can learn that learners know about this topic whether or not. If they answer it seem they know, they have studies the topic before, now you know where to tackle, where to go through, where you stress your point. The topics it came from the previous class and if they answer you can see that they have studied something at least

Researcher: when teaching matter and material strand, we use examples, models or analogies or illustrations, they can be of great help in explaining concepts, which one did you use, if any and why

Teacher: The one the leaners answered and then as a teacher I stress my point ask them again to give the answer, after stressing the point to see if they understood or not

Researcher: So will it be examples, models, analogies or illustrations? Did you use any examples

Teacher: Yes

Researcher: Illustration

Teacher: **even the illustration, when we draw the periodic table and when we compare the periodic table from the time table from the classroom, I think those are the illustration**

Researcher: investigations, experiments, projects and demonstrations, are done when teaching matter and material strand, which one did you use

Teacher: **I'm going to give them assignment from here and the project of drawing the poster. The periodic table for the class. The one we are going to post and let them draw the periodic table themselves**

Researcher: why is it important for them to draw periodic table? What are you willing to attain from that?

Teacher **So that they can be able to know the periodic table and to draw it themselves. The skills of drawing the periodic table**

Researcher: The activity above, will it assist in attaining the aim of the lesson if not why? Or to draw the periodic table will it assist in attaining the aims

Teacher: **Yes, if they draw the periodic table I will see they have the skills, if the can put the atomic number they have understood. The difference between periodic table and the numbers and even the symbols, that one can tell me they have understood the periodic table**

Researcher: Will they be copying the periodic table from the textbook

Teacher: **At first, we have looked at the periodic table from the textbook at the end of the day, they will draw the periodic table without looking at the textbook by knowing it they will be able to draw it**

Researcher: So they will be monitored while drawing it? They will be drawing it in class under your supervision.

Teacher: **Yes**

Researcher: Not using the textbook

Teacher: **Yes, not using a textbook, drawing it by heart, draw it as a project they can be in-group, draw it on a big picture, big chart or even i their work books, each and every one of them**

to draw the periodic table and after that draw the chart for the classroom

Researcher: So they will be drawing all the elements in a periodic table without seeing them from the book.

Teacher **Yes, because they will be in a group and they will be reminding one other**

Researcher: Including the atomic numbers and the mass numbers

Teacher: **Yes,**

Researcher: When presenting, did you asks questions to evaluating or to constructing concepts?

Teacher: **To construct concepts**

Researcher: when given a type of commutative approach, we have a dialogic authoritative, interactive and non-interactive, what did you use and why?

Teacher: **the non dialogic one**

Researcher: Do you want me to repeat

Teacher: **Yes you can**

Researcher: The interactive authoritative is where by you credit only the correct answers and discredit the incorrect one and the interactive dialogic its where by all answer are welcome but you only credit the correct ones. Which one did you think you used?

Teacher: **Credit the correct ones**

Researcher: You only credited the correct ones and discredited the incorrect one?

Teacher: **Yes, as they have said the answers, the correct one and the incorrect one but I have credited the correct one**

Researcher: So you have used the authoritative

Teacher: **Yes**

Researcher: and the interactive and non-interactive, did you use the non-interactive dialogic or you used a non-interactive authoritative. Remember a non-interactive authoritative the answer are one sided and non-interactive dialogic no other answers are allowed but during the process you explain the point of views

Teacher: **When teaching the periodic table no other answers are needed because, hydrogen is hydrogen and if the atomic number is number 1 it is number 1, it is not for discussion it is just like that**

Researcher: Meaning your answers were one sided

Teacher: **One sided because it is a fact that number 1 is hydrogen**

Researcher: So you used non-interactive authoritative

Teacher: **Yes**

Researcher: And the type of discourse there it IRF initiation response feedback, where by you asking questions and learners respond and you give feedback and there is IRFIF it is the initiation response and feedback. You ask questions and learners respond then you give feedback. Whenever you give feedback in such a way learners are able to respond to the feedback you are giving them and it prompts other questions when leaners ask questions and you give feedback. Which one do you think you used?

Teacher: **The one that prompts questions, hence I even touched the compound, instead of using another topic, other question and answers have prompt the question the answers we will be talking about the compound**

Researcher: and why did you use that kind of discourse?

Teacher: **sometimes you told yourself you going to use this method but when teaching and interacting with the learners, when the learners respond it just change and it pushes you to the direction that the learner have responded at you**

Researcher: This brings us to the end of our interview

Teacher: **Thank you**

Researcher: Thank you so much ma'am for your time

DAY TWO: PRE-INTERVIEW

Researcher: Ma'am, shall we start with our pre interview,

Teacher: **Yes, Ma'am**

Researcher: What are going to teach today?

Teacher: **Am going to continue with the previous lesson, which is the element**

Researcher: Okay, what resources are you going to use?

Teacher: **Chalkboard, books, ya I think so**

Researcher: Which books? Textbooks or classwork books

Teacher: **Textbooks and learners books**

Researcher: Okay, which teaching method are you going to use today during your presentation?

Teacher: **Question and answer**

Researcher: Only?

Teacher: **Ya, question and answer, and writing method**

Researcher: Okay, when teaching matter and materials, are you going to use models, analogies and illustrations to explain concepts. Which one are you going to use today and why maybe?

Teacher: **No, am going to use illustrations. I will continue from where I ended the learners did not get enough chance to draw the periodic table on the board. So am going to ask them to draw the periodic table on the board, ask few of them to do that, I have seen that they have mastered it, in our books everyone of them**

Researcher: Okay, investigations, experiments projects and demonstrations are done when teaching matter and material strand, which one will you use and why

Teacher: **Okay**

Researcher: Do you think the investigation you going to use will assist in attaining the aims of the lesson?

Teacher: **Alright!**

Researcher: When presenting a lesson today, are you going to ask questions, to evaluate or construct concepts?

Teacher: **Okay, given the type of commentator approaches, we have the interactive, authoritative approach, am going to explain it to you. An Interactive authoritative approach is, crediting correct answer and discredit the incorrect ones. We have interactive dialogic approach, whereby all answers are**

accepted but only credit the relevant ones. Which one are you going to use today?

Researcher: Alright, and we have interactive and non-interactive approaches, the non-interactive authoritative is whereby the answers are one sided and are presented in a formal setting. Non-interactive dialogic approach is whereby you do not allow other responses, but you are explaining the point of view I the process

Teacher: The dialogic?

Researcher: Okay, given, the type of discourses we are having we are having IRF that is the initiation response feedback. Whereby as the teacher you will be giving out the questions and learners will be responding then you give feedback. and then the IRIF is whereby you initiate a question and they give you response, then you give feedback., whereby they can still trigger the question or give them a new question all together and they give you response and you give them a feedback

Teacher: So you will be using the IRF

Researcher: Why maybe?

Teacher: Ok, That bring us the end of our pre interview, shall we head to the class

Researcher: Thank you so much ma'am

DAY TWO: POST INTERVIEW

Ma'am, shall we begin with our post observation interview? Besides the resources you've used, what other teaching resources can use to teach the same concepts? How would you use such resources? Beside the textbook you used and the chalkboard, what other resources can you use?

The practical teaching aid, like we find floral in the toothpaste. I can come up the toothpaste and show them and let them taste the toothpaste. Like the iodine, I can come up with the salt and let them taste and let them know that elements we use them everyday. The aluminium roll I can come up with and show them, the one we close the butler with

After presenting a lesson, how do you know that learners have learnt or gained a better understanding of what you taught?

When they make a diagram of an element and place the symbol of the element and atomic numbers. That shows me that they have understood

What Ideas, did you expect the learners to learn during the lesson?

Know how to draw the diagram of a periodic table and know how to place the symbols. And know what the symbol mean, like H for hydrogen

Why is it important for your learners to learn these ideas?

So that they can know, know the periodic table

What prior knowledge do your learners need to have to learn these ideas?

The prior knowledge is to come up with a practical thing and show them, like come up with the silver methal and show them. The aluminium as I have said, the Claudine, chlorine, gold and show them what we are talking about. About the platinum where do we find gold. What is the use of gold, things like that.

In your lesson today, I realised you talked about atomic number, do your learners know what an atomic number is? I did not see you explaining what is an atomic number and what is it used for in a periodic table?

I think they know, if they do not know when we continue I will emphasize its importance

I realised that, you did not encourage them to copy from the textbook, why were you doing that maybe? What is the aim that you are trying to achieve?

I want them not to krem or to copy but to know them even they didn't see it or copy from somewhere. Know it by heart, know how to draw it, know atomic numbers, without any help from the textbook or whatsoever

How is that gonna help them? Know them by heart

I will be sure they know, the periodic table, the one that is organised by dimetry medalem

Do you want them because when you going to assess them you are not going to give them the periodic table?

No I will not give them the periodic table. I do want them to know it because am going to assess them it, I want them to know how they work. Their numbers how, they their reaction and their product when they are linked

So when you assessing them, you will not give them periodic table?

No I will not give them, they will already know them

Thank you ma'am for your time. This brings us to the end of our post interview

DAY THREE: PRE-INTERVIEW

Researcher: Ma'am, shall we start with our pre interview,

Teacher: Yes, ma'am

Researcher: What are going to teach today?

Teacher: The metals

Researcher: The Metals

Teacher: Yes

Researcher: Okay, what resources are you going to use during your teaching process or during your lesson?

Teacher: The textbook and the real sources

Researcher: Real sources, like

Teacher: Like the rod, representing the alimium. Like I will show them gold, represent gold and explain further what is the uses of gold for us. Agon, I will use the example of earth. Air that we breath and example to them about air, although we can not see air, it will be representing oxygen

Researcher: Okay, which teaching method are you going to use today during your presentation?

Teacher: Question and answer

Researcher: Okay, are you going to use models, example, illustration and analogies during your lesson

Teacher: The illustration am going to quote from the textbook, the periodic table to show them the difference of the metal, non-metal and semi-metal, I will show them the difference from the textbook and the colours

Researcher: Okay, investigations, experiments projects and demonstrations during your lesson today to explain the concepts

Teacher: Investigation as a task, yes am going to give them the task investigation to do at home to answer some question

Researcher: Why investigation

Teacher: **To find out some elements and the metals, non-metals and semi-metals from their hoe**

Researcher: Do you think the investigation you going to use will assist in attaining the aims of the lesson?

Teacher: **Yes, so that they can know the function of the metal, non-metal and semi-metal that they are important to our todays lives**

Researcher: Are you going to ask questions, to evaluate or construct concepts?

Teacher: **Am going to ask questions to evaluate but out of those question the abstraction or the construction of the question just pop out**

Researcher: We have the type of commentator approaches; we have the interactive, authoritative approach, am going to explain it to you. An Interactive authoritative approach is, crediting correct answer and discredit the incorrect ones. We have interactive dialogic approach, whereby all answers are accepted but only credit the relevant ones. Which one are you going to use today?

Teacher: **The one that will encourage to give the correct answer and discredit the one that is incorrect but out of those each will just work together because when you take the correct answer, others can ask to construct other questions**

Researcher: Why are you going to use the approach the one that you going to use, the interactive authoritative

Teacher: **Because, because gold, the function of gold is to make Jewellery, the function of oxygen is for the human being to breath in and plants breath out oxygen, it is a fact it can not be changed**

Researcher: Okay, between, and we have interactive and non-interactive approaches, the non-interactive authoritative is whereby the answers are one sided and non-interactive dialogic approach is whereby no other answers allow, but you are explaining the point of views of view, which one are you going to use today during your lesson

Teacher: **The interactive authoritative approach**

Researcher: The one you have chose before

Teacher: **Yes**

Researcher: You have to choose between non-interactive authoritative and non-interactive

Teacher: **The interactive authoritative approach**

Researcher: Or the interactive authoritative approach

Teacher: **Because the none one is one sided, so if it is one sided. What if a learner come with a question I must explain further**

Researcher: So you going to use the non-interactive authoritative

Teacher: **Yes, but the interactive will also come in**

Researcher: Okay, given, the type of discourses we are having we are having IRF that is the initiation response feedback. Whereby you will be giving out the questions and learners will be responding then you give feedback. and then the IRIF is whereby you initiate a question and they give you response, then you give feedback., whereby they can still trigger the question or give them a new question all together and they give you response and you give them a feedback

Teacher: **IRF**

Researcher: Why IRF

Teacher: **Because they are going to give me an answer and the answer will be, must be correct and if it is not correct it is not going to be taken.**

Researcher: Are you going to give them feedback?

Teacher: **Am going to give them feedback**

Researcher: Ok, shall we head to the class please

DAY THREE: POST INTERVIEW

Ma'am, shall we begin with our post interview?

Yes Ma'am

Besides the resources you've used, what other teaching resources can use to teach the very same concepts? How would you use such resources?

The real spacemen, like I can take the toothpaste as I have said to shoe them, it is made out of chlorine, the salt there is iodine in the salt. The color Gold, the earing to show them it is made out of gold

After presenting a lesson, how do you know that learners have learnt or gained a better understanding of what you taught?

When I ask them questions and they give me answers.

And if they don't

If they don't that means they, didn't understood and we must go back to that lesson again and teach them again.

What Ideas, did you expect the learners to learn?

The difference of the metals, the metal, the difference of the element, metal one, semi-metal one and the non-metal one

Why is it important for your learners to learn these ideas?

If they know the function of the element, they will use it in their days lives and they can make. They can come up with ideas to make better things that we can use in our every days lives. Scientist and come up with a better idea to study more things

What prior knowledge do your learners need to have to learn these ideas?

That elements are used in our every days life, we have them at home, in our school, work place everywhere. Even the oxygen we are breathing it is one of the element

During, our pre interview you mention that you will be teaching element but I observed that you also taught mental, semi-metal, what was the purpose of that?

The topic, the bigger content is the matter the sub topic we include semi-metal and non-metal. It is one topic, it is just it is the subtopic

You did not explain, the properties of each, for instance the properties of metals or properties of semi-metals and non-metals, so why was that not done or was that not the aim of the lesson today

Am going to give them the investigation, so in the investigation they are going to investigate the properties of metal, non-metal and semi-metal. In other words, when we do the corrections it will be explained there

This brings us to the end of our post interview, thank you very much for your time

Thank you

APPENDIX: K
KATE OBSERVATION TRANSCRIPTS

KATE OBSERVATION TRANSCRIPT

Observation of Kate: at Hope Combined School in Grade 8 Natural Sciences Classroom

Day one lesson

Line	Description
1.	**0-4 minutes**
2.	The classroom was conducive for teaching and learning. The classroom
3.	was well swept and clean. However some of windows were broken.
4.	Learners were seated on the desks and they were sharing desks. The
5.	desks were arranged in rows and columns with enough space for the
6.	teacher and leaners to move around. There was no electricity in the
7.	classroom. All learners wore their school uniform. Kate greeted the learner
8.	good morning class, learners greeted back good morning Ma'am (all
9.	learners were standing on their feet when responding). Kate continued
10.	how are you class? And all learners responded "we are fine Ma'am and
11.	how are you Ma'am? Kate said fine thank you, you may take your seats
12.	and the learners said thank you Ma'am. (All learners took their seats after
13.	being instructed to do so). Kate asked learners whom of them is having a
14.	toilet paper. One learner stood up and gave it to her. Kate called Thandi
15.	(pseudonym) to come take a script from her. Kate said yesterday we
16.	learned about the properties of metals. She further said the properties of
17.	metals they are what? One learner raised her hand, Kate gave her a
18.	chance to respond. Kate said yes Lunga (pseudonym). Lunga responded
19.	they are shiny. Kate said yes… they are shiny what else? Yes Gugu
20.	(pseudonym). Gugu responded as follows: most solid mercury. Kate
21.	replied "most solid mercury" seriously? Of metal? Nooo… Kate said
22.	"Thulani (pseudonym) can I have my papers". Thulani gave her the papers.
23.	She then continued. Okay let's hear other properties of metals. She further
24.	said they are shiny, they are stretchy, they could burn. what else? Their
25.	appearances are shiny isn't so? Learners responded yes. Kate further
26.	asks are they shiny only? Learners responded no.. and they are strong.
27.	Kate asked do they conduct electricity, learners responded yes. Kate said
28.	today we are learning about the non-metal ones. Learners said after her
29.	"non- metal ones". She then instructed the learners to open their textbooks
30.	on page 116. She then read the sub topic " the properties on non-metal
31.	ones" to learners. Kate asked : what do they say about the properties?
32.	Gugu responded they are dull. Kate replied yes they are dull. What else
33.	Thulani? They are shiny. Kate replied no they are not shiny. Kate asked,
34.	if we say something is dull how does is look like, learners responded it has
35.	rust. She made an example of a rusted metal and explained that if
36.	something is rusted it does not necessarily mean it is dull. She further
37.	asked again what dull mean. Learners responded that it means it is not
38.	shiny. She then asked the states of matter of non- metals. Learners
39.	responded they are gases, liquids and gases. She further emphasises that
40.	non- metals exist in three states of matter which are solids, liquids and

gases. She asked if non-metals conduct electricity? Learners responded no. she added, non- metals are poor conductors of electricity. And explained what a poor conductor is and making comparison between metal and non- metals using isiNdebele. Learners agreed with her by saying yes. She asks if non- metals conduct heat? Learners responded with a no.

4-8 Minutes

Kate made an example using a plastic if it conducts heat or not? Learners responded that heat does not conduct heat. No it does not conduct heat (repeated after learners). She further read from the textbook that heat does not arrive in a plastic because a plastic is not a metal angithi **(isn't so)?** Learners responded with a yes. Kate asked does it conduct a magnet? Some learners said yes some said no, she then singled out one learner Thabo (pseudonym) khengibuze wena ipuphu le ophekangayo ekhenu nawuyfaka I magnet iyabamba ku (**does a maize meal you use at home stick to a magnet**) magnet? Thabo answered no. no (she repeated after the learner response). She further asked if I use a magnet on a door frame will it stick or not? Learners responded yes. And if I put it in a wall will it still stick (she asked), learners responded no. so between a wall and door frame which one is a metal and which one is a non- metal? Iboda **(wall)** is a non-metal and a door frame is a metal (learners responded). Kate continued what is a melting point of a non-metal? (Only same learners were participating) she asked if she's teaching only three learners in a class since those were the ones who was participating, she further noted that others are playing and they do not have their textbooks with them. Gugu responded low melting point. Low melting point (she repeated after the learner response). She continued they say that (reading from the textbook) non-metals do bot stretch. She then gave an example (can I stretch a wall)? Learners responded no. she then asked she can stretch or bend a maize meal? Learners said no. she proceeded that you cannot bend or stretch the maize because it is a non- metal. Kate said note this: (reading from the textbook) they say that non- metals are poor conductors of electricity you know that right? Learners said yes. She continued reading they further say non-metals have a lower melting and boiling point. (Still reading) non- metals are found on the right hand side of the periodic table. She then instructed learners to open up on page 122 (only few had their textbooks). She then asked who can tell us how many non –metals do we find on the right hand side? Thulani responded 16. Kate asked the class if it is 16 some learners said yes some said no. She then said no they are not 16. She proceeded that they are 16 on the right hand side plus one that is up on the left hand side which sums up to 17. She then asked how many non- metals are there in a periodic table? Learners were silence (none of them responded). Kate repeated the question. Thobile (pseudonym) responded they are 17. They are 17 (she repeated the answer) angithi **(isn't it)**. Learners responded yes.

8-12 Minutes

Kate asked: Siwabona ngan ama non- metals? **(How do we identify non-metals)?**

Learners responded with a yellow colour. With a yellow colour (repeating the answer) from our periodic table. She then said okay I have a classwork

for you it is not on your textbook, I will write it on the chalk board for you. It will be only for ten minutes because it is a short one siyazwana angithi (**are we together**)? Learners said yes. Kate then started writing the classwork on the board and learners started writing inside their classwork books (Few learners were not writing). While Kate was writing on the board learners were quiet and copying the work into their classwork books. While she was still writing on the board she explained, you are writing the opposite one lana angithi **(here isn't it)?** of the metal ones which is the non-metal (facing the board). Leaners did not respond.

12- 16 minutes

Kate continued writing a classwork on the board. She then said only two questions write very quickly. Few learners who were not writing then approached Kate asking for their books. Kate then asked from the class who saw or took the books of those learners. Learners did not respond. She then instructed them to go check them from her office. Kate then started moving around checking if learners were writing. Mina ngithi niyaqeda kanti nisakhuluma **(I thought you were finishing up but you are still talking)?** (While moving around). Usazuma I ballpoint (**are you still searching for a pen)?** Asking one learner, learner (did not reply). Kate contined zilula izintwezi sizenze nje angithi, (These things are very simple we just did them now isn't it)? Leaners said yes. Kate said Peter (pseudonym) kwangathi uhlezi awubhali **(you seem not to be writing).** Peter replied I am still awaiting for the ruler. Niyabolekisana ama ruler la (do you borrow rulers from one another)? Learners responded with a yes. Kate said Ehh… (Seeming very shocked).

16- 20 Minutes

Kate said iyaphela I 10 minutes **(10 minutes it is almost over).** Gong… gong… (Knock on the door). Kate uhmm **(meaning yes…)** as she approached the door. There was learners standing at the door, she then went out of the classroom. Kate entering the classroom (Walking around) abanye sebayaqeda abanye abakathomi **(some are almost done whilst others have not yet started).** Kate said ngbona abay 2 khona bathoma ukbhala (**Two learners have just started writing).** She proceeded (standing in front) akaqedileko ukubhala abalethe iincwadi **(Those who are done writing let them bring their books).** Learners (None of them stood up or submitted the book). Kate went out of the classroom to reprimand learners who were making noise outside her classroom.

20-24 Minutes

(As she walks in with leaners) What took you so long to find your books? Kate asked learners she instructed to go search for their books in the office. Learners said we were still reaching for them. Kate proceeded be seated and write quickly then submit those books. Kate said come and submit your books. Two learners stood up to go and submit, while others were still seated and busy writing. Kate started marking the submitted books (While marking the first book) Kate said abasiy 2 abaqedileko (**Are these the only learners who have completed the classwork)**? Learners (Did not reply). Kate said John (pseudonym) kwenzakalani ufuna ini? **(What is wrong with you, what are you looking for)?** John replied nex **(meaning nothing).** Learners started going in numbers to submit their books. Kate returns few learners to go and draw lines in their classwork

books since they wrote without making a table. (As she is busy marking) Kate said I 10 minutes iphelile azize iincwadezo (10 minutes it is over bring those books). Bring the books (She repeats). Learners went to submit one by one, but others were still writing some searching for answers from their friends textbooks others borrowing textbooks from those who had them.

24-30 minutes

Kate said iselapha qangi **(Instructing one learner to go threw away a gum before submitting her book)** learner did as per instruction

(Loudly so) Kate said woke umuntu akasikime alethe incwadi **(Let every stand up and submit his/ her book).** Learners (Continued to write). (Repeated) I said let everyone come and submit their book. She proceeded abanye balinde ukukopa phezu kwabanye **(Others are awaiting to copy from others).** Learners started submitting while others were still writing. Kate said boke abangakaqedi abasukume balethe iincwadi bavuleleni baphume siphelile iskhathi (**All those who are not done stand up and submit your books, make a way for them the time is up).** Learners started making their way to the front to submit their books. As some learners were still seated and writing Kate singled them out. Learners then stood up to go submit their books. (As she was busy marking) She then picked that one learners was copied from her friend, She then asked the learners if she copied? Learner denied. The bell rang indicating that the period was over. Kate said those whom I did not mark their books submit them during lunch so that I will mark them okay. Learners said yes. One learner helped her to carry her textbook as she walked out of the classroom.

Day two lesson

0-4 Minutes

As Kate entered the classroom she started off by greeting the learners, Kate greeted the learner good morning class, learners greeted back good morning Ma'am (all learners were standing on their feet when responding). Kate continued how are you class? And all learners responded "we are fine Ma'am and how are you Ma'am? Kate said fine thank you, you may take your seats and the learners said thank you Ma'am. (Some learners took their seats after being instructed to do so while others they were still walking to their seats). Some learners were not wearing school uniform, as I was a Friday some were wearing casual clothes for the purpose of fundraising. Jane said okay let us open our books. She (repeated) let us read in our books on page (paging over the textbook) on page 118, anyone who can read for us. Few leaners took out their textbooks, most of them were seated doing nothing and some took out their classwork booked. Jane said anyone who can read for us? Learners (did no reply). She continued oh anikwazi ukufunda **(Oh can't you read)?** One learner stood up and stated reading, semi-metals: semi- metals are in the region between metals and non- metals in the periodic table. The semi-metals are Boron, Silicon, Germanium, Polonium and Antimony. Semi – metals have some properties of metals and some properties of non- metals. They look like metals and solids but they acting like non- metals. Silicon is the most common semi-metal, it is shinny which gives it a property of a metal but it is not ductile and non- malleable it is brittle which gives it a property on a non- metal. Kate walked out of the classroom whilst the learner was

still reading. Germanium and Boron are also shinny substances like metals but they are hard and brittle like non- metals. Kate (walked in) learner continued, semi- metals can conduct electricity but not as well as metals. They are called semi- conductors this is a very high demand of semi-conductors as they are used in most of electronic devices such as computers, phones and radios. And the learner sat down. Kate said okay iqedelele nangale the next page le phezulu **(Continue reading on the next page starting from the top).** The learner stood up again and continue reading from the next page. (As she read) because semi- metals are brittle, they can break so easily and so cannot be used to build heavy structures. However they can be used to make glass, Silicon and Germanium are often used in electronic devices such as cell phones. The three semi- metals Germanim, Antimonium and Thallium are used to make re-writable dvd's. Kate said thank you and the learners sat down. Kate proceeded today we are leaning about semi-metals which they are telling us ukuthi **(that)** the semi- metals have the same properties of metals and some of the non- metals (As she is reading from the textbook). She continued and said which in the previous lesson we learned about non-metal angithi **(right)?** Learners replied with a yes. She carried on and said sesiyawazi soke ama non- metals **(do we all know non- metals)?** Learners replies with a yes. Kate continied, in our periodic table let us look at our periodic table (As she pages through the textbook) we find non-metals. She asked what page number has the periodic table? One learners replied page 112. Page 112 (She repeated). (While she was paging from her textbook) she said let us all open up on page 112. Few learners opened up their textbooks while others indicated that they do not have textbook. Two learners walked in and Kate asked why they were late for class. They indicated that they writing a test since they were absent the previous day when it was written. Kate then let them seat down.

4-8 Minutes

Kate then proceeded and said page 112. The green elements on the periodic table they are semi- metals. She then asked how many they are? Few learners responded they are 8. She continued (reading from the textbook) they say here ukuthi **(that)** we have got semi-metals which can be a solid at room temperature, kutjhukuthi nayingapha na **(meaning when it is in this room)** at this point injan **(how is it)** I solid angithi **(isn't it)?** Learners responded with a yes. She proceeded but when it is heated it becomes a liquid (Reading from the textbook). She continues they also say that a semi- metals can be shiny or dull siyazwana angithi **(Are we clear)**? Few learners responded with a yes most were quiet. She said some of the properties are metals and some are non-metals. She continued (reading) they say a semi-metals is a good conductor as we know that a non- metals is not a good conductor of electricity then metal is a good conductor right? (No reply)From learners. She proceeded they say semi- metals make a good electrical conductor, materials that conduct electricity only if they are heated. She then gave an example and said, let us all go back to page 118, we have four semi- metals. Learners who had textbooks they started paging. She then continues any one oyaziko lapho nawuqale eenthombeni (**that you familiar with looking at the pictures)**? Learners did not respond. She repeated any one oyaziko and utjho ukuthi

wayibonaph (That is familiar with the pictures and say where you have seen it). (Still no reply) from learners. She said niyangiphoqa kanti bengikhambe nabonani e Golfreecity **(I am disappointed, whom did I went with to Goldreefcity)?** Learners were silent. She said uhmmm… not at Goldfreecity e Planetarium? Learners did not reply either. She then proceeded amatje la esiwabonako lapho aniwaboni **(Can you see the stones on the pictures)?** Learners responded siyawabana **(Yes we can see them).** Kate continued which one can you call from the pictures? Gugu responded picture B. Kate then asked what is on picture B? Gugu responded and say Germanium. Kate (repeated) Germanium, then we have four different types a Silicon which is a … igama elithi Silicon niyathoma uklizwa (**Is it your first time hearing about Silicon)?** Learners said no. Kate said where have you heard about Silicon and what is it used for? Learners did not respond. Kate said huh? One learner responded iberega ukuvala iimbhobo **(It is used to seal leaking corrugated irons)** Kate (repeated) Ivala iimbhobo neh **(It seals leaking corrugated irons right)?** Learners responded with a yes. She proceeded injani yona **(How does it look like)** is shiny or dull? Learners said it is shiny. Kate (shocked) nope. Learners said it is dull. Kate said it is dull and white right? Leaners said yes. Kate continued and said the one we talking about here it is from the materials that are from the periodic table, it is an element yona iyodwa siyazwana angithi **(On its own are we clear)?**

Learners responded with a yes.as we know that we have different elements in a periodic table, so it is one of the elements in the periodic table. As she proceeded she said we have 8 element that are semi-metals reading from the textbook) they say it is a good electric conductor, for your information ngibawa ukunibuza **(May I ask you)** how many elements of semi-metals we have in the periodic table? (As she moved around). Learners did not respond. She then continued and said using your own knowledge how many do we have? One learners responded and said 8. Kate further asked where do we find them on the periodic table? From the left hand side or the right hand side or bottom or top? Learners said from the right hand side.

8-12 Minutes

Kate explained that there are also non- metals on the right hand side, but firstly there are non- metals, then comes semi- metals. She said to can say they are between semi-metals and non- metals siyazwana angithi **(Are we clear)?** Learners said yes. Kate said ok I have got a classwork for you, let us all open up our classwork books. Kate asked is there anyone ongakazisisi **(Who did not understand)?** (While she was wiping the board). Learners did not reply. She asked (repeatedly) anyone..? Learners did not respond, they were busy taking out their classwork books. Kate asked what is a semi-metal and where do we get the semi-metal? Learners did not reply. She asked (repeatedly) what a semi –metal is? Thando (pseudonym) answered but she was not audible. Kate asked her to speak allowed so that everyone could hear her response. Thando did not say the answer again. Kate asked Gugu to give an answer, Gugu did not give an answer. Kate then said semi- metals are solids and they have properties of metals and non- metals siyazwana angithi **(Are we all clear)?** Let us all say semi- metals are solids and they have the properties of metals and

non- metals. Learners say that repeatedly. Kate said anginizwa noke **(I cannot hear all of you).**

"Semi- metals are solids and they have the properties of metals and non-metals" learners said that repeatedly. Kate instructed (As she was writing a classwork on the board) that let learners narrate per row. She then picked the first row to narrate, she then said Thulani I cannot hear your voice. She then proceeded to the second, third and the last row. She said, ok let us write the classwork. Learners opened their books and started writing the classwork.

12-16 Minutes

Kate wrote the classwork on the board, and other learners were whispering borrowing pens and pencils from their friends. Learners were very quiet when writing the classwork. Kate then said check the example I made for you before attempting to answer the questions okay? Learners responded with a yes.

16-20 minutes

Kate explained (How to complete the table given as a classwork) using examples and said we have got a Copper, and Copper is an element, what is the symbol for Copper? Cu angithi (right)? Learners said yes. She asked where do I get Copper, semi- metals, metals or non- metals? Learners said metals. She then gave the next example and said I have got a Boron (She wrote Boron on the board), what is the symbol for Boron? Learners said B. She wrote the symbol for Boron on the board and continued and asked, where do we find Boron? Learners said in semi-metals. She then wrote (Semi- metals) on the board. Kate said this is how you complete the table I gave you as your classwork. She said nayithi twenty past iincwadi zoke phambili (**at exactly twenty past bring all the books to the forth),** it means une 10 minutes yokubhala **(You have only 10 minutes to complete your classwork).** Learners started writing. Kate asked which learners are absent. Learners called out their names. Kate asked Jerry (pseudonym) where was his book, Jerry said he has it. Kate said he must start writing. She explained that the first question is asking from the first 20 elements from the periodic table that you have learned about and know from the heart which ones are semi- metals. Learners were silent. Kate was moving around checking whether all learners were writing.

20-24 Minutes

Learners were writing while Kate was moving around. Kate said Jerry khona usambala umbuzo wokthoma abanye sebayaqeda nokuqeda **(You have only started writing the first question while others are almost done).** Kate corrected one learner who copied the question wrong from the board. Most learners did not have textbooks so they were looking on sides and back from those who had textbooks, other were seated waiting to borrow textbooks from those who had them.

24-30 minutes

While Kate was still moving around, one learner stood up and said Ma'am I am done can I submit my book? Kate said yes you can and she continued moving around. The learner submitted the book then went back to her seat. Kate said in question two you also indicate if the element is a metal, semi-metal or a non- metal. Kate then went put to reprimand learners who

were making noise outside the classroom. As she walks in Kate said ksele one minute iincwadi zoke azibe phezu kwetafula **(Only a minute left let all the book be on the table).** Three learners stood up and submitted their books whilst other were still busy writing. kate ngibawa iincwadi, azize iincwadi **(Can I have the books, bring the books).** Few learners stood up to go and submit others continued writing. Kate proceed sukumani woke umuntu akasukume alethe incwadi (Stand up, let everyone be on their feet and submit the book). Few went and others whispered that they are not yet finished. Kate repeatedly asked for books. Learners went in number to go and submit. Kate then started making the books. The bell went off indicated that the period has ended. Kate instructed the learners to come fetch their books before school out as she shall have finished marking and go and revise the work done in the class at home. Learners said yes. Kate ten went out of the classroom.

Day three lesson

0-4 Minutes

When Kate entered the classroom there was no one inside. Learners started coming few seconds after since they were coming from another class. Kate stood in front of the class awaiting for all learners to come inside. Learners come in and stood up in their feet awaiting Kate to greet them. Kate started off by greeting the learners, Kate greeted the learner good morning class, learners greeted back good morning Ma'am (all learners were standing on their feet when responding). Kate continued how are you class? And all learners responded "we are fine Ma'am and how are you Ma'am? Kate said fine thank you, you may take your seats and the learners said thank you Ma'am. Learners seated down as per instruction. Kate said (As she was moving around handing out papers) we are going to do an investigation my role for today is to explain were you do not understand then you will submit those papers afterwards. She proceeded I have got some products here as yesterday we talked about the testing of substance, today we are **tasting** acid and base siyazwana angithi **(are we clear)?** Learners said yes. She said okay from our textbook is page (As she paged over the textbook) 103, we will start from page 198, as we talk about acids let us read first. She said okay I have brought the resources here I will tell you what they are, and you will come and **taste** whether is acid or base I gave you a part of notes where you can see the **Lithium pape**r when it turns blue is it a Carbon or is it base or an acid. She proceeded and said anyone who can read the noted for us very fast, anyone (As she arranged the resources). **One learner stood up and started reading the instructions.**

4-8 Minutes

After the learner finished reading the instructions. Kate called one learner to go fetch some water (As she was still busy arranging the resources). She asked can we all see the substance? Learners said yes. She said okay Thando went out to fetch some water for us, ngikhohlwe into yinye (I forgot one thing), Gugu run to the kitchen and bring a dish washing soap. She proceeded (lifting one item at the time showing it to learners) we have got a suger, can you see that I wrote out desprin?

Learners said yes. She proceeded we have a coffee, rooibos, (Thando walked in with a glass of water) instead of dispirin and handy-andy just

stretch out, replace handy- andy with rooibos and dispirin write rooibos. She continued replace soda water with orange (Thando walked in with a liquid soap) she said this is dish washing soap (Showing it to learners) I am going to poor it inside a glass (As she poures) we have a dish washer la **(Here)**, sinamanzi **(we have got water)** ngokulandelana kwazo **(In this order)**, sinamanzi anetjhukela **(we have sugar water)** we have lemon juice, we have coffee (As she mixes coffee and water), we have rooibos, orange, vinegar and the last one we have baking soda.

8-12 Minutes

She said all our substances are here can you see them? Learners said yes. She proceeded and said we have got our Lithium papers we have got red and blue (As she is showing them to learners), they say (Reading from the paper) the red one turns blue when it is base, when it is in an acid it remains red, then the blue one in an acid it turns red in an base it remains blue (Two learners walked in) siyazwana angithi **(Are we clear)?** You are going to complete the table in the handout I gave you, I am going to give (as she counts the substances she has) 9 Lithium papers to 9 people, and they are going to do the Lithium papers, they will start with the acid one then the bas one okay? Learners said yes. She said any volunteers the abayi 9 bokuthoma (The first 9). Learners sat and did not go to the forth. She proceeded okay let two people come from each row. Learners started going. Kate gave each learner a blue litmus paper. She said this is a blue one, each one of you will dip the paper in a different solution go in order. She said we will start with water (The first learner approached to dip the paper in water) the rest of you observe as they will be moving around and you complete the table. Learners followed one another in order and dipping the papers. Kate said dip half of it for minutes before showing it off.

12-16 Minutes

Kate said you can now take out the papers and go around showing it off, starting with the first one. The rest of you must check if the paper has changed or not then complete the table okay. Learners said yes. Learners then started moving around shoeing off the papers while others were observing and writing as they pass by. Kate explained that if the paper turned blue or remained colour blue, you just write whether the colour turns red or blue are we clear? Learners did not reply. Kate ordered the learners to go in order and indicating which substance they are showing off. She proceeded and said you make a tick in a table depending whether the colour has changed or not, and in the last column you indicate whether the substance is an acid or a base okay? Learners did not reply as they were concentrating on what they needed to observe. Kate said heeeyyy… (Indicating that they are making noise). Learners were making noise and unsettled, moving around after She reprimanded them then they were settled. The 9 learners continued showing off the papers while Kate was monitoring them. Learners started making noise again Kate reprimanded them again, then they settled down. Kate said when you done showing off your paper throw it in the bin then come fetch the red Lithium paper. Learners did as per instruction.

16-20 Minutes

Kate then gave the learners a red lithium paper. She said you are going to do dip the paper in the solution you used with the blue paper okay? Learners said yes. She then ordered them to stand in order. Learners did as per instruction. She asked if learners wrote the answers for their first observation. Learners said yes. She said okay, now we are using a red Lithium paper, She then said start dipping your papers in solutions in order from the first one to the last one. 9 learners started dipping the papers. Kate said dip it for few minutes before you can show. Learners stood in a row with their papers dipped in different substances. She then ordered the 9 learners to start showing off (Calling them in order of the substance they used). One learner said Ma'am how do we answer? Kate said like you did in the first one, you make a tick in a column whether it is blue you make a tick if it is blue or red and at the end you indicate whether it is an acid or a base. Learner further asked if they are repeating the experiment or not? Kate said no the first one we tested with blue now we using red are we clear? Learner did not reply. Learners continued showing off while the rest of the class were observing and talking to the ones showing off.

20-24 Minutes

Kate said move very fast bangaloko abanibuza imubuzo **(They should not be asking you questions)** they only need to observe. Learners then started moving very fast. Kate said when you done throw the papers in the bean and sit down. She proceed and said okay, quietly thank you the start answering the questions afterwards. Show the learners who were circulating around the answers based on what you have observed. She proceeded and said write the answers on the hand out that I gave you not inside your classwork books. Learners then started answering other asking for answers from their mates. She said I am giving you only 15 minutes to complete the task then you must submit the papers, discuss with your mates. Learners started discussing and writing answers. Kate started moving around to check if learners are discussing and writing the answers. She explained, firstly you need to complete that graph or that table.

24-30 Minutes

Kate moved around checking what were the learners writing. Learners were now quiet and not discussing yet they were writing. She said tick on the table first before you can write whether the substance is a base or an acid. When she passes in other leaners she (noted the head) meaning she is approving the answers. Ksele 5 minutes **(5 minutes remaining)** (as she observed time). Other learners moved from their desks to go seek for answers. Kate asked (while moving around) why other have blank spaces? Leaners did not reply, they carried on writing. She proceeded the clue is there up giving you ideas, and please do not guess we were doing this practical angithi **(right)?** Leaners said yes. She asked then why are you guessing? Learners did not reply. She said where you encounter a challenge call me I will come and help you. The bell went off indicating that the period has ended. Kate said okay listen, since you are not done, you will complete the work at home and submit it tomorrow before the first period okay? Learners said yes. Kate left the class.

APPENDIX: L

JOHN OBSEVATION TRANSCRIPTS
DAY ONE

Teacher	Good morning
Learner	Good morning Sir
Teacher	How are you
Learner	We are fine sir how are you
Teacher	Fine, sit down (although leaners are sitting down), Good people we have a visitor today, as I told you last week that we will this beautiful ma'ma here with us. Your surname ma'am
Reseacher	Ntuli
Teacher	Ma'am sothembani , will be with us for few minutes, so will you take out your natural science text books put the book in front of you, those who have textbooks, and also your classwork books in front of you
Learner	*learners taking out textbooks
Teacher	Remember we've been doing acid and base
Learner	Yes
Teacher	Why acid and base? Acids are made out of different chemicals. Chemical that makes amaAcids. Acid is dangerous because it has some elements that are included in making that acid, so this acid and base chapter is taking us to a new chapter, which am going to introduce today. Guess what, its periodic table. On your textbook open where they talk about periodic table on page 178, yes 178. Are you there 178
Learner	Yes
Teacher	Yes, while I am distributing a periodic table so that we can able to see what is this periodic table. So Immediately you see like this you know this is a periodic table, as from now you will be knowing this is a periodic table. Why a periodic table, why those are th questions that we must be able to answer today Why periodic table, because it is something new you coming from intermediate phase you don't know what is this. This is a new thing all together you want to know why this periodic table, what is it? Is it going to help me, what am I going to get from this periodic table Those are the questions, bantwana bam ekumele sendzeni? To answer at the end of the day, at the end of the period neh
Learner	Yes

Teacher	Can someone read for me there in your book, okay let me read for you. What you learn about this topic, the arrangement of elements on a periodic table The way they are arranged neh! Look at those elements, you see is Hydrogen, labium in group one (showing the learners) this call the amagroup, these are groups. Why are these elements in group one. All elements in one group they behaviour the same or they have similar behave, they behave similar hence they are in that group. But before that, there was this Russian by the name Dmitry mandeleff, when you read this Dmitry mendeleff he was a Russian, in 1820 that's when he discovered or that's when he come up with this periodic table in 1820 many many years ago. So he came up with this periodic table and who is this person Dmitru mandeleff who was a russion. But after him, there are so many scientist who wanted to come with new things new ideas on top of what this Russian mandelef has already discovered. So then now, let is look at this periodic table, You find that now hydrogen, we call them element, in you book ikhona definition of element, who can read for us, what is an element it is there.
Learner	Element, a substance that can not be broken down further
Teacher	It is a substance that can not be broken into simple properties, you can not brake an element. What is a matter?
Learner	*silence*
Teacher	You don't know? From grade 6, a matter? Niyikhohliwew? Grade 6 Anything, that has got a mass to occupy. We call this *duster* a matter, paper is a matter but today we are going to look at this element *looking at the periodic table handout* Before we can explain about this element, I want you to look at this element. Does the symbol represent the name. For instanced *writing on chalkboard* H
Learner	Hydrogen
Teacher	So this symbol does not mean this is the letter, it is the first letter o f the element. You understand because we have sodium Look at sodium, number 11 there, do you see
Learner	Yes
Teacher	But what is the symbol Na
Learner	Na

Teacher	The symbol has nothing to do with the name, in other words some elements are fortunate whereby you find you talk of foslorus the symbol is P bt you come to 19. 19 is potassium is K
Learner	K
Teacher	You see number 19 there
Learner	Yes
Teacher	So don't say because potassium start with letter p and automatically the symbol is P no neh Whatelse, can you see the iron there but the symbol is Fe. Ferilium, some symbols derive from latin, Russia. Russian language whatsoever. Remember the one who started this was a Russian. So some other names derive from other languages latin, Greek whatsoever so originally ferilium but its iron and other elements But for you in grade 7, we are interested for you to know how many elements? Atleast from 1 until 20. Can you catch them Can you catch those elements from 1-20, is simple because we have hydrogen number 2 we have helium . we have
Learner	Hydrogen and we have helium
Teacher	Under hydrogen, we have helium number 10 neh, you see under lithium you have sodium number 11, Na do you see?
Learner	Yes,
Teacher	Can you do that, mention these elements from 1-20
Learner	Yes
Teacher	It's not difficult neh? Because I have mention some few. But then I have got some very interesting method of grasping all those elements from 1-20. Am going to show you that one, we will be looking at the groups, different groups for instance (Showing the leaners the periodic table hangout) you see the colours are not the same we be explaining that tomorrow. Also why these colours are not the same and why they are being grouped But today am interested in the periodic table, (drawing table on chalkboard) you must be able to write the first 20 elements, if youcan know these 20 elements, you will be the best learner. But I want you to observe, look at me how am I going to do this (Writes the elements) Ya, these are the first 20 elements, just check them on your periodic table handout. 1. Hydrogen, 2. helium, 3. lithium

	4. beryllium 5. boron, 6. carbon, 7. nitrogen, 8. oxygen, 9. fluorine, 10. neon, 11. sodium, 12. magnesium, 13. aluminium, 14. silicon, 15. phosphorus, 16. sulfer 17. chlorine, 18. argon, 19. potassium, 20. calcium I think, we can write this. Am going tell you my secret, after that am going to rub and after that am going to request one from you who can come, neh! Will you be able to do that
Learner	Yes
Teacher	My secrete is this I write my Hilium and He (He created a acronym) LiBeBCNOFNeNaMgAlSiPAr potassium Calcium
Learner	Learners laughing
Teacher	I repeat for the last time, from number 3 (He created an acronym) LiBeBCNOFNeNaMgAlSiPAr potassium calcium I know my 20 elements Tomorrow we will concentrate on something else but still on periodic table. Without writing on your hands, I need you to come and try. Xxxx do you want to try
Learner	Learner, tried to write the element
Teacher	He tried, didnt he? Anyone to finish?
Learner	Learners trying
Teacher	Lets give xxx a round of applause
Learner	Learner trying
Teacher	Is it correct now?
Leaner	Yes
Teacher	LiBeBCNOFNeNaMgAlSiPAr potassium and calcium What we will be doing tomorrow, I want you to go and check what are these elements and also look at the chemicals that we are using all the detection, it can be a soap, or any that you eat. Look at it at the back. Look at a soap, the one you use to wash the cover of that soap maybe it is made out of the following detection or whatever. Bazokutshela kuthi yendzwe ngani and whatever nokudla losikudlayo.

	A good example utswayi, kuth ledziwe ngani. Then from Tomorrow we will be explaining, kuthi what is this element, are they dangerous yes some are dangerous and some are not dangerous and where do they come from. Thank you so much for this lesson, I think you enjoyed this lesson Anyone with a question, after we have introduced to say, Maneer angizwanga la nala I think, it was an introduction. Keep this paper (periodic table handout) and thank you Ma'am Keep learning about the periodic table

DAY TWO

Teacher: "Good day."
Learners: "Good day Sir."
Teacher: "How are you?"
Learners: "Fine, thanks and how are you?"
Teacher: "We are fine. Yes, can someone clean the chalkboard for us? We are continuing with what we learnt yesterday. Those who remembered to bring along their hand-outs put them on the table. I understand that maybe because of the timetable, Natural Science was supposed to be in the morning, but however we are going to continue. Ya! Shall we start. Yesterday we introduced the periodic table and then we said it was devised by a Russian by the name of Dmitri Mendeleev in 1860. According to him, Dmitri Mendeleev, he said he saw this periodic table in a dream. I don't know can we believe that or not. He said he saw this periodic table in a dream. Remember before him there was no periodic table. Actually, he is the first person to come up with this periodic table. So he said he saw this periodic table in a dream. While he was sleeping he saw this periodic table. I don't know how true is that, but that's what the textbook is telling us. And so, we asked yesterday, what is an element? And then I remember Mfundo answered us. Who can tell us, what is an element? Let us start there. Mfundo, what is an element? You see? You see that you are not serious with your work? Yesterday you answered me very well but today when we must continue where we left, you cannot answer me. What is an element?"

Learner: **“An element is a pure substance which cannot be broken down further.”**

Teacher: “It is pure substance which cannot be broken down into smaller or further. So, why this element? So he arranged these elements according to their behaviour. In the periodic table, we find the vertical columns. And then he said these vertical columns are groups. If you can look at your periodic table, he said these are groups. But then now there are other arrangements. This other arrangement is horizontal. And then he said this horizontal arrangement are periods. So, in other words, the periodic table has got groups which are vertical and periods that are horizontal. And so, for you to understand a period table, you must know that how many groups that are there. Groups are being mentioned, we can count from our periodic tables. How many are they? Let us count the groups.

Learners: **(count out loud)**

Teacher: “I’m going to this; these are the groups and also we have the periods that are down there. Why these groups and why these periods? Periods and groups are there also to show us where is metal situated and where non-metal is situated and where are the semi-metals situated. And so according to this periodic tables, we have metals, we have non-metals and we have semi-metals. There you are. So if you can look at your periodic table there, on your left hand side until aluminium, which is number 13, you see aluminium?”

Learners: “Yes.”

Teacher: “From this part to this part. As you can see that zigzag arrangement from 1 until there, except 1. 1 is not a metal. As you can see, the colour there is white just like these other elements. Hydrogen, yes, is in group 1. It’s with the metals but funny enough hydrogen is not a metal. Metals are situated on a periodic table on your left hand side. So these are your elements. And then where can you find your non-metals? Can you see the non-metals? Not semi-metals but non-metals. Who can tell me, where are the non-metals on the periodic table? You don’t see the non-metals? Ok, the non-metals are on your right hand side. And then where are the semi-metals? The zigzag part neh? They are at the centre. That zigzag part, those are the semi-metals. So then now, I want you to remember that 20 elements we have done yesterday. Do you still remember? We did 20 elements. Without looking on the periodic table,

can we do that today? Do you still remember my secret? What is my secret?"

Learners: **(mumble in response)**

Teacher: "But did it help you? Can we have someone who can just right them? The 20 of them. Can we do that? Because we want to see whether you understood yesterday or not? Can you do that? Quickly. I think Kabelo will help us here. (draws table on chalkboard with element numbers). So, why these 20 elements? Because we are at a primary level. We must know at least these 20 elements before we can go to high school level. So do we have someone who can come?"

Learners: **(take turns to fill in the table on the chalkboard)**

Teacher: "Listen, on that periodic table, I want you to search for me Natrium. It's number? Natrium is there, listen people natrium originally is a term that derives from latin (He write latin on chalk board), we have so many elements in the periodic table whose name derives from greek , from latin, but this natrium you will never believe me, this natrium it is the very same sodium, is number 11 neh

Learners: **Yes**

Teacher: Sodium is the very same Na, (write on the chalkboard), isn't sodium Na

Learners: **Yes**

Teacher: Na, is Natrium you see, like I told you yesterday iron, we are writing iron as Fe (Writes on chalkboard) from ferilium but then we cannot write I now, maybe I is for irodim, is I for irodine? Look at irodine yes 53. So we cannot write iron as I neh. (he write on the board) we cannot say Iron=I but I is for what? Irodine neh so then we have to look at latin term for iron which is ferilium and write Fe neh

Learners: **Yes**

Teacher: Yes, mercury which is Mg and so other stuff but what am interested is that we have metals, non-metals and semi metals so now you can now see where there non-metals are situated in the periodic table as well as what the 3 metals situated in the periodic table, a s ell as what? The metals. So I've brought to you, I do not know where is it, I've got a torch where is it maybe I left it because I wanted to demonstrate to you what we going to do but we are going to fetch t neh.

For instance when you talk of water we say water is H2o (he writes on board), this is water, this is?

Learners: **Water**

Teacher: This is water, neh H2O I water, so we are going to look at this combination. How two molecules oxygen plus oxygen they form what?

Learners: **Water**

Teacher: Water. We have what? Sodium (he write on chalkboard Na+C2) plus chlorine and chlorine is number 17.We are taking number 17+11 they form what? Salt. Itswayi lesidlayo ekhaya is sodium (pointing at the symbols written on the board) plus chlorine. Sodium chloride is salt. And when looking at this chlorine I want you to look at this carefully and bring some items tomorrow. Icolgate konje inani? In e chlorine or ine florine

Learners: **Florine**

Teacher: I want you to check, you can bring your toothpaste tomorrow bring your Colgate, Aquifresh tomorrow so that we can look at these elements that are being used there. Not only toothpaste also other boxes salt, what else? Cornflakes we want to check what are the elements that are being used there. What else? And then remember all the elements you are going to bring tomorrow our teacher is here, she wants to see all those Items. Why are we interested in those things? We want to see the combination of those elements. For instance here is the first one (pointing at Na+C2 on the chalkboard.), of salt it is sodium and chlorine when you mix the two you get what? Salt. Bahlangana sodium neh chlorine kwabayini tswayi

Before we can write a classwork, we have this page. I want to ask questions before you can write. Here are the simple questions on page 181, we can start with number 1 I want to see hands.

Who devised the first periodic table? Yes xxx

Learner: **Dmitri Mendeleev**

Teacher: Dmitri Mendeleev, very good! Make simshayele isandla

Learners: **Leaners clapping hands for correct answer given**

Teacher: why do we clap hands? It is to encourage one another. So this is our motto whenever someone has got an answer correct we clap hands. The one who device is Dmitri Mendeleev. What is the second question? Where was this periodic table worked out? in which year? Yes

Learners: **18**

Teacher: 1860 or 1816

Learners: **1860**

Teacher: Yes in 1860, he devised, he worked out this periodic table. By the way this Dmitri Mendeleev was a Russian, he was

from Russia. Who can tell me how many elements were in the first periodic table, that he device in 1860

Learners: **20**

Teacher: Not necessarily, they were more than that. It shows you do not concentrate I said there were 63 elements and I said from 63 we have more than 100 of elements. Then we want to know who discovered other elements. This will be our investigation.

I think you will have to go and investigate, why Dmitri Mendeleev discovered 63 and who discovered the other 100s or less than 100 elements. It might happen that it is still him and it might happen that there is somebody else who came up with the other elements.

Where on the periodic table of elements, are metals? Where are the metals on the periodic table? Who can tell me?

Learners: **on the left hand side**

Teacher: on the left hand side, that is where you find the metals. A round of applause please

Learners: ***learners clapping hands***

Teacher: Again, on the periodic table where do we find non-metals?

Learners: **At the right hand side**

Teacher: at the right hand side, I did not see your hand up. Let us clap please

Learners: ***learners clapping hands***

Teacher: Thank you; also, they say where on the periodic table of elements are the semi-metals

Learners: **the right hand side**

Teacher: The right hand side?

Learners: **Yes**

Teacher: In the middle, I understand you want to say zigzag but we cannot say zigzag now because we do not know where is the zigzag neh. When you say in the middle it's correct because this are non-metals, these are metals, and at the centre you have what? Not necessary at the centre but in the middle we have semi-metals. Lets us see atomic number before we can write. Turn with me to 180 in your textbook and they say an atonic number is the number of a certain type of particle in an atom, the same atom there will be a certain number, which represent the atoms that are there. Atom that's where we are counting we want to see when we say element is hydrogen we want to check also the atomic number. We have there number 89 is? The name of 89 there, can you see 89

Learners:	**Learners mumble in response**
Teacher:	Yes, so that's the example of that element, let us take the serious one. Let us take Boron number 5 (He write B on the chalkboard) neh
Learners:	**Yes**
Teacher:	and then Boron is number 5
Learners:	**Yes**
Teacher:	what are going to do? Number 5 is atomic number. Then what else? B, this is our chemical symbol and then the last one is what? Chemical name. what is this chemical name?
Learners:	**Boron**
Teacher:	Boron neh
Learners:	**Yes**
Teacher:	Boron is a chemical name. in each and every element you will find these 3 items. You can take number 19, which is potassium; you will find the atomic number for potassium is 19, the chemical l symbol for potassium is
Learners:	**K**
Teacher:	K very good, the symbol for potassium is K and what would be the chemical name
Learners:	**Potassium**
Teacher:	very good. The symbol here is K the atomic number is number 19 but when you write the chemical name you are no longer start with K but you understand that this K stands for what
Learners:	**Potassium**
Teacher:	Potassium, so let us finish asking question so that we can write the classwork. The second question says give a symbol for and the last question what elements are the following symbols. This is the end of our lesson, lets us write classwork neh.

DAY THREE

Teacher	"How are you?"
Learner	"Fine and how are you Sir?"
Teacher	"We are fine. Thank you. Sit down. Today we want to finish the work that we started the day before yesterday. We started with what subject or the topic of Building Tables. Do you still remember? "
Learners	"Yes."
Teacher	"And then, who can tell me, on day number 1, what have we done? Besenzani? Day number 1 on periodic table, who can tell me? We looked at what? We looked at the elements. Also the definition of matter. Do you still remember?"
Learners	Yes

Teacher	“And then we looked at who devise the periodic table. And we said who is that person?”
Learner	“Dmitri”
Teacher	“Dmitri, neh? Dmitri Mendeleev. In which year? Do you still remember?”
Learner	“1860”
Teacher	“1860 neh? Many, many years ago. Tell me, is it more than a hundred or is it more than a thousand? You must calculate there then. So this periodic table is very old. It’s not a new thing. So yesterday we wrote a classwork. On that classwork, we wanted to see the symbols of those elements. In that classwork, we also wanted to see the names of those elements. I hope that you wrote my classwork. Neh”
Learners	“Yes”
Teacher	“Make sure that now we swap or we interchange our books. Just give your neighbour your book so that we can do the corrections. By the way the work in on page…?
Learners	“181”
Teacher	*“Yes. On page 181. Eh, yesterday there were questions that were not answered. I want you to look at those questions. We did not answer metal. What is a metal? We never answered that neh? What is a non-metal? We never answered that. What is a semi-metal? We never answered that. So I want you to look at those definitions. What is a metal? What do you understand when we talk of a metal? What do you understand when we talk of a non-metal? And what do you understand when we talk of semi-metals? And then we are going to look at what is the difference between a metal and a non-metal? What is the difference between a metal and semi-metal? And so on and so on, neh? So by the end of this lesson, you must able to differentiate between a metal, non-metal and semi-metals. I hope you are looking at those definitions now. Shall we do the corrections quickly and let us right on the chalkboard your corrections. Today’s date?”*
Learner	:23”
Teacher	“23. Thank you. 23 of?”
Learner	“May “
Teacher	“Sorry now, we want to check number 1. And then, by the way what is the question? Actually here we want the person. And then, who is the person by the way
Learners	“Dmitri Mendeleev.”
Teacher	“Dmitri Mendeleev neh? You will correct me with the spelling.”
Learners	“Without the first ‘l’.”
Teacher	“Thank you. And then they say which year?”
Learner	“1860”
Teacher	“1860s”
Learner	“Yes”
Teacher	“Thank you. And then come to number 2. Number 2 they want what? They want the metals? Where are the metals? Ok. They

	want the metals neh? Where are they situated? Where can we find the metals?"
Learners	"Left hand side."
Teacher	"The right hand side or left hand side?"
Learners	"Left hand side."
Teacher	"Yes. They say on the left hand side of the periodic table. And then what else? Number 2 or letter (b), non-metals. They are situated on the far right hand side of the table. So do you mark there?"
Learner	"Yes"
Teacher	"Make sure that you mark. You can use your red pen to mark. And the (c). These are what? Semi-metals. What do you understand by the term 'semi-metals'? Boys, you are playing soccer. I think it's not for the first time you hear 'semi'."
Learner	"Semi-finals."
Teacher	"Yes. Semi-finals. What do you understand by 'semi'? So you want to tell me that these are the finals and these are the semi-finals? What do you understand by the term 'semi'? Or in mathematics we also have semi-circle. It is not a full circle but a semi-circle,neh? Ya. Mpumi, what do you understand?"
Learners	They are not full metals
Teacher	"They are not full metals, neh? I think I will correct that one. They are not full neh? In other words, they are almost like. They are semi. They are not full, neh? They are half. In other words the composition thereof is not full metal but its half. Semi, neh? After semi-finals we do have what, finals neh? So these are the semi-metals. And then, what about the non-metals? They are not metals, neh? Yes. They are non-metals so meaning that they do not have what we call, qualities of a metal. Their qualities are not the same. In science, I think grade 4 or grade 5, we are talking of a conductor and non-conductor. Conductor of electricity and non-conductor of electricity. Non, we are referring to those objects that do not conduct electricity. We are saying those are non-conductors. Whenever you see this 'non', it means it's not that. So obvious it will be the opposite of metal. Non-metal would be the opposite of metal. So certain metals are found in the region between. Are found in the region between metals and non-metals. There you are, number 3. Then number 3 what do they want there? You give symbol. It would be very very easy. They want now, symbols. (a) is Carbon. Remember, we said when you write the name, you write with a capital letter. Carbon, you will never see i-Carbon e-so in size. But always you see carbon in small letters. And then what would be the symbol?"
Learners	C
Teacher	Then C is in capital letter. Don't write a small C. Don't write small c. (b) Helium. The symbol?"
Learner	He
Teacher	"He. And then whatelse, lithium. Lithium?
Learner	Li
Teacher	Magnesium?

Learners	Mg
Teacher	“There are those who are writing capital letters here. Who are saying (writes LI on the board). This is wrong. We do not have something like this in Science. Those who are saying (writes MG), this is not a magnesium. With capital ‘G’, this is not magnesium. Make sure that its capital letter ‘M’ and a small ‘g’. And then Argon?”
Learners	Ar
Teacher	Ar. And then Hydrogen?”
Learner	H
Teacher	“g (writes ‘potassium’ on board).”
Learner	K
Teacher	“Why not ‘P’? ‘P’ is for phosphorus. So we cannot put another ‘P’. What else do we have? Boron. And then boron?”
Learners	B
Teacher	“B, neh? And then (i), neon. And neon?”
Learners	Ne
Teacher	“Ne. What else? Chlorine. And then chlorine?”
Learner	Cl
Teacher	Cl. And the last one, sodium.”
Learner	Na
Teacher	“Na. By the way, we said this Na is being derived from which word? We wrote it yesterday. This Na is derived from a Latin word which is?”
Learners	Natsium
Teacher	Yes, Natsium for sodium. And then coming to number (4), the last question. The question there is saying, write the names of elements now. (a)Si?”
Learners	Silicon.”
Teacher	Silicon. (b) N?”
Learner	Nitrogen.”
Teacher	Nitrogen. (c) Be?”
Learner	Beryllium.”
Teacher	Beryllium. And then (d) O?”
Learners	Oxygen
Teacher	Oxygen. By the way, what do we breathe in?”
Learners	Oxygen
Teacher	Oxygen. Can you see oxygen with your naked eye?”
Learner	No.”
Teacher	With your microscope?”
Learner	No
Teacher	We cannot see it, neh? Both with a microscope as well as the eyes, we cannot see. Next (e) S?”
Learners	Sulphur.”
Teacher	“(f) He?”
Learners	Helium
Teacher	Helium. (g) C?”
Learner	“Carbon.”
Teacher	“Carbon. And then (h) F?”

Learner	“Fluorine.”
Teacher	“Fluorine. So never confuse this and start with a ‘o’. And then Al?”
Learners	“Aluminium.”
Teacher	“And then (j) P?”
Learners	Phosphorus.”
Teacher	“If you have finished marking then you can give the owner the book then let us check those items that we said we are going to check today. But before we can find them, let us look at the definition. I have said look at the metals. What are the metals? Any element that is hard, and shiny, and a good conductor of heat (writes on board). And then, non-metal, any element that does not conduct heat. Like I have said that this would be the opposite. And then the last one, semi-metal. An element that has some properties with metals and some with non-metals. Listen now. Semi-metals, they are always between metals and non-metals. Because semi metals share some properties with metals and non-metals. Take out your items so that we look at them. We are going to look at the substances that are being used to make this still water. Any question?

APPERNDIX: M

ROSE OBSERVATION TRANSCRIPTS

DAY ONE

Learners:	**We are fine thanks, and how are you ma'am**
Teacher:	I Am Fine Thank You, Sit Down
Learners	**Thank You Ma'am**
Teacher:	*Teacher Writes On Chalkboard* Our Topic For Today Is The History Of Periodic Table, Let Us Say All Of Us
Learners	**The History Of Periodic Table**
Teacher:	Again
Learners	**History Of Periodic Table**
Teacher:	Again
Learners	**History Of Periodic Table**
Teacher:	Again
Learners	**History Of Periodic Table**
Teacher:	Again
Learners	**History Of Periodic Table**
Teacher:	History Of
Learners	**Periodic Table**
Teacher:	Who Can Tell Me What Is Periodic Table, What Is Periodic Table, If You Know Raise Your Hand, Any One? Do You Know A Periodic Table? Yes Msisi
Learners	**Periodic Table Is Like A Table, Like Periods**
Teacher:	Is The Table For The Period, You Have Tried But Not Exactly But You Have An Idea What A Periodic Table Looks Like Or Is Like A Table
	Is This A Table (Pointing At The Paper Posted On The Wall)
Learners:	**No / Yes**
Teacher:	Those Who Are Saying Yes, Raise Up Your Hand
Learners	**Learners Raising Up Their Hands**
Teacher:	Those Who Say This Is A Table Raise Up Your Hand
Learners	**Learners Raising Up Their Hands**

Teacher: Okay, Put Your Hands Down, Those Who Are Saying No, Raise Up Your Hand

Learners **Learners Raising Up Their Hands**

Teacher: Okay, Why Are You Saying No,

Learners **Leaners, Putting Their Hands Down**

Teacher: Don't Put Your Hands Down, Raise Up Your Hands

Learners **Because, It Is Not The One We Put Food On**

Teacher: We Are Not Talking About That Table; The Table We Are Talking About Is The Table For The Periodic Table. This Is The Table, Periodic Table. Now We Are Talking About The Table For The Element. Table For?

Learners: **Elements, Elephant**

Teacher: No Elephant, Element Let Us All Say

Learners: **Element**

Teacher: Let U Say

Learners **Elements**

Teacher: Let Us Say

Learners: **Element.**

Teacher: Now Who Can Tell Me About This Element. We Are Going To Study About The Periodic Table For The Element Okay Let Us Start By Saying Matter. What Is The Matter

Learners **Matter Is Something That Is Make Out Of Strong Material**

Teacher: Everything That Occupies Space That Has Mass And Volume Is A Matter. Isn't

Learners **Yes**

Teacher: Are Made Out Of *Pointing At Element Written On The Chalkboard*

Learners **Element**

Teacher: Just Give Example Of Element That You Know. Yes Xxx

Learners: **Kettle**

Teacher: Curtain, Iketlela, Mmmmmmh Not Exactly Nokulunga

Learners **Time Table**

Teacher: Timetable Is Not Exactly. Where Can We Find An Element?

Learners **Steel**

Teacher: Steel Yes, Where Do We Find The Steel? Yes These Butlers Are Made Out Of Steel Which Is An Iron, Yes Another One. Yes Mosetla

Learners **Steel**

Teacher: Yes Another One, Yes Nokulunga

Learners **Copper,**

Teacher: Yes Cooper, Come A Write Nokulunga

Learners: ***Nokulunga Write Copper On The Board***

Teacher: Another One, Faster Yes Another One Xxx

Learners **Aluminium.**

Teacher: Yes Good, Come And Write Aluminium, Good Nokulunga, Good Lehlogonolo

Learners **Lehlogonolo Writes Aluminium,**

Teacher: Yes,

Learners **Platinum,**

Teacher: **Platinum, Come And Write**

Learners **Manana Writes Platinum**

Teacher: **Platinum Write Platinum For Us Faster**

Learners **Iron**

Teacher: Iron, We Have Iron I Have Given You Iron As An Example Give Me Yours, Yes …

Learners **Gold**

Teacher: Yes Gold Correct Come And Write Gold For Us

Learners **Silver Ma'am**

Teacher: Silver Correct, Come And Write Silver

Learners **Diamond**

Teacher: Yes Diamond. The Last One

Learners: **Calcium,**

Teacher: Calcium, Yes Come And Write Calcium

Learners ***Learner Writing Their Elements On The Board***

Teacher: Yes, Write Faster. Is The Spelling For Calcium Correct

Learners **No**

Teacher: Is The Spelling For Diamond Correct

Learners **No**

Teacher: Is The Spelling For Silver Correct

Learners **Yes**

Teacher: Is The Spelling For Platinum Correct

Learners **Yes**

Teacher: Is The Spelling For Aluminium Correct

Learners **Yes**

Teacher: Is The Spelling For Aluminium Correct

Learners **Yes**

Teacher: Seriously? Look At The Spelling

Learners **Yes/No**

Teacher: Copper

Learners: **Yes**

Teacher: Steel

Learners **Yes**

Teacher: You Said Diamond Is The Wrong One Come And Correct It

Learners **Surprise Is Correcting The Spelling For Diamond**

Teacher: Can We See Diamond?

Learners **Yes**

Teacher: Is The Spelling Correct

Learners **Yes**

Teacher: Okay, All These Elements, We Have 118, We Have How Many?

Learners **118**

Teacher: *Teacher Write (118) On The Board* We Have How Many

Learners: **We Have 118 Elements**

Teacher: How Many

Learners **118 Elements**

Teacher: These Elements Are Presented On A Periodic Table. When We Talking About The Table, We Are Talking About The Sketches Like This One (Pointing At The Periodic Table Posted On The Wall) The A Table For Our Periods And We Have Table For? *Pointing At The Chalkboard*

Learners: **Elements**

Teacher: Table For Elements, Who Knows The Periodic Table? Come And Draw A Periodic Table So That We Can Place Our

Elements. Msizi At Least Know How To Draw And You Maselele You Will Help Us Know Our Periodic Table Better

Before That, There Is A Scientist That Is Called Dimitri Mendeleev. That Is Called?

Learners: **Dimitri**

Teacher: Teacher Writes *Dimitri Mendeleev On The Board* He Is Called

Learners: **Dimitri**

Teacher: Is A Scientist Who Is Called

Learners **Dimitri**

Teacher: Who Is Called

Learners **Dimitri Mendeleev**

Teacher: Dimitri Mendeleev

Learners **Dimitri Mendeleev**

Teacher: Lets Us All Talk, Dimitri Mendeleev

Learners **Dimitri Mendeleev**

Teacher: Again

Learners **Dimitri Mendeleev**

Teacher: Again

Learners **Dimitri Mendeleev**

Teacher: Dimitri Mendeleev, A Scientist Who Have Come Up With Table, To Put Our Elements, He Came Up With The Table So That Our Elements Can Be Well Presented. Therefore, Some Of Us Have Said They Know This Table. Msizi, Come And Draw The Table For Us So That We Can See The Periodic Table And Maselela Will Msizi Draw The Table .

Learners **Learners, Going To The Chalkboard**

Teacher: You See The Elements.

Learners: **Yes**

Teacher: Don't Forget Them

Learners **Learners Drawing The Periodic Table**

Teacher: In The Mean Time, Who Did We Say Came Up With This Table

Learners **Dimitri Mendeleev**

Teacher: We Said Who Came Up With This Table

Learners Dimitri Mendeleev

Teacher: Let Us Help One Another

Learners: **Leaners Helping One Another By Drawing**

Teacher: This Is The Example Of Our Periodic Table; It Is Not Exactly Like The One That Masilela And Msizi Have Drawn, Let Me Not Write The Number. Sit Down In The Meantime.

We Have Talked About The Element We Have The Element And Compound. Les Us Say $H0_2$

Learners: **$H0_2$**

Teacher: What Is This HO_2, It Is Hydrogen From Our Elements. We Have Hyrogen (However Written Hydron On The Board). Look At It, I Have Given You Hydrogen, What About

Learners **Oxygen**

Teacher: Yes

Learners **Oxygen**

Teacher: If An Element Has Two Element On It, It Is No Longer An Element But A Compound Because Why, It Has Two Elements In One… At The Same Time. We Have Hydrogen And Oxygen, Into Ezi 2 Ngaphakathi Kwento Eyi 1. Okay Let Us Continue With Our Periodic Table

Msizi, Has Written Atomic Number, Symbol, Element And Again Atomic Number, Symbol And Element. Can You Explain What Is Going On There?

Learners **Atomic Number Put In A Names**

Teacher: Meaning The Element Has The Numbers, The Element Has The Numbers

Learners: **Number**

Teacher: The Element Has The

Learners **Numbers**

Teacher: The Element Has The Number. Come Sbonelo And Write The Number So That We See When You Talk About The Number What Are You Talking About

Learners **Leaner Is Writing The Numbers On The Board**

Teacher: Okay, Where Have You Learnt This? Yes

Learners **Textbook**

Teacher: Or From The Textbook Not From Your Previous Class

Learners **Yes**

Teacher: Or You Copying Okay Close You Books All Of You. I Can See You Have Gone Through The Textbook, Which Is Good. You See All Of This (Pointing At The Periodic Table)

Learners **Yes**

Teacher: We Will Come To This. I Have Developed A Style Of Drawing A Periodic Table. When I Draw The Table, I First Draw 6 Blocks (She Draws) I Come To 5 Block, Then I Come To 4, 4 Block Which Are 8 I Mean 6. I Am I Wrong Or Right

Learners **Wrong**

Teacher: 6 Block Or 8

Learners **8**

Teacher: And 3 Block And 5 Blocks It Is 6 Block. You Will Correct Me If Am Wrong, But I Want My Periodic Table To Look Like Scientist Dimitris Periodic Table. Msizi Has Written The Number From Small To Bigger Number.

Okay Let S Open Our Textbooks, Open On 92, Those Who Do Not Have The Textbook Look At It From Your Friend

Leaners: ***Leaners Moving Around To Share Textbook****

Teacher: I Want Us To Start By Placing, Naming And Place The Numbers And Symbol On Our Table Like This, Okay Number Have

Learners **H**

Teacher: H Wat, Am Going To Say Number And That Is The Atomic Number And You Say The Symbol And The Name Of The Element. We Are Going To Say All Of Us. Let Us Say All Of Us, We Have Number 1

Learners: **H**

Teacher: Which Is

Learners **Hydrogen**

Teacher: Which Is

Learners: **Hydrogen**

Teacher: Number 2

Learners : **K, Calcium**

Teacher: Number 2 We Have He, Which Is

Learners **Halium**

Teacher: Helium, Let Us Say All Of Us,

Learners **Helium**

Teacher: Number 3

Learners **Li**

Teacher: Li, Which Is

Learners **Lithium**

Teacher: Lithium Let Us Say All Of Us

Learners **Lithium**

Teacher: Number 4

Learners

Teacher: **Which Is**

Learners: **Barium**

Teacher: Number 5

Learners **B**

Teacher: Which

Learners **Barron**

Teacher: Number 6

Learners **C**

Teacher: Which Is

Learners: **Carbon**

Teacher: Number

Learners **N**

Teacher: Which Is

Learners **Nitrogen**

Teacher: Number 8

Learners **O**

Teacher: Which Is

Learners **Oxygen**

Teacher: Number 9

Learners **N**

Teacher: Which Is

Learners **Fluorine**

Teacher: Which Is

Learners **Fluorine**

Teacher: **Fluorine**

DAY TWO

Teacher: "Good morning class."

Learners: "Good morning Ma'am."

Teacher: "How are you?"

Learners: "We are fine, thanks and how are you Ma'am?"

Teacher: "Fine. Thank you. Sit down."

Learners: "Thank you Ma'am."

Teacher: "Ok. We are continuing with Elements. We have ended doing the diagram of elements. Do you remember the elements?"

Learners: "Yes!"

Teacher: "All of you?"

Learners: "Yes!"

Teacher: "Ok, let us name them. The ones that you know. Raise up your hand and name the ones that you know. Yes Ziyanda."

Learner: "Iron."

Teacher: "Iron. Come and write iron for us."

Learner: (writes on chalkboard)

Teacher: "Yes Malandela?"

Learner: "Steel."

Teacher: "Not exactly. Yes Lele?"

Learner: "Gold."

Teacher: "Gold, come and write gold for us."

Learner: (writes on chalkboard)

Teacher: "There are those who are talking. Yes Lebo?"

Learner: "Aluminium."

Teacher: "Yes. Come and write aluminium for us. Joy?"

Learner: "Diamond."

Teacher: "Diamond, come and write diamond for us. Nkunzi?"

Learner: "Copper."

Teacher: "Copper, Lehlogonolo?"

Learner: "Platinum."

Teacher: "Platinum. Thapelo?"

Learner: "Silver."

Teacher: "Silver. Ok, we have an iron, gold, aluminium, platinum, silver. Ok, let us name the symbols of those elements. Do you know what a symbol is?***"***

Learner: "No!"

Teacher: "Don't you know what a symbol is? Let us name the symbol for iron. Raise up your hand. Yes Lebo?"

Learner: "i."

Teacher: "Nope. Not exactly. Yes Msizi?"

Learner: "IR."

Teacher: "iR. Not exactly. Yes Amogelang?"

Learner: "iN."

Teacher: "iN, Nope. The last one. Eh, Mfuki?"

Learner : "iO."

Teacher: "iO. Not exactly. But the symbol for Iron is Fe. Fe is the symbol for?"

Learners: "Iron."

Teacher: "What is the symbol for Iron?"

Learners: "Fe."

Teacher: "What is the symbol for gold? What is the symbol for aluminium? What is the symbol for diamond? What is the symbol for copper? What is the symbol for platinum? What is the symbol for silver? Yes, Lehlogonolo?"

Learner: "CA."

Teacher: "CA? No. What is the symbol for gold?"

Learner: "GA."

Teacher: "GA? Not exactly, let us raise up our hands. Eh, Sibonelo?"

Learner: "I have the symbol for aluminium."

Teacher: "Ok, the symbol for aluminium?"

Learner: "Al."

Teacher: "Al, that is correct. Come and right the symbol for aluminium. Any symbol that you know, raise up your hand and tell us. Thupulle, tell us the symbol that you know. Any symbol that you know? Anyone? Nokulunga? Any symbol that you know? You can choose any element. Come on, wake up! Don't open the textbook, I will tell you when. Yes Msizi, even though you have copied?"

Learner: "Calcium."

Teacher: "Calcium is an element but we don't have a calcium here. I want a symbol for gold, the symbol for diamond, copper, platinum, silver. Ok, let us all open our textbooks. Let us open our textbooks on page 92. We have the atomic number there. On page 93, we have the symbol, the element. Atomic number, symbol, element. From element 1 upto element 20. You can go where there is a textbook. Quietly so."

Learners: (Switching positions)

Teacher: "Page 93, we have the atomic number, do you see it? Do you see atomic number?

Learners: "Yes!"

Teacher: "Do you see symbol?"

Learners: "Yes!"

Teacher: "Do you see element?"

Learners: "Yes!"

Teacher: "Let us all pay attention. Ok, I am going to say atomic number 1 and you tell me the symbol and the element, ok?"

Learners: "Yes!"

Teacher: "Ok, let us start. Atomic number 1?"

Learners: "H."

Teacher: "It is?"

Learners: "Hydrogen."

Teacher: "Atomic number 2?"

Learners: "He."

Teacher: "It's the symbol for?"

Learners: "Helium."

Teacher: "Atomic number 3?"

Learners: "Li."

Teacher: "It's the symbol for?"

Learners: "Lithium."

Teacher: "Atomic number 4?"

Learners: "Be."

Teacher: "It is the symbol for?"

Learners: "Beryllium."

Teacher: "Number 5?"

Learners: *"B."*

Teacher: "B is the symbol for?"

Learners: "Boron."

Teacher: "Atomic number 7?"

Learners: "C."

Teacher: "C is a symbol for?"

Learners: "Carbon."

Teacher: "Atomic number 8?"

Learners: "O."

Teacher: "O is a symbol for?"

Learners: "Oxygen."

Teacher: "Oh! I have jumped 7. Atomic number 7?"

Learners: "N."

Teacher: "Symbol for?"

Learners: "Nitrogen."

Teacher: "Number 8?"

Learners: "O."

Teacher: "Symbol for?"

Learners: "Oxygen."

Teacher: "Number 9?"

Learners: "F."

Teacher: "For?"

Learners: "Fluorine."

Teacher: "Number 10?"

Learners: "Ne."

Teacher: “Symbol for?”

Learners: “Neon.”

Teacher: “Atomic number 11?”

Learners: “Na.”

Teacher: “Symbol for?”

Learners: “Sodium.”

Teacher: “Atomic number 12?”

Learners: “Mg.”

Teacher: “Symbol for?”

Learners: “Magnesium.”

Teacher: “Atomic number 13?”

Learners: “Al.”

Teacher: “Symbol for?”

Learners: “Aluminium.”

Teacher: “Atomic number 14?”

Learners: “Si.”

Teacher: “Symbol for?”

Learners: “Silicon.**”**

Teacher: “Atomic number 15?”

Learners: “P.”

Teacher: “Symbol for?”

Learners: “Phosphorus.”

Teacher: “Atomic number 16?”

Learners: “S.”

Teacher: “Symbol for?”

Learners: “Sulphur.”

Teacher: “Atomic number 17?”

Learners: “Cl.”

Teacher: “Cl not Ci. Symbol for?”

Learners: “Chlorine.”

Teacher: “Atomic number 18?”

Learners: “Ar.”

Teacher: “Symbol for?

Learners: “Argon.”

Teacher: "Atomic number 19?"

Learners: "K."

Teacher: "Symbol for?"

Learners: "Potassium."

Teacher: "Potassium. Ok the last one."

Learners: "Ca."

Teacher: "No. Atomic number 20?"

Learners: "Ca."

Teacher: "Symbol for?"

Learners: "Calcium."

Teacher: "I think now you know them. You know the number. You know the symbol and the element. Ok, let us sit down and draw a diagram for the elements. And it should have number 1-20. Ok, let us sit down. Go back to your place."

Learners: (moving around)

Teacher: "Ok, let us continue. Now we know the atomic number, we know the elements and we know the symbols. Can we do the diagram for those elements or a table for the elements that we have spoken about? Lift up your hand and come and draw the diagram for us. Yes Obakeng. Faster and be fast. We are going to help one another. Yes, draw the diagram for elements. If he is incorrect, you raise up your hand and correct him."

Learner: (Draws diagram on chalkboard)

Teacher: "Not that one. Not a table. The one that I have organised for us. A diagram. Faster. Faster Obakeng. Let us know 20 of them and then we continue with others. Is this our periodic table? Its like this?

Learners: "No!"

Teacher: "Ok. Anyone to continue? Msizi, don't erase, just add. Our periodic table is like this? Let us come and correct the diagram first. When you draw it in your exercise book, use a ruler."

Learner: (draws on chalkboard)

Teacher: "Is this correct?"

Learners: "Yes."

Teacher: "Write properly. We are going to need space for the symbols. Write the number on top. We start by the small ones and then the bigger ones. Ok?"

Learners: "Yes."

Teacher: "How many elements do we have? Raise up your hand, how many elements do we have all-in-all?"

Learner: (after a couple of guesses) "118."

Teacher: "Yes, the correct one is 118. 28 are artificial and the other ones are natural. Ok, we are going to continue up to 20 right now. Without looking at the textbook, we are going to write 1-20. Write only 2 Msizi and then give others a chance. Let us close our textbooks. When you come here you write only 2."

Learners: (take turns to write on chalkboard and correct each other)

Teacher: "Is this correct?"

Learners: "Yes!"

Teacher: "Let us look at our elements, are the symbols correct, all of them?"

Learners: "Yes!"

Teacher: "Can we all draw this? Are we going to get it correct?"

Learners: "Yes!"

Teacher: "Ok, let us say them once and then I erase them."

Learners: (mention all written elements)

Teacher: "Take the textbook, put it in your bag. Let us write the classwork. Let us all be quiet. I don't want to see you speaking or talking. We are all doing our work. We are all writing."

DAY THREE

Teacher: Ok, good morning class.

Learners: Good day Ma'am.

Teacher: How are you?

Learners: We are fine, thanks, and how are you Ma'am?

Teacher: Fine, thank you. Sit down.

Learners: Thank you Ma'am.

Teacher: Let us read our topic for today.

Learners: Metals.

Teacher: We have Metals. Ok, who can tell me what metals are? Last time we have studied about?

Learners: Elements.

Teacher: Amongst those elements we have metals. Metals which are different. The metals are categorized into 3 categories. The first category is? Who can try the first category? Yes Msizi.

Learner: Iron

Teacher: Those are the examples of the metals. Those are the examples of the elements. The category of the elements?

Learner: Steel

Teacher: Yes, the iron the steel, the diamond, the platinum, aluminium, hydrogen oxygen. Those are example of elements, which are categories into metals. the We have the metal, semi-metal and the non-metal. Let us name them:

Learners: Metals, semi-metals and non-metals

Teacher: Who can tell me, what is the difference between those 3?

Learners: (attempt to give answers)

Teacher: From the periodic table, how can we differentiate them?

Learner: You can put the elements that are heavy in metals, and put the elements that are not heavy in non-metal are normal

Teacher: Let us hear you msizi

Leaners: Metal is stronger than semi-metal and semi-metal is stronger than non-metal

Teacher: the metal are stronger, semi-metal are less stronger than metal. And non metal are not strong. From the periodic table, how can you differentiate? The element

Leaners:

Teacher: -Yes, they are categorized in their heaviness. The heavy ones you put together. The semi-metals, the ones are a bit low in their heaviness, are put together also. And the non-metals, the ones that are not heavy at all, they are put together. Heavy ones are put on the right hand side. The metal ones are put on the right

hand side. The semi-metals are put in the middle, and the non-metals are put on the left hand side of our periodic table. Let us open our textbooks and see what we are talking about. Let us all look at our periodic table. What can you say about the metals? The metals are on the right hand side, the semi-metals are in the middle and the non-metals are on the left hand side. What can you say about what you see? Raise up your hand and tell us about what you see. Only the same hands? Let us hear from others. Girls where are you? Talk about the colours, what do you see?

Learners: **(attempt to give answers)they are shiny**

Teacher: I do not see that

Leaners: **Metals have a purple colour, semi-metals have yellow. Non-metals have blue.**

Teacher: At the periodic table, you can differentiate them by colour. Metals are purple. Semi-metal yellow and non-metal blue

The metals are

Leaners: **Purple**

Teacher: Semi-metals are

Leaners: **Yellow**

Teacher: Non-metal

Leaners: **Blue**

Teacher: Ok, let us look at our periodic table. Can you name the metal elements from our textbook? Yes Msiza

Learners: **Aluminium**

Teacher another one

Leaner: **Calcium**

Teacher: Calcium because of their colour

Leaner: **Relium**

Teacher: Relium, come write relium for us.

Yes Nokulunga,

Leaner: **Lithium**

Teacher: Yes, come write lithium. Give us the last one I know the are many but give us the last one

Leaner: **Aluminium**

Teacher: aluminium, come write aluminium

Leaners: **(take turns to name and write the elements on the chalkboard and elements according to their colours. Also they deal with the functions of the elements)**

Teacher: Ok, the semi-metal

Leaner: **Boron**

Teacher: come write

Leaner: **Write Boroon on chalkboard**

Teacher: is the spelling correct

Leaners: **NO**

Teacher corrects the spelling (Boron)

Leaners: **Silicon**

Teacher: come write

Leaner: **Silycon**

Teacher: is the spelling correct?

Leaners: **NO**

Teacher: Teacher corrects the spelling Silicon. The last one there are many but the last one

Leaners **Silicon**

Teacher: we have silicon, name any element that is yellow, look at the table. There ones that are yellow (showing the leaners in a textbook). The last semi-metal element, I know there are many

Leaner: **Silver (writes on chalkboard)**

Teacher: Silver, now non-metal one

Leaner: **Carbon (write on chalkboard)**

Teacher: Another one, oxygen come write

Learner: **Oxygen (write on chalkboard)**

Teacher: Nothando,

Leaner: **Helium**

Teacher: Helium, okay let us talk about the function pf these elements. Let us where do we find hydrogen. (Teacher write on chalkboard function of element) Okay function of **nitrogen,**

Leaner: Leaner is unclear mentioning number 7

Teacher: what is the function, what is the uses, where can we find nitrogen?

Leaner: in a car

Teacher: mmmmmmh ya, but nje where can we find it

Leaner: in a desert

Teacher: Nitrogen is here in the atmosphere, we find it here (pointing air) What about oxygen, nitrogen works together with the oxygen for us to breathe, for animals to

Leaner Breath

Teacher For plants to

Leaner Breath

Teacher We breathe in

Leaner Oxygen

Teacher We give out

Leaner Carbon dioxide

Teacher We breathe in oxygen, we breathe out

Leaner carbon dioxide

Teacher the plants give in

Leaner carbon dioxide

Teacher and out

Leaner Oxygen

Teacher and that is a? making a sign to give the leaners a hint

Leaner rotation

Teacher not rotation but it is the

Leaner production

Teacher No

Leaner recycling

Teacher no

Leaner

Teacher ……. What is the use of helium, it is there in your textbook. Let us look at the uses of these elements. Maisela read for us the use of elements in page 34

What is the uses of Helium

Leaner to carry liquid in

Teacher: No, the can that we use to drink in like coca cola, like sprite, whatever we drink, the can are made out of?

Leaners: aluminium

Teacher: what is the metal is used to make the butler, yes they have used what?

Leaner Steel

Teacher: They have use steel, not exactly steel

Leaner: Iron,

Teacher: Iron, not exarly iron

Leaner: copper

Teacher: what is the use copper, they have used copper for that thing in your pocket (Writes copper-coins, on the chalkboard) the R1s, R2s, R5s in your pockets are made out of copper.

What about gold, earing, that I am wearing are made are out of Gold

What about silver

Leaner: Teeth,

Teacher: Explain I do not understand

Leaner: can

Teacher The can is made out of aluminium, what about platinum?

Gold- Jewellery (learners spelling)

Leaner: Platinum for mining

Teacher Yes, platinum for mining but what is its use

Leaners; Glasses

Teacher: No, here are sunglasses do you see platinum here

Leaners: Glasses are not the same

Teacher: can you explain

Leaner: drinking glass

Teacher what did they use to make sun glasses

Leaners plastic

Teacher: Yes, when they are recycling. Abanye bafundela ukhohlwa.

Go and find out the uses of different elements, come back tomorrow and tell me the differences the two different elements.

Okay, this is the end of our lesson today ma'am.

APPENDIX: N
SEQUENCE OF TOPICS

Grade 7	Grade 8 Content and concepts	Grade 9	Grade 10
Separating Mixtures **Mixtures** • A mixture is made up of two or more substances or materials that have different physical properties • Physical properties of the materials in the mixture determines the separating method to be used **Physical Separating methods of mixtures includes** • Sorting • Sieving • Filtrating • Using a magnet • Evaporation • Distillation • Chromatography	**Atoms** **mixtures of elements and compounds** • elements and compounds are often mixed together, such as in air, sea water, rocks and living things • mixtures are separated by physical means; compounds can be separated by chemical means	Mixtures are not thought at this grade.	**Mixtures** **Heterogeneous and homogeneous mixtures** • revise the properties of a mixture • revise the properties of heterogeneous mixtures • revise the properties of a homogeneous mixture • give examples of heterogeneous and homogenous mixtures

Physical properties of materials • properties of materials determines their suitability for a particular use such as: ◦ -Strength ◦ -flexibility ◦ -boiling and melting points- ◦ -electrical conductivity ◦ -heat conductivity The boiling point of a substance is the temperate at which the liquid starts boiling (boiling is a rapid change in the state from a liquid state to a gas state) Other factors (such as cost, colour and texture) are also taken into account when using materials	**Particle model of matter** **Density, Mass and Volume** • The density of a material described the amount of mass in a given volume of that material Density and states of matter • Gases are less dense than liquids and liquids are less dense than solids Density of different materials • Some materials have low density and some have high density • The individual particles making up on material may have different masses compared to the individual particles making up another material. In addition, there are spaces between the particles. • The density of a material will depend on the kind of particles it is made up of and	Properties of materials are not taught at this grade	**The materials in which the an object is composed** Revising the properties of materials e.g. • Strength • Thermal and electrical conductivity • Brittle, malleable or ductile • Magnetic or non-magnetic • Density(lead/ aluminium) • Melting points and boiling points

	the size of the space between them. • A material which has lower density will float on a liquid which has a higher density. Expansion and contraction of materials • Solids, liquids and gases tend to expand when heated and contract when cooled • Particles of liquids and gasses are in a state of constant motion • As a material is heated, the movement of the particles increases and they mover further apart, therefore the material expands • As material is cooled, the movement of particles decreases and they move closer together, therefore the materials contracts • When a material expands or contracts, the size and number of particles does not change. Instead, it is only the spaces between the		

	particles that bigger or smaller		
Elements and compounds Elements and compounds are not taught at this grade	**Atoms Pure substances Elements** • An element is a material that consists of atoms of only one kind, such as hydrogen (H), oxygen (O), Carbon (C) sodium (Na) and chlorine (Cl) • All known elements are listed on the Periodic Table of Elements. They are limited in number and are the building blocks of millions compounds • Some elements on the Period Table of Elements form diatomic molecules for example hydrogen (H2) • Sometimes atoms react together chemically to form molecules of compounds (such as H2O, CO2) Compounds • A compound is a material that consists of atoms of two or more different elements	Atoms are not taught at this grade	**Pure substances: elements and compounds** • Revise the microscopic and symbolic representations for elements, compounds and mixtures • Revise the definition of an element • Revise the definition of compound • Revise the definition of pure substances • Revise the classification of substances as pure, as compounds, or as elements

	chemically bonded together, such as water (H2O) • The atoms in a given compound are always combined/bonded in a fixed ratio such as water, where the ratio is always two hydrogen atoms (H) to one oxygen atom (O) • A chemical bond is the force that holds atoms together • Compounds such as water (H2O) are formed by chemical reactions • Compounds can be broken down in a decomposition reaction into other compounds or their original element by heating or electrolysis. For example, electrolysis decomposes water (H2O) to form hydrogen (H2) and oxygen (O2)		
Names of compounds Not taught at this grade	**Names of compounds** Not taught at this grade	**Names of compounds** • Many compounds are names according to their elements, such as sodium chloride (table salt) which is	**Names and formulae of substances** • Revise the names of compounds using the names of the elements from which they are made

		made of the elements sodium and chloride. But other have common names such as water and ammonia • Some compounds have names such as carbon monoxide CO, carbon dioxide CO2, sulfur trioxide SO3. In these compounds: ◦ **mon**oxide-tells us that **one** oxygen atom has combined with the carbon atom ◦ **di**oxide-tells us that **two** oxygen atoms have combined with carbon atom ◦ **tri**oxide-tells us that **three** oxygen atoms have combined with the sulfur atom	• Revise the cation and anion table • Revise the writing of names when given the formulae • Revise the writing of formulae when given names • Revise the meaning of the names endings like-ide,-ite and –ate • Understand the meaning of prefixes di-,tri- etc.
Metals, semi-metals and non-metals • Metals are usually shiny, ductile and malleable, solid (excepts	**Metals, semi-metals and non-metals** are no taught at this grade	**Metals, semi-metals and non-metals** are not taught at this grade	**Metals, non-metals and metalloids** • Revise the classification of substances as metals,

mercury) and have high melting and boiling points • Non-metals have a variety of different properties (depending on whether they are solids or gases) • Semi-metals are solids and have some properties of metals and some properties of non-metals			metalloids and non-metals using their properties • Identify the metals, their position on the periodic table and their number in comparison to the number of non-metals • Revise the classification of non-metals using their properties • Identify the non-metals and their position on the periodic table • Describe metalloids as having mainly non-metallic properties • Revise the classification of metalloids by their characteristic property of increasing conductivity with increasing temperature (the reverse of metals) e.g. silicon and graphite. • Identify the metalloids and their position on the periodic table
The concept of the particle model of matter Is not taught at this grade	**The concept of the particle model of matter** • Atoms and molecules are referred to as particles in the particle model of matter	**The concept of the particle model of matter** Not taught at this grade	**Three state of matter** • Verify the particulate nature of matter by investigating diffusion and Brownian motion

	• The particle model of matter is a scientific theory used to explain that all matter (solids, liquids and gases) is made up of particles • These particles are too small to see (in a drop water there would be many billions of water particles) • The spaces between the particles are empty • Scientists have evidence that suggests that the particles are arranged differently in a solid, liquid and gas in a **solid**, the particles • are closely packed in a regular arrangement • do dot move around but vibrate against each other • have strong forces holding the, together • have small spaces between them • In a **liquid**, the particles • are loosely arranged but still quite close together		• List and characterize the three states of matter • Define freezing point, melting and boiling point • Identify the physical state of a substance at a specific temperature, given the melting and the boiling point of the substance • Define melting, evaporation, freezing, sublimation and condensation as changes in state • Demonstrate these changes of state

	• can move quite fast and slide past each other • have weaker forces between them • have small spaces between them • In a **gas**, the particles • have no particular arrangement • move very fast • have extremely weak forces between them • have very big spaces between them compared to solids and liquids		
• Introduction to the Periodic Table of Elements • Arrangement of elements on the Periodic Table • The Periodic Table of Elements is a classification system for the elements which make up matter and materials in the world [an element is a pure substance which cannot be broken down further] • The Periodic Table was devised by Dmitri Mendeleev in the 1860s. He arranged the	**all known elements are listed on the Periodic Table of the Elements** Atoms – building blocks of matter • all matter is made up of tiny particles called atoms • An element is made up of atoms of the same kind. For example all the atoms of an element, such as copper, are identical	**Elements as a reference tool in the topics that follow]** • the elements can be classified into metals, non-metals and semi metals • the elements found in groups (vertical columns) have similar chemical properties • Textbooks and reference materials	**Given a periodic table or suitable data;** • Define the atomic number of an element and give its value - Give the number of protons present in an atom of an element - Give the number of electrons present in a neutral atom - Show that by removing electrons from an atom the neutrality of the atom is changed

elements according to their properties in a table format • the elements of the Periodic Table are arranged into three main categories; metals, semi-metals and non-metals: ◦ -metals are arranged on the left hand side of the table ○ non-metals are found on the far right hand side of the table ◦ -semi-metals are found in the region between metals and non-metals • Each element has its own name, symbol, atomic number and position on the Periodic Table	• an element is a substance that cannot be broken down into two or more substances by chemical means (An element cannot be changed into another element by means of a chemical reaction) • atoms of one element differ from the atoms of all other elements	• each element on the Periodic Table (in its own block) has an atomic number (smaller number), mass number (larger number), name and symbol • a formula/e is ratio of the symbols of the elements and number of atoms for each symbol in a compound	- Determine charge after removing/adding electrons from the atom. - Calculate the number of neutrons present - Calculate the mass number for an isotope of an element

APPENDIX: O
DATA ANALYSIS SCHEME (DAS)

Theme	Category	Characteristics
Teacher Knowledge	**Content**	Concepts
	Context	Curriculum
		Resources
		Socio-economic background
	Learners understanding	Prior-knowledge
		Misconceptions
		Linguistic ability
Instructional Strategies	**Teaching method**	Lecture
		Demonstrations
		Discussion
		Questioning
	Explanatory frameworks	Illustrations
		Analogy
		Models
		Examples
	Activities	Projects
		Investigations/Experiments
		Classwork/ Homework
		Demonstrations
Classroom interactions	**Types of discourses**	Dialogic discourses
		Authoritative discourses
		Reflective discourses
	Patterns of discourses	Nature of teacher's initiation, response and feedback (IRF/IRFRF)
	Teacher questioning	Evaluate

And discourses		Construct understanding
		Develop thinking skills
	Communicative approaches	Interactive-authoritative
		Interactive-dialogic
		Non-interactive-dialogic
		Non-interactive- authoritative

APPENDIX: P
APPROVAL LETTER FROM SIYABUSWA CIRCUIT OFFICE

education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

Old Traffic Department, Next to Ubuhlebethu Combined
Private Bag X 4018, Siyabuswa 0472
Tel: 013 973 1235

SIYABUSWA 2 CIRCUIT OFFICE

CONFIDENTIAL

REF : 03/10/19
ENQ : MRS. KEKANA D.K
TEL : 013 973 1235

MS NTULI TG
POBOX 1132
SIYABUSWA
0472

SUBJECT : REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT SCHOOLS.

1. The above matter refers:
2. This serves to inform you that your request for permission to conduct research on the topic: "Explaining the teaching of Natural Sciences in the rural schools of Siyabuswa 2 Circuit in Mpumalanga Province" has been granted.
3. You are expected to observe ethical consideration particularly those relating to confidentiality, anonymity and voluntary participation by research subjects.
4. Kindly inform Circuit Manager(s) and the principals of selected Schools prior to your interactions with your research subjects.
5. Wishing you the best in your study.

DEPARTMENT OF EDUCATION
MPUMALANGA PROVINCE
SIYABUSWA CIRCUIT
03 -10- 2019
CIRCUIT MANAGER
P/BAG X4018 SIYABUSWA 0472

CIRCUIT MANAGER
MRS. KEKANA D.K

03/10/2019
DATE

APPENDIX: Q
CODED TRANSCRIPT

KATE OBSERVATION TRANSCRIPT

Observation of Kate: May 2019 at Hope Combined School in Grade 7 Natural Sciences Classroom

Day one lesson

Line	Description
1.	0-4
2.	minutes
3.	The classroom was conducive for teaching and learning. The classroom was well
4.	swept and clean. However some of windows were broken. Learners were seated
5.	on the desks and they were sharing desks. The desks were arranged in rows and
6.	columns with enough space for the teacher and leaners to move around. There was
7.	no electricity in the classroom. All learners wore their school uniform. Kate greeted
8.	the learner good morning class, learners greeted back good morning Ma'am (all
9.	learners were standing on their feet when responding). Kate continued how are you
10.	class? And all learners responded "we are fine Ma'am and how are you Ma'am? Kate
11.	said fine thank you, you may take your seats and the learners said thank you Ma'am.
12.	(All learners took their seats after being instructed to do so). Kate asked learners
13.	whom of them is having a toilet paper. One learner stood up and gave it to her. Kate
14.	called Thandi (pseudonym) to come take a script from her. Kate said yesterday we
15.	learned about the properties of metals. She further said the properties of metals
16.	they are what? One learner raised her hand, Kate gave her a chance to respond.
17.	Kate said yes Lunga (pseudonym). Lunga responded they are shiny. Kate said yes...
18.	they are shiny what else? Yes Gugu (pseudonym). Gugu responded as follows: most
19.	solid mercury. Kate replied "most solid mercury" seriously? Of metal? Nooo... Kate
20.	said "Thulani (pseudonym) can I have my papers". Thulani gave her the papers. She
21.	then continued. Okay let's hear other properties of metals. She further said they are
22.	shiny, they are stretchy, they could burn. what else? Their appearances are shiny
23.	isn't so? Learners responded yes. Kate further asks are they shiny only? Learners
24.	responded no.. and they are strong. Kate asked do they conduct electricity, learners
25.	responded yes. Kate said today we are learning about the non-metal ones. Learners
26.	said after her "non- metal ones". She then instructed the learners to open their
27.	textbooks on page 116. She then read the sub topic " the properties on non-metal
28.	ones" to learners. Kate asked .: what do they say about the properties? Gugu
29.	responded they are dull. Kate replied yes they are dull (reading from thr textbook).
30.	What else Thulani? They are shiny. Kate replied no they are not shiny. Kate asked, if
31.	we say something is dull how does is look like, learners responded it has rust. She
32.	made an example of a rusted metal and explained that if something is rusted it does
33.	not necessarily mean it is dull. She further asked again what dull mean. Learners
34.	responded that it means it is not shiny. She then asked the states of matter of non-

APPENDIX: R
TURN IT IN REPORT

NTULITHULI CHAPTER 1-5

ORIGINALITY REPORT

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APPENDIX S
ETHICAL CLEARANCE CERTIFCATE

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2019/06/12

Ref: **2019/06/12/51923505/09/MC**
Name: Ms TG Ntuli
Student: 51923505

Dear Ms Ntuli

Decision: Ethics Approval from 2019/06/12 to 2022/06/12

Researcher(s): Name: Ms TG Ntuli
E-mail address: ntulithuli.gladys@yahoo.com
Telephone: +27 78 209 1017

Supervisor(s): Name: Prof AV Mudau
E-mail address: mudauav@unisa.ac.za
Telephone: +27 12 429 6353

Title of research:

Evaluating the classroom practices of senior phase when teaching matter and materials strand in the Siyabuswa circuit of the Mpumalanga province

Qualification: M. Ed in Natural Sciences

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2019/06/12 to 2022/06/12.

*The **low risk** application was reviewed by the Ethics Review Committee on 2019/06/12 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date **2022/06/12**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2019/06/12/51923505/09/MC** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
motlhat@unisa.ac.za

Prof PM Sebate
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APPENDIX T
EDITORS CERTIFICATE

Academic consultancy
"Perfection is our DNA"

309 Aardal flats
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academicconsultancy3@gmail.com
07 October 2019

To whom it may concern

This letter is to confirm that I, Keegan Bruce Schmidt, freelance copy-editor, have edited and proofread the ***dissertation, "Exploring the classroom practices of Natural Sciences teachers when teaching Matter And Material in some of the schools in the Siyabuswa Circuit" by Thuli Gladys Ntuli*** grammar and spelling.

I have not changed any of the ideas presented in this proposal, only the grammar and spelling has been altered for the purposes of clarity. This is to confirm that I have edited the document to a level I deem satisfactory.

Should you have any questions feel free to contact us

Keegan Schmidt
Qualifications:

- BIS (University of Pretoria)
- BIS Hons (University of Pretoria)