

Teachers' Experiences of Implementing the Further Education and Training (FET) Science Curriculum

By

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DECLARATION

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Abstract

This study investigated a single research question, that is: How do teachers experience the implementation of the Further Education and Training (FET) National Curriculum Statement (NCS) for Physical Science? The focus of the study was on searching the inner consciousness of Physical Science teachers as they engaged with the teaching of the subject on a daily basis. It is in the inner consciousness where one finds the truth about people's perceptions, beliefs, emotions, challenges and convictions about/towards phenomena that the study sought to determine. In so doing, this study searched for *phenomenological truth* about the daily realities Physical Science teachers are faced with, as they implement the NCS. Phenomenological truth is floatable, precarious in nature, and subject to an individual's perception of truth. It is important to note that phenomenological truth makes no reference to absolute truth.

At the time this study was conducted the NCS was the only policy document with legal status for schools in South Africa. As a result the NCS influences and directs the pedagogical practices of teachers. This is because the NCS has a specific expectation of Physical Science teachers with regards to their understanding of the content, the delivery of the content, the learning environment, and professionalism. Through searching the consciousness of teachers, they revealed how they experienced what they do in the Physical Science classroom. In other words, how they experience *what, how, when* and *who* they teach. Probing into the consciousness of teachers and how they experience the implementation of the NCS provides valuable insight into the quality of curriculum delivery. This study did not only focus on the implementation of the NCS, but also examined why it might be difficult for teachers to change their practices.

Phenomenology is both a theory and a method. The study was guided by the ideas of Edmund Husserl - who is regarded by many phenomenologists as the father of phenomenology, Martin Heidegger, Maurice Merleau-Ponty, and many other phenomenologists. Husserl (cited in Derrida, 1967) believed that we should begin any explanation with experience, which is a scientific description that does not presuppose any significance of the existence of the metaphysical world. By delving into the

complexities of experience one can locate the flowing life of an individual's consciousness as it occurs. Husserl posited the belief *returning to the things themselves* (cited in, Derrida, 1967; Spanos, 1976; Groenewald, 2004) to describe the purity of experience as data. In this study I sampled three teachers and employed a phenomenological methodological framework to capture their lived experiences. I used one-on-one semi-structured face-to-face interviews to construct the data. In addition, field notes were used to turn the direct experiences and observations of the participants into vivid descriptions. In phenomenology researchers use field notes to make the voice of people heard in the text.

I drew on Husserl, Heidegger and Merleau-Ponty's philosophical pathways that a person must be understood from his position within a specific time and place to present the findings. The major finding in this study showed that the teachers' consciousness, with respect to Physical Science teaching was negatively influenced by the legacy of apartheid-education. This negative consciousness through which they framed their thoughts and filtered their ideas became the collective mindset through which they personified their teaching. The study revealed that the delivery of the NCS (by the teachers) was mostly axiomatised by old habits and images in their thoughts engrained in their memory under apartheid education. The findings also showed that their (teachers') consciousness with regards to the NCS unconsciously oscillated between the present and the past and that they continuously and unconsciously bring the past (old ideas and beliefs) into the present. The teachers constantly have to struggle against the phenomenological self or attitude and ceaselessly suppose and follow thoughts of pre-comprehension or preconception.

Opsomming

Die doelwit van hierdie studie was om die volgende navorsingvraag te beantwoord: Hoe ervaar onderwysers die implementering van die Verdere Onderwys en Opleiding (VOO) Nasionale Kurrikulum Verklaring (NKV) vir Fisiese Wetenskap? Die hoofdoel was om meer insig te verkry oor wat binne onderwysers se psige plaasvind soos hulle op 'n daaglikse basis hul uitleef in die Fisiese Wetenskapsklaskamer binne die raamwerk van die NKV. Dit is binne die psige waar hul persepsies, diepgewortelde waardes, emosies, en uitdagings rondom die NKV rus. Om hierdie rede is die studie geïnteresseerd om die fenomenologiese waarheid van die alledaagse realiteite waarmee hulle aanhoudend gekonfronteer word, te myn. Fenomenologiese waarheid is vloeibaar en verskil van persoon tot persoon en hou geen verwysing met absolute waarheid nie.

Toe hierdie studie plaasgevind het, was die VOO NKV die enigste wettige beleidsdokument vir die deelnemers. Die onderwysers was dus verplig om die voorgeskrewe beginsels soos in die NKV saamgevat toe te pas in die voorbereiding en aanbieding van hul lesse. Die NKV beskryf in diepte die inhoud vir elke graad (10-12), hoe die inhoud aangebied moet word, die klaskamer atmosfeer, asook die professionaliteit van die opvoeders. Al die antwoorde soos saamgevat in laasgenoemde, lê binne die psige van die onderwysers. Die ondersoek van die psige van die onderwysers lei tot 'n begrip van *hoe, wat en waarom* Fisiese Wetenskaps-onderwysers doen wat hulle doen. Alhoewel die fokus van hierdie studie op die implementering van die NKV is, dra dit ook by tot groeiende kennis aangaande hoekom onderwysers dit moeilik vind om hulle praktyke te verander wanneer dit kom by die hernuwing van 'n kurrikulum.

Fenomenologie is beide 'n navorsingsmetode en 'n teorie. Die literatuuroorsig van hierdie studie is geïnspireer deur die idees van Edmund Husserl, wat bestempel word as die vader van fenomenologie, asook Martin Heidegger, Maurice Merleau-Ponty, en verskeie ander fenomenoloë. Derrida (1967) is oortuig daarvan dat enige verduideliking akkuraat beskryf kan word indien geleefde ervaring in ag geneem word. Geleefde ervaring spreek direk tot die onderliggende psige van 'n individu, en deur die psige te ondersoek, is dit moontlik om 'n individu se oortuigings ten opsigte van sy/haar geloof,

persepsies en uitdagings, asook hoe die individu reageer op hierdie aspekte te verstaan. Husserl gebruik die uitdrukking ‘returning to the things themselves’ wanneer hy verwys na die belangrikheid en oorspronklikheid van ervaring (vermeld in, Derrida, 1967; Spanos, 1976; Groenewald, 2004). Om hierdie rede is ‘n fenomenologiese metode gevolg om die lewenservaringe van drie swart onderwysers vas te vang. Hierdie fenomenologiese vertolkende ondersoek word deur veelvoudigemetodes van inligtingsinsameling gekenmerk. Inligting in hierdie studie oor die deelnemers se ervaringe is verkry deur middel van individuele onderhoude, en die ontleding van die inhoud daarvan. Addisionele inligting is verkry deur veldnotas. Die doelwit van die veldnotas was om die deelnemers se direkte ervaringe en waarnemings in besonderhede te beskryf.

Die ontledingsbenadering van elke deelnemer is gedoen binne die raamwerk van Husserl, Heidegger en Merleau-Ponty wat gegrond is op teorieë wat die belangrikheid van plek en tyd uitbeeld. Die resultate van hierdie studie het getoon dat die onderliggende psige van elke deelnemer deur die nalatenskap van apartheid negatief beïnvloed is. Hierdie negatiewe denkpatrone waardeur die onderwysers se idees formuleer vorm die kollektiewe ingesteldheid waardeur hulle hul onderrigswêreld skep. Verder het die studie onthul dat hul aanbieding van die NKV meestal gedryf word deur ou gewoontes wat binne hul denke gekristalliseer het. Hulle vind dit dus moeilik om deur hierdie ou gewoontes te breek. Hul denke wissel gedurig tussen die verlede en die hede en roep die verlede voortdurend binne die hede. Alhoewel die bevindinge van hierdie studie gekoppel is aan plek en tyd is daar ‘n konstante struweling tussen die fenomenologiese self en hul ou gesette denke.

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CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 Introduction

This thesis focuses on the lived experiences of Further Education and Training (FET) Physical Science teachers in South Africa, more specifically on how they implement the National Curriculum Statement (NCS) for the subject. I introduce this study with an ethnographical narrative so as to capture the phenomenon under investigation and to contextualise the research question.

A grey-haired fifty-five year old teacher by the name of Ntabazimbi was walking down one of the passages of a school, mumbling to himself. One of his friends and colleagues, Nhlapo, with whom Ntabazimbi has been teaching for more than twenty-five years, saw him mumbling, walked across to him and asked: “Ntabazimbi what are you mumbling about?” Ntabazimbi responded: “I am on my way to the headmaster’s office where the (my) subject advisor is waiting for me, so I am trying to remember and rehearsing what to tell him.” As the conversation continues we learn that Ntabazimbi has been visited by the same subject advisor, who is ten years his junior, for the last three years. Ntabazimbi is nearly demoralised by the many lessons he is being taught by the (his) subject advisor on how to teach in the best possible way. What frustrates Ntabazimbi even more is that he still has another ten years of teaching left, which will take him to retirement. Ntabazimbi feels he has lost his passion to teach, because he believes that he can do a much better job and produce better results if he is given the freedom to teach the way he understands his learners and how they learn.

This anecdote from Ntabazimbi’s biography constructs an indication of how we might negotiate meaning, power and truth almost every day. Furthermore, it is a reflection of how our lives as teachers (or human beings) are directed or controlled by external powers (or forces over which we have little control) on a daily basis. We are constantly directed by some expert – whether from the religious field or some higher authority – on **how to live or how to do our work**. Humans, in general, almost always have to function within structures that have meaning which appear as systems or complex static configurations to which they should subject themselves. Other more profound structures, sometimes more superficial, are created to construct a tradition to socially engineer them as if there is only one way of doing things.

Today, policy documents – some with legal status (e.g. NCS) others not (assessment and examination guideline documents) – direct our actions. From an educational perspective, policy documents provide details of the practices and provisions of teachers in South Africa. They are also used to illustrate the broader picture of what underpins teacher practices. One example of a policy document in education that governs teachers' practices is the NCS for each subject. Lin, Chang and Cheng (2010:1) encapsulate the importance of policy documents and point out that the implementation of educational policies is not only a local issue but an international concern.

The dialogue between Ntabazimbi and Nhlapo represents a form of collecting and presenting data. Throughout the dialogue Nhlapo distanced himself with reference to his views, beliefs and values. Whatever Ntabazimbi experienced at that moment was divulged in a conversation to Nhlapo and there was no need for him to analyse or interpret Ntabazimbi's response. All Nhlapo needed to do – to capture what was going on in Ntabazimbi's mind – was to ask him. The truth about Ntabazimbi's beliefs, feelings, convictions and so forth was revealed in the conversation, which is a reflection of Ntabazimbi's consciousness and his intentional acts. Nhlapo could have responded differently by pre-judging Ntabazimbi and theorising why he thinks Ntabazimbi responded the way he did. But without knowing he used the lens of phenomenology and acted like a phenomenologist whose primary interest is in understanding the lived world of Ntabazimbi by abstaining (distance) from any prejudice.

My aim in this study is to mimic Nhlapo by playing the role of a phenomenologist in investigating the following research question: How do teachers in the FET band experience the implementation of the NCS for Physical Science? This study is concerned with **lived experiences** of teachers. Its aim is to gain a deeper understanding of the nature and meaning of what teachers experience every day, as they engage with the NCS. Phenomenologists study lived experiences from which they develop theories. Van Manen (1990: 9) writes:

Phenomenology asks: What is this or that kind of experience like? It differs from almost every other science in that it attempts to gain insightful descriptions of the way we experience the world pre-reflexively, without taxonomizing, classifying, or abstracting it.

In so doing the phenomenologist unveils or reveals, from a sequence of experiences, the structures and internal meaning inherent to the lived world of individuals. My interest in investigating the lived experiences of teachers is both philosophical and historical. In the next section I will focus on the historical aspects of my research.

1.2 Historical background

This research is interested in what Physical Science teachers are *conscious* of when they teach. By consciousness I mean the way that teachers feel and what they think about what they are doing when their teaching is directed by the NCS. Investigating the consciousness of teachers can reveal how they experience what they do in the classroom – put differently, how they experience **what, how, when and who** they teach. Probing into the consciousness of teachers and how they experience the implementation of the NCS will also highlight the quality of curriculum delivery. The NCS document for Physical Science has a specific expectation of science teachers, with regards to their understanding of the content, learners, instruction, the learning environment and professionalism. The fact that curriculum planners and teachers rarely engage with each other may lead to different understandings and interpretations of the NCS. The background of the study can be viewed from two points of reference, namely, the drawbacks of the apartheid curriculum and the shift to the current NCS for FET.

1.2.1 Drawbacks of the apartheid curriculum

Much has been written about the history of education in South Africa during the apartheid era. During this period the aim of education was not only to achieve social separation, but its social philosophy was legitimising the arena for white supremacy and the complex system of racial and cultural ordering that evolved around it (Soudien and Baxen, 1997). Both the implicit and explicit curricula were configured to socialise blacks into accepting white superiority (Nkomo, 1990). According to Soudien and Baxen (1997), this provided the ideological cornerstone upon which apartheid education was built. The common notion of apartheid education articulated by Verwoerd in 1953 was that education must train and teach people in accordance with their opportunities in life based on the spheres in which they live (Nkomo, 1990). Blacks were seen

by whites as *hewers of wood and drawers of water* (Cross and Chisholm, 1990: 45). The school science curriculum, according to Browne (1992), was based on observation and conceptual development. According to Jansen (1999), the curriculum was characterised by a uniform and predictable curriculum environment. The content was prescriptive, authoritarian, sexist and context blind. He argues further that this curriculum was introduced to schools with vastly different resource contexts. It is this legacy that the new National Department of Education in South Africa was forced to confront after 1994. The challenge was to facilitate a change from a previously fragmented, inequitable and racially segregated and oppressive system into one that aimed to satisfy the need for equity, equality and redress. In this context teachers had to contend with a new education system that was based on equality of opportunity, desegregation, multiculturalism, equity, redress and so forth. In the next section I will elaborate on this shift to reform the South African education system.

1.2.2 The shift to the NCS for FET

The year 1990 was a highly significant moment in South Africa's history. Competing political movements and political actors vehemently began to stake their curriculum positions in anticipation of what now seemed inevitable – the emergence of South Africa's first democratic state after the national and non-racial elections in 1994. What emerged from the deliberations was a White Paper on Education and Training (RSA, 1995) that outlined the direction of education and training in South Africa. Based on the guidelines of this document, an outcomes-based National Qualifications Framework (NQF) and an outcomes-based curriculum framework, namely, Curriculum 2005 (C2005) was introduced. Jansen (1999) provides a short historical explanation of how outcomes-based education (OBE) emerged in South Africa. He argues that the introduction of OBE lies in the different competing influences, namely, internal (Department of Labour), external (Spady version of OBE in the USA), historical (apartheid legacy), educational (performance-based learning) and economic (globalization). The unanticipated introduction of OBE was a response to the initial period of non-intervention (1994-1997) in the apartheid curriculum, apart from the superficial cleansing of elements from this curriculum (Jansen, 1999). According to Le Grange and Beets (2005), this superficial cleansing of the apartheid curriculum meant that the Physical Science syllabus did not change greatly following

the abrogation of all apartheid laws. This curriculum change only signalled a break with the past system.

C2005, depicting the intended year of its full General Education and Training (GET) implementation, was underpinned by a philosophy that is outcomes-based (Jansen, 1999). According to Jansen (1999), the emphasis in such a curriculum is more on outcomes, learner-centeredness and activity learning. In this curriculum the role of the teacher changes to that of a facilitator. Emphasis is placed on meaningful learning (see DOE Policy Document, 2003). The new curriculum aimed to produce a learner who thinks logically, analytically, holistically and literally. Teachers, on the other hand, must be designers of learning programmes and materials, researchers and subject specialists (see DOE Policy Document, 2003). Whether these roles actually materialised at the classroom interface is an open question.

Soon after the implementation of C2005 teachers complained of frustration, disillusionment, poor training, the complexity of the language and design of the new curriculum, lack of support and the rushed introduction of the curriculum (Matoti, 2010; Jansen 1999). After a three-month review process of C2005 in 2000 by the Chisholm committee, appointed by the Minister of Education, it was found that the curriculum implementation was compromised by factors such as tight time frames, lack of resources, poor departmental support and complex language design. This led to the introduction of the Revised National Curriculum Statement (RNCS) in 2002.

The changes were ostensibly introduced to strengthen the delivery of education in the country. The stringent revisionary process of the GET and lessons learned resulted in the smoother implementation of the NCS for FET. Since its implementation in 2006 very few changes to the learning outcomes, critical outcomes or assessment standards of Physical Science have been made to the FET natural sciences curriculum as opposed to the GET natural sciences curriculum, where the eight learning outcomes were soon reduced to six. The valuable lessons learned in the GET resulted in a more stable and well-balanced FET phase. It is against this background that the study will be conducted.

1.3 Problem statement

The history surrounding the transition from the apartheid curriculum to an outcomes-based curriculum does not need to be retold. However, the introduction of OBE changed the educational landscape of South Africa dramatically. South Africa developed a qualifications framework which aims to reform the system of education and training through outcomes-based qualifications. The NQF has three qualification bands, namely, GET, FET and Higher Education and Training (HET). According to Allias (2006), the recent and rapid expansion of senior secondary education (that is, the FET band) has led to a questioning of the role of senior education as well as to fundamental questions about the nature and structure of education systems, given the fact that the world is experiencing significant changes in the global economy and in industrial processes. A country such as South Africa is under pressure to keep abreast of scientific and technological development. Therefore science teachers have a considerable responsibility, since it is at school level that basic scientific skills and processes are learned.

A learner entering the FET phase takes a total of seven subjects. The seven subjects constitute the four core compulsory subjects and three elective subjects, of which Physical Science may be one. The FET phase culminates in the National Senior Certificate (NSC) in Grade 12 (previously known as Standard 10). In Grade 12 all learners are required to write an external examination (that is, the NSC) set up by the Department of Basic Education (DBE). The external examination is conducted under the watchful eye of the Council for Quality Assurance in FET, which is called UMALUSI. UMALUSI is a council that sets and monitors schooling standards in South Africa. Its objective is to ensure that quality teaching and learning take place. In addition, UMALUSI monitors external examinations to ensure that a high-standard, systematic, and fair examination process is maintained. The external examination (that is, the NSC) contributes 75% towards the final mark, while the remaining 25% focuses on school-based continuous assessment activities comprised of three term tests, two practical Science projects (one each for Physics and Chemistry), and a research assignment. Each of these assessments (namely, those that make up the 25%) has specified weightings listed in the NCS. Furthermore, learners write the examination under external supervision. The Physical Science external examination in the FET phase consists of two question papers, namely, a Physics and a

Chemistry question paper of equal weight (with respect to marks) in the final composition of the subject.

Good Grade 12 results in Physical Science open doors for learners to careers such as engineering, medicine, biotechnology and astronomy. However, the present challenge facing school Science in South Africa is the declining percentages in passes and poor pass averages. This situation is even more pronounced in historically disadvantaged schools.

According to the NCS, some of the outcomes in the FET phase for Physical Science envisage that learners would be creative and able to think critically (WCED Policy Document, 2003). These outcomes could only be met if teachers use innovative teaching strategies that juxtapose the learning outcomes with the relevant assessment standards. For example, teachers teaching Boyle's Law are not only required to collect data to verify textbook information, but they are also required to develop learners' insight into the objectives and rationale behind these experiments by explaining what led Boyle to arrive at these laws. Here teachers might need to be knowledgeable about the work of Torricelli and his experimental evidence for atmospheric pressure and how he designed the barometer from which Boyle derived his theories. Grade 12 learners are expected to demonstrate an understanding of Boyle's Law by designing their own experiment and collect similar data that confirm the inverse proportionality relationship between volume and pressure. A learner is then expected to link Boyle's law to real-life applications, for example, creating tyres with stronger casings to reduce accidents on roads. Higher-order cognitive skills require the learner to know that an increase in temperature results in an increase in pressure; therefore a stronger tyre casing would prevent accidents caused by tyre bursts.

Paradoxically, researchers who have examined classroom practices at the GET level report few of the latter outcomes in the Science classroom and subsequently question corresponding change (Jansen, 1999; Mzwake-Jakes, 2008). Instead of a constructivist pedagogy that forms the overarching framework for OBE, there is an abundance of traditional teaching strategies. Teacher talk and learner passivity still hold sway in the Science classroom. Teachers rely heavily on textbook notes and practical instructions. Woodbury and Gess-Newsome (2002) found that if teacher knowledge and belief about the nature of science or the nature of learning

science are incompatible with curriculum reform, this diminishes the outcome of what was meant to be fundamental reform.

Therefore, it might be important to investigate how teachers experience the implementation of the new FET curriculum, particularly in traditionally disadvantaged schools. The rationale for the selection of traditionally disadvantaged teachers is that the literature points to at least some of these teachers suffering from low morale as a result of being overworked (Jansen, 1999; Evans, 2000; Stoffels, 2006). Teaching Science in such schools might therefore require more input than other subjects, because the teacher has to prepare for practical work as well as to care for the equipment and the laboratory. Similarly, teaching in over-crowded classrooms can be even more challenging and sometimes makes Science unpopular as a school subject.

The Physical Science teacher is responsible for the delivery of the curriculum. From a phenomenological perspective, the research question of this study aims to focus on is the way teachers experience the NCS for FET, with the research aim being acquiring knowledge of the world in which they live. As Van Manen (1990: 5) writes:

... to know the world is profoundly to be in the world in a certain way, the act of researching-questioning-theorizing is the intentional act of attaching ourselves to the world, to become more fully part of it, or better, to become the world.

The essence of this research is on being. Being means **to be**, which includes both **what and who**. Therefore one cannot separate **what** from **who**. The **what** is the driving force that gives impetus to the **who**. Figure 1.1 depicts how the delivery of the NCS might impact on a teacher's mind. It is what teachers are conscious of that drives their teaching. Some teachers might be conscious of delivering and finishing the curriculum in time, whereas others might be more interested in preparing learners for examinations. Whatever goes on in the minds of teachers is very important to gain an understanding of what they think about what they think they are doing. Teachers in South Africa are under pressure to perform and their practices are directed, guided and influenced by the NCS. Therefore, it will be of interest to know how the NCS presents itself to the consciousness of the teacher.

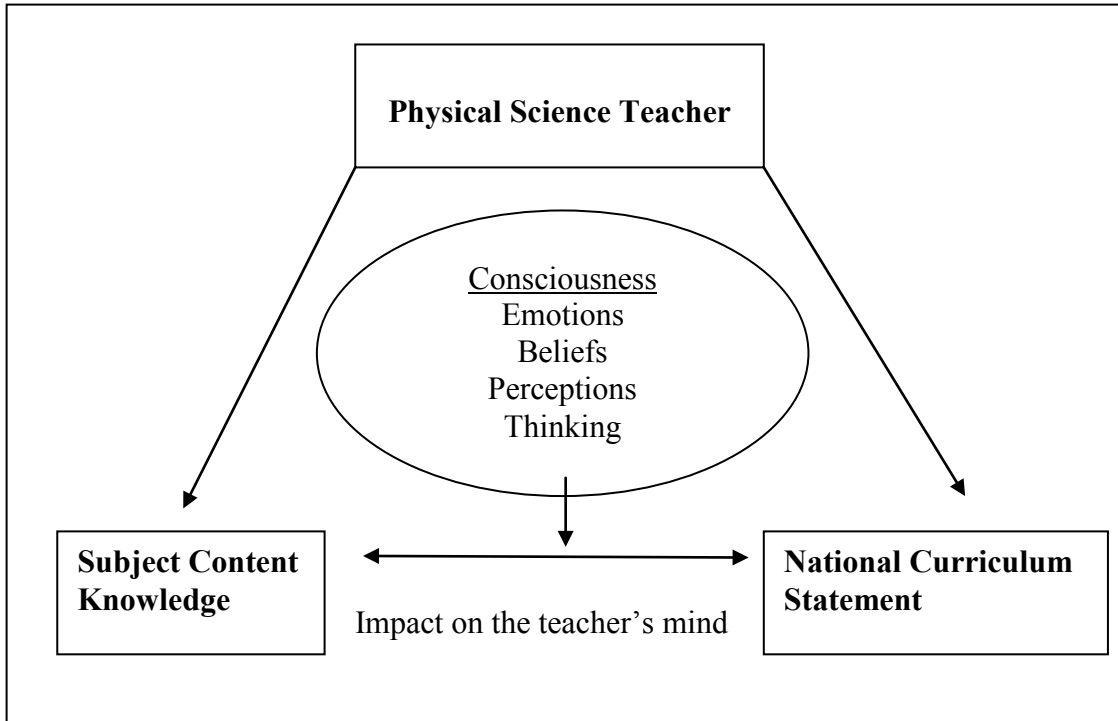


Fig 1.1: A model of the consciousness of the teacher

1.4 Research question

In order to realise the objectives of the investigation the following main research question informed and guided the research:

- How do teachers experience the implementation of the NCS for Physical Science?

The study employed a phenomenological framework. As phenomenology aims to gain a deeper understanding of experiences, the following sub-questions were developed in this regard:

- How do teachers experience what they teach?
- Do teachers follow the teaching methodologies outlined in the NCS for Physical Science?
- How are the teachers' thinking, beliefs, feelings, convictions and perceptions directed towards implementing the NCS?

- What do Physical Science teachers think about what they think they do in the Science classroom?

The study searches for truth about the research question and its sub-questions regarding teaching experiences. Phenomenologists believe reality is subjective in nature. It is called phenomenological truth that is floatable, precarious in nature and subject to the individual's perception of truth. Phenomenological truth in this study refers to a specific context and therefore is separate from absolute truth

1.5 The purpose of the study

Some theorists from the idealist and positivist traditions are largely interested in knowledge that is generalisable and true for one and all at the same time. Phenomenologists produce non-empiricist, non-naturalist data that provide an ideal clarification of the meanings (of theories) that is composed of the experience of the consciousness (empirical not empiricist). Phenomenology is, in a broad sense, a philosophy or what Van Manen (1990: 7) calls a *theory of the unique*. Phenomenology is interested in what is essentially not generalisable, such as human experience. For example, the natural human attitude in everyday life responds to specific phenomena. Husserl (1970) describes this natural attitude as original, unique, pre-reflective and pre-theoretical.

The purpose of this study is to describe and explicate the **consciousnesses** of teachers directed at their teaching experiences in the FET phase, and their engagement with the NCS for Physical Science. Specifically I shall investigate the experiences of three Physical Science teachers. Each teacher comes from a different background, has a different biographical profile, qualifications and years of experience of teaching the subject. This study wants to delve into what is most important to each teacher when they teach. By important I mean the secrets and intimacies that are also constitutive of their teaching experience. The following three aspects will be helpful in constituting teachers' experiences in order for us to:

- i) Have an understanding of the deeper and fuller knowledge of what the teachers' major concerns are when they teach;
- ii) Identify the teachers' weaknesses or strengths, vulnerabilities and innocence in the subject and;
- iii) Provide insight into what contributes towards the broader good of the teachers.

Most research that has been done so far tends to trivialise these issues. One needs to gather enough information about teachers to be able to articulate the epistemological and methodological implications of the teachers' practices.

1.6 Scope of the study

There is a need for research that interrogates and explicates teacher experiences that highlight any particular issue that is conceived not as a way of knowing but as a way of being. This type of research is concerned with research participants who will **be** themselves. This study was conducted in the city of Cape Town in the Western Cape (a province in South Africa). The choice of Cape Town was based on the fact that schools were conveniently located so as to make the study viable. The target population of this study is three Physical Science teachers who teach in high schools in the FET band in the Northern District of Cape Town. Because the research focuses on depth and richness of data only a small number of participants were selected. In a phenomenological tradition two to ten participants are sufficient to saturate a study (Groenewald, 2004: 11). It is for this reason that I selected only three participants for the study.

1.7 Literature review

The literature review focuses on exploring the various theories and what previous findings reveal with regard to lived experiences. One of the subsections of the literature review, that is, the theoretical framework, analyses the theories which inform the framework of this study in order to respond to the research question.

1.7.1 *Theoretical framework*

Firstly, this study is situated within the phenomenological tradition. Consequently, the study is informed by the theoretical underpinning of phenomenology, which draws inspiration from the work of Edmund Husserl, who is regarded as the fountainhead of phenomenology (Groenewald, 2004) in the twentieth century, and various other phenomenologists, such as, Merleau-Ponty and Heidegger, who further developed Husserl's work.

1.7.2 *Impact of the NCS on the teachers' lived world*

I draw arguments and narrations from the interpretation generated by dominant and counter-hegemonic discourses on the NCS. The use of the NCS as an academic discourse is an attempt to interact with the Physical Science teachers who communicate knowledge and meaning in the classroom. The NCS, which is the only policy document with legal status (for schools) in South Africa, influences and directs the pedagogical practices of teachers. It is not only the implementation of the NCS that this study is concerned with, but also to find out why it might be difficult for teachers to change their practices from the old NATED 550 curriculum to the NCS. Some studies found that policy makers produce curriculum policy change with no or very little consultation with teachers (Evans, 2000: 173). Others argue that, when teachers are faced with a paradigm shift, they interpret and enact it through the filters of their own experiences, beliefs, theories, ideologies, etc. (Hargreaves, 2002; Brodie, Zaheera and Modau, 2009). This results in teachers responding differently and quite uniquely to educational policies.

Ogunniyi (1986) holds the view that no education system is more important than its teachers. Teachers are the implementers, interpreters and analysers of the curriculum. Thus standards in the Science classroom may fall because of the attitude of teachers towards the curriculum. What teachers think and do, and their personal disposition and feelings concerning the curriculum are central to the effective implementation process. According to Fullan (1992), an understanding of the subjective world of teachers is a necessary precondition for effective curriculum implementation. The subjective way in which teachers mediate meaning through assumptions and perceptions, impacts on the realisation of the educational ideals. Therefore teachers must be

acknowledged and the curriculum construction process has to be negotiated, so to speak, instead of being imposed on teachers by policy makers.

This shift to the FET NCS has not only increased the teacher's workload, but also intensified it. Research on teacher workload done by Gitlin (2001:3) found that *the intensification* of a teacher's work might lead to *self-regulating tendencies of teachers*. His findings suggested that, as a result of the intensity of the teachers' work, they adopt mechanisms to alter the effect of these forces. For example, some would have oversimplified lessons, others follow the recommended textbook and curriculum, or they would set menial tasks for learners to enable them to get administrative work done themselves. One of the critical outcomes of Physical Science is to link it more closely to its practical usage in industry (for details on Learning Outcome 3, refer to Department of Education Policy Document, 2003). This results in the intensification of the teachers' work despite the lack of time, overload and consistent change. Because of the legality and the functional significance of the NCS, it is important to understand how teachers experience its implementation. In the next section I focus more specifically on the lived experience of the teacher.

1.7.3 Phenomenology

Phenomenology is a philosophy that is concerned with lived experiences. It is concerned with the temporal flux of what is lived – which Husserl regarded as the ultimate source of (phenomenological) truth. Adyman (2009) describes phenomenology as the science of lived experience. He argues that there can be no lived world without the lived body and subsequently experience. In essence, in the absence of the teacher the NCS becomes non-existent. The NCS is like music and the teacher is expected to dance to its tune and rhythm (pace setters). Different teachers respond uniquely to the legal call of the NCS and its demands. It is this lived experience, the way in which the NCS is implemented, that this study sought to uncover.

Edmund Husserl (cited in Derrida, 1967) believed that we should begin any explanation with experience, which is a scientific description that does not presuppose any significance of the existence of the metaphysical world. In the explication of experience is found the flowing life of

consciousness as it occurs. According to Husserl, experience is data in the most pristine and pure form. These data form the basis of all sciences. Husserl used the phrase **returning to the things themselves** (cited in, Derrida, 1967; Spanos, 1976; Groenewald, 2004) to describe purity of the data. The phenomenologist uses the data and becomes like a geometer, someone who contemplates what a triangle is and figures out the essential features of what is going on in the mind of teachers. Husserl (1970) argues that every three-dimensional object is hiding something, for example, the back side of an object is always unseen. The question that this study aims to investigate is what is going on in the minds of Physical Science teachers when they teach? What is it that teachers might be concealing and how does it influence their practices as teachers? It is this experience that I wish to attempt to describe without the intrusion of my presuppositions. A more detailed discussion on phenomenology follows in Chapter 2.

1.8 Research design and methodology

The research design describes the plan that guides and directs all activities and processes. In the phenomenological tradition the plan and activities have a specific protocol that attempts to provide a deeper understanding and insight into one's consciousness (Husserl, 1970). One of the key issues phenomenologists must do is to bracket off everything inside or outside of themselves and attempt to explain the essences or form of each intentional act of their research participants. Husserl's aim was to describe the experience without the intrusion of presuppositions, science or Aristotle's substance metaphysics (Husserl, 1970). In phenomenology the research design is treated as a blueprint whereby the researcher describes, clarifies and explains the non-empiricist, non-naturalist meaning of experience of consciousness (Derrida, 1967).

1.8.1 Method and methodology

Methodology refers to the theory or philosophy that underpins the method. Method is the process that involves the employment of different forms of data construction instruments. According to Smyth (2006: 2), the choice of method must be consistent with the philosophical and theoretical underpinning of the study. Phenomenology is based on a view of *being* (ontology) that holds as fundamental premise that there are multiple realities that are subjective

in nature (Tan, *Wilson and Olver*, 2009). Such a premise is consistent with Husserl's declaration that true knowledge about subjects (teachers, humans in general) exists only in the mind or consciousness of the individual (Husserl, 1970; Van Manen, 1990). Therefore this study is broadly informed by theories on phenomenology.

Van Manen (1990) argues that the key to quality research lies in the choice of the methodology that is employed. He points out that researching lived experiences involves description, interpretation and self-reflective and critical analysis. The aim of phenomenology is not to taxonomise natural phenomena and explain behaviour probabilistically, as found in a positivist-quantitative research, but to explain and understand the lived experiences. The aim of phenomenology is to describe as accurately as possible the phenomenon but abstaining from any pre-given framework and remaining true to the facts. Therefore to remain true to this paradigm the focus should be on questioning the way human beings experience the world, and on seeking to know the world in which humans live. In phenomenology researchers must allow humans to express themselves about how they feel and what they think about issues. In this instance, the focus is on how teachers feel while implementing the NCS.

1.8.2 Sampling

Geographically, the study is located in the city of Cape Town, which is situated in the Western Cape in South Africa. Cape Town was chosen because I had easy access to the schools and the teachers. Another reason why the study is located in Cape Town is because I reside in the city, which made the study economically viable. The teachers were selected using purposive sampling, which is also referred to as deliberate sampling. I used my own judgement aligned with the purpose of the research to select the participants. Details on how I selected the participants are described below.

According to Hycner (cited by Groenewald, 2004: 8), the phenomenon being researched dictates the type of research participant. I chose participants who had experience in the implementation of the NCS (FET phase) and in either teaching or learning under the traditional apartheid

curriculum, that is, the NATED 550.¹ My objective with these selection criteria was to gain an insight into the individual practices of teachers under apartheid and into the shift (since two of these teachers are near retirement age) they had to make in teaching the prescriptions of the NCS. A total of three teachers were selected (fully discussed in Chapter 4). As mentioned, Groenewald (2004:11) contends that two to ten participants is sufficient for a phenomenological study.

1.8.3 Data-gathering techniques

At this juncture it is important to note that in a phenomenological study data are constructed on a face-to-face basis via interviews, field notes or rich descriptive essays. This approach has various benefits, for example, the richness and depth of the data. My central research question was directed at the teachers' experiences of the NCS. In a phenomenological paradigm one must allow the data to emerge while bracketing the self out in order to prevent any bias. Husserl refers to this distancing of oneself as **epoché** (Husserl, 1970; Van Manen, 1990). Epoché is **the freedom from supposition** and means "to stay away from", in order for the rich descriptions of the teachers and the context within which they teach to flow naturally from their point of view. When teachers divulge information through interviews, I advance into their consciousness. In most schools in the country teachers are voiceless and marginalised, and placed on the periphery of issues relating to policy formulation and curriculum development; this study therefore aims to give a voice to teachers in this regard. In the next section I will discuss the two methods I used to construct my data, namely, interviews and field notes.

1.8.4 Interviews

According to Takman (cited by Cohen and Manion, 1989), interviews (structured/unstructured) allow researchers to get inside the minds of people in order to understand and to interpret their

¹ In the NATED 550 Science curriculum the focus was on aims and objectives (as opposed to learning outcomes and assessment standards under the NCS) giving teachers clear guidance of what they need to achieve. A prescriptive methodology such as lecture style or inputs-based strategies was given in the NATED 550 Curriculum. Practical work focused on confirming the known without a formal scientific write up. The Science teaching approaches of teachers were more theoretical and content driven than is currently the case.

viewpoints on various issues. Nijhof (1997) confirms this idea when he notes that researchers use interviews as a looking glass through which they enter the respondent's experience, capturing his/her social world. Interviews also allow researchers to make direct contact with their research participants. By becoming part of the phenomenon being studied, the researcher validates the knowledge or data gathered experientially (Nijhof, 1997).

The primary advantage of interviews is that people will usually respond when confronted in person, which allows the researcher to note specific reactions and eliminate misunderstanding or ambiguity about some questions. Any movements, facial expressions, the length of pauses in between answers or any non-verbal cues made by interviewees during the interview can turn accounts of interviews into vivid descriptions. During interviews research participants are free to expand on the topic as they see fit.

I used face-to-face, semi-structured open-ended interviews with all research participants throughout the study for data construction. In each interview every participant was asked the same questions in the same sequence. This method provides the research participants with the opportunity to tell their own stories about how they feel and what they think about specific phenomena. I attempted to develop a good relationship with each participant teacher. With this in mind I conducted the interviews in circumstances where they felt comfortable and relaxed in sharing their stories and views related to my research question (for more details see Chapter 3 and for full interview schedule see Appendix A).

My focus during the interview was on the **realm of the teachers' consciousness** and how they felt about issues related to the implementation of the NCS. This question formed the basis of my interview. I constructed data on this question until the topic of experience with the NCS was exhausted. In relation to teachers' experience of the NCS, I also delved into other issues, such as their first experience with the subject Physical Science during their school career and during their pre-service teacher training programmes on how to teach the subject. My aim here was to focus on the development of their professional identity, for example, their feelings and emotions that had already been established with the subject as early as their school career.

My intention was to determine if any fear, anxiety, stress or trepidation was created at school towards the subject and whether the backwash effect of this might have impacted on their teaching careers. There is evidence in the literature (both locally and internationally) that negative emotions, such as a lack of confidence, anxiety and frustration, may cause teachers to perceive the subject as an incomprehensible set of abstract concepts to memorise, not realising the value of the subject (Dogan, 2011:1). Other questions drew attention to their professional experiences related to their teaching, and their feelings and views regarding the new educational changes (such as the NCS) that took place in the profession over the last two decades and how these affected their perception of the subject. The information divulged through interviews will give me a notion of what to do. Through these interview questions I could establish their concerns about the subject and how these concerns affect their implementation strategies of the NCS in the classroom. In addition, I could zoom in on their rationality and how they implement these rationalities in their different practices and behaviour in the classroom.

Throughout each interview I complied with Husserl's (1970) duty of abstention or bracketed the self (myself) off from their responses. I was more interested in what was transpiring in their minds, without holding any preconceived notions about them. Similar to Husserl, I focused on the **essences of the things themselves**, which are their stories that represent their consciousness. It is in their consciousness where their truth about the implementation of the NCS is concealed. In phenomenology whatever anyone wants to prove must be proved on the basis of things which are evident to us. Truth in phenomenology is what is given by the respondent to the researcher. Truth that is *given* means it is not subject to interpretation, nor is it a matter of analysis or construction. Doing phenomenology means that the researcher must allow the data to emerge. This means allowing respondents (namely, the three teachers in this case) to tell their stories; the phenomenologist captures the rich descriptions of the context within which they teach. Philosophers in phenomenology allow research participants to tell their stories of what they think about what they do when they are doing it. They therefore give meaning to their own behaviour. Furthermore, they tend to integrate their behaviour into general strategies applied in their teaching methods. To get into their consciousness requires certain questioning techniques which I will discuss next.

1.8.5 Questioning techniques

I used what Price (2003) refers to as the *laddered technique* to delve into the complexity of the teachers' consciousness. This technique selects the most appropriate level of questioning. In this strategy the researcher responds to the respondent's dialogue, based on the idea that both share a common goal or notion of what is most intrusive during discourse.

Researchers cannot presuppose what impact a question might have on the respondent. For example, which question will generate interest or discomfort during an interview? Laddered questions operate on three levels. Firstly, inviting descriptions are aimed at setting the scene and making the respondent feel that the researcher is interested in what he/she has to say or offer. Secondly, followed by knowledgeable or invasive questions, this happens later in the interview when the respondent shows signs of relaxation or comfort. It involves questions, such as, what do you think? How do you feel? In this type of questioning it is important to emphasise that the interviewer must not lead the respondent to respond in a certain way by starting the question with phrases, such as 'Do you think that...?' or 'Do you feel that...?' This might invite responses in which the respondents compromise their responses to satisfy the needs of the interviewer.

Through showing empathy, sensitivity and interest in the participant's responses, trust is established between the researcher and respondent. This sets the stage for the third level of questioning; namely questions of personal philosophy. These are the most invasive questions, which focus on beliefs, values and deep-seated feelings. This takes one to the core of the respondent's personal identity. Asking questions at this level is about asking **who you are** and may leave the respondents feeling that the researcher is judging them. Each interview was audio-recorded and transcribed to text.

1.8.6 Field notes

According to Emerson, Fretz and Shaw (1995:1), field notes allow the researcher to turn direct experiences and observations into vivid descriptions. The researcher's aim when taking field notes is to visualise scenes in the field in writing. The researcher evokes the different

organisational strategies and sensory details of first-person as opposed to third-person accounts into finished text. Researchers using field notes can make the voice of people heard in the text they produce. Emerson *et al.* (1995) point out that one aspect of good research reporting is when a researcher remembers dialogue and movement like an actor. Good researchers sense moods and rhythms – similar to the way a poet does.

I wrote down all verbal and non-verbal cues during the interviews. I followed the advice of Groenewald (2004: 13-15), who states that *the researcher must maintain a balance between descriptive notes and reflective notes*. Each time I wrote down field notes I dated them and correlated them with each of the other respondents' views. Here again, whilst jotting down field notes, I was mindful of Husserl's notion of abstaining or 'staying away' from becoming judgemental or biased about what happened during each interview. The method I followed was to write down field notes either during the interview or, at the latest, the morning after the interviews. Whilst compiling the field notes I focussed on what took place during each interview (for further details see Chapter 4.4).

1.8.7 Data storage

With the consent of each participant, I audio-recorded all interviews. The audio recorder I used had three folders with forty hours of recording time in total. Each interview was clearly labelled and dated (for example, Dudley, 3 March 2011). Immediately after the interviews were conducted I listened to each interview to get a sense of the whole interview and made notes. I focused on key words, phrases and statements used by each participant. Each interview was transcribed and safely stored on my computer hard drive with a security code.

1.9 Credibility and reliability of data

In qualitative research terms, such as, **credibility, dependability, transferability and conformability** have been proposed to replace terms such as *validity, reliability and objectivity* situated in the quantitative paradigm (Guba and Lincoln, 2005). Results from qualitative research are often viewed with scepticism by positivists. In an effort to gain acceptance as a

valid form of research, the credibility and validity in the study were enhanced by employing member checking and peer debriefing (for more details see Chapter 3 subsection 3.1.1) The design of the interview questions and conducting the interviews were monitored through detailed and informed discussions with the teachers and my supervisor. I attempted to increase the credibility of my study by creating contextually rich data as a basis for checking, questioning and theorising. This was established by developing a close relationship with each teacher, giving them the freedom to speak as they saw fit (for further details see Chapter 4.3).

1.10 Ethical considerations

When I applied for permission from the Western Cape Education Department (WCED) to do this research, I attached the letters of consent of the teachers who agreed to participate in the study. I followed all the ethical guidelines of the University and submitted the required documents (discussed in Chapter 4.2). This process took approximately one month before a positive outcome was communicated to me. This committee ensured that I considered all ethical issues, such as informed consent, anonymity, confidentiality, storage and dissemination of the data. During the data construction process I ensured that the daily time-table of the school was not disrupted for the duration of the data-construction process. The names of the schools and educators who participated in the research were protected, with pseudonyms as requested by the teachers.

1.11 Significance of the study

Firstly, it is hoped that the findings that emerge from this study can make a meaningful contribution towards attempts directed at improving teacher professional practice. This is particularly relevant to schools that perform poorly in Physical Science. Secondly, the findings should provide the much needed baseline data for future studies in this area, considering the fact that very little research has been done in science education using a phenomenological perspective in South Africa.

Phenomenology as a research methodology is well documented in the medical and religious fields. This methodology could provide valuable and trustworthy insights into how teachers experience the implementation of the NCS. In my view methodologies from the discipline of natural science, psychology, sociology and so forth are unable to provide significant insights into the inner perceptions, values and beliefs of teachers. For example, a criticism of positivism is that the research results do not lead to an improved understanding of social problems and that the research is disconnected from the context in which it was carried out. In psychological studies criticism levelled against positivism is that the researcher focuses on coding as a basis for drawing research conclusions, thereby making the findings questionable as they might require in-depth analysis to confirm their practical significance.

Phenomenology provides the gateway to **truth** which, according to Husserl (cited in Derrida, 1967:195), is only found inside the mind and consciousness of the person (in this case the teachers). The major focus of this study is to ascertain truth about how teachers feel and what they think about what they do in the classroom. Realising this objective requires a method that will allow them to reveal the truth about their practices. This kind of data can best be collected through a phenomenological method.

This study will also provide a snapshot of three Physical Science teachers and how they experience the FET NCS. One common aspect of phenomenology is that the results may not be generalisable to a larger population, because the research participants may hold different views from those of the general population. An awareness of these possible experiences could be a useful starting point for dialogue between curriculum planners and teachers on issues relating to the NCS.

Researchers employing statistical tools to conduct research provide results that are positivist in nature in the sense that they are either statistically significant or not. The question is: are results that are statistically significant also practically significant? It is fair to universalise research findings as in the case with the Trends in International Mathematics and Science Study (TIMSS), Progress in International Reading Literacy Study (PIRLS) and various other standardised tests. This study will produce different results than those from quantitative studies, giving an insight

into how each participant teacher feels and thinks about matters relating to the curriculum. This is because this theory (phenomenology) takes into consideration the relationship between ontology and epistemology, and acknowledges the plural, changing and incomplete nature of interpretation. This study goes against the grain of the positivist's notions that there is a single, external and valid reality in nature because phenomenologists believe in multiple realities that represent a truth of an individual's experiences.

1.12 The structure of the thesis

This study is divided into six chapters. The first two chapters are theoretical in nature and deal with the theoretical foundation of the thesis. Chapters Three and Four deal with the actual investigation, where the data are constructed and a model is proposed for the data explication process. Chapter Five analyses, discusses and interprets the data and results against the background of Chapter One and Two. The final chapter, namely Chapter Six, concludes the research and highlights the major findings. Chapter Six makes recommendations and proposes suggestions for future research.

Chapter One provides an overview of the background of the study, the problem statement, the research question, the purpose, the research design and methodology, the significance of the study, the scope of the study, a short literature review, the ethical considerations, and the structure of the thesis.

Chapter Two focuses on the theory that frames the study. The aim here is to give an extensive literature review. It is against this framework that my findings will be analysed and discussed.

Chapter Three describes the research methodology that was employed. Issues such as the research design, sampling, instrumentation, validity and reliability, credibility, transferability and replicability are addressed.

Chapter Four reports on negotiating access to the research setting, meeting the teachers and the ambiance of the interviews. The chapter concludes with the transcription analysis of the study.

Chapter Five presents and discusses the interviews and their findings. The chapter provides a base for further research.

Chapter Six summarises the findings presented in Chapter Five. Conclusions covering the whole study are drawn and recommendations for future studies are suggested. All this is done from a phenomenological perspective on the lived experiences of the people who participated in the research.

1.13 Summary

Chapter one provides the background and the statement of the research problem to set the context for my study. I attempted to draw an association between the phenomena under investigation and the research framework underpinning phenomenology. The importance of phenomenology as a research methodology is explained and highlighted throughout the chapter. The other salient point discussed in this chapter is the importance of fidelity in the phenomenological tradition, namely the philosophy, on the one hand, and the construction of the data, on the other. Equally important, this chapter succinctly described credibility and transferability issues as well as the ethical considerations involved in the research. This chapter concluded by providing a breakdown of the structure of the thesis. In Chapter Two I will turn my attention to discussions of the theoretical framework that underpinned my study by way of a literature review.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 Introduction

An important part of the research project is examining where a particular research question comes from in one's own life – why it seems important to the teacher-researcher. In many cases this is a matter of investigating one's own socialization – a kind of self-reflection that becomes part of the investigation (Bellenger 1992:201).

In this chapter I will focus on three salient aspects of this research project. First, I will explain my understanding of the roots/source of the research question that motivated me to conduct this study. According to Bellenger (1992:201), *a research question is for the most part always rooted within one's own personal biography and located within a certain social and historical context.* In the light of Bellenger's (1992) point, my personal biography will provide the platform from which to explore the origins of my research question. Furthermore, my biography draws attention to the way that the social and political context in South Africa at the time of my education shaped and influenced my career development both as a learner and teacher of Physical Science. Second, I will discuss the historical development of Physical Science as a school subject to put into perspective where the NCS fits into the current trends and developments in the teaching and learning of Physical Science. The NCS is not only a historical issue, but also has socio-political significance. For decades a plethora of researchers (both locally and internationally) in the field of science education have asserted that school curricula are not value-neutral disciplines, but mostly denote ideas and elements of state aims and ideologies (Jansen, 1999; Ogunniyi, 1978, 1986, 1996; Goodson, 1993; Popkewitz, 1987; Apple, 1993). The third aspect will focus on phenomenology as introduced in the early part of the twentieth century by Edmund Husserl, who is regarded as one of the fathers of phenomenology. My discussion on phenomenology will also include the works of other phenomenologists such as Martin Heidegger (1964), a student and later a colleague of Husserl, as well as many others, such as Merleau-Ponty, Ricoeur and Derrida. Later in this chapter I will discuss the ontological and epistemic dispositions

of the theory of phenomenology in detail, as it forms the crux of the theoretical framework. By discussing my personal lived experiences as a learner and teacher of Physical Science, I will first lay the foundation for a better understanding of phenomenology.

2.2 My early years as a Physical Science learner

My research question is rooted in my personal experience of Physical Science both as a learner, a university student and a teacher. My biography, therefore, becomes important in revisiting my experiences to explain the origins of my research question. This is important, because my biography provides an insight into my own inner consciousness and also allows other Physical Science teachers to sense, feel, visualise and re-experience with me those moments of my life. My biography has a threefold purpose, namely, (i) I argue that within my experience is embedded a larger narrative of science education inquiry, the people, the schools and educational landscapes; (ii) I explain the long historical, political and social influences on my thinking and how they influenced and shaped my thinking; and (iii) I highlight how my biography invites other teachers to see, feel and experience Physical Science teaching and learning the way I experienced it. My biography, with reference to Bellenger (1992), highlights that one does not simply undertake research projects or choose research sites haphazardly, but does so consciously and sometimes unconsciously. Any biography is a construction of knowledge that represents a mixture of the social, political, psychological and cultural influences on our own lives.

It is well established in the literature that the adult's perceptions of the world are strongly influenced by his or her childhood experiences (Belsky and Steinburg, 1978; Popkewitz, 1987). An account of my childhood experiences (captured in my biography) as a learner of Physical Science therefore becomes imperative to this research, because it attempts to describe and explain the origin of the perceptions I hold about Physical Science. Moreover, my biography also explains how historicity shaped, influenced and informed my life (Foucault, 1972). Underlying my biography is

the complex structure of my consciousness and how it directed me towards Physical Science.

I was born in a small suburb of Cape Town called Ravensmead. Ravensmead was classified as a coloured area under the Group Areas Act of 1966 and was characterised by high levels of poverty, illiteracy, gangsterism and other negative influences. Foucault (1972) remarks that each community has its own truth, its general politics of truth, that informs and shapes individuals. At that time most black (so-called non-white) families lived in shacks and many did not have access to electricity and technology (television, computers and the internet). Children were expected to be passive and submissive – respecting, and not questioning, their elders was a core value. This had a backwash effect on my school and university career insofar as I had been conditioned to believe that asking questions was disrespectful.

In primary school, when the teacher was busy with administrative or personal matters, or absent from school, we were instructed to put our heads on the desks with our fingers on our lips. If we were found guilty of an offence, such as talking, we were dealt with harshly. Through such activities and control, inexplicable conscious states of fear, illogical trends of thought and various phobias occupied my mind. This inner consciousness as a form of life that was originally impressed upon me in the Science classroom had the potential to be reproduced in generations to come (Bernet, 2002:329).

At primary school level science was introduced as nature study in Grade 3. Themes such as My Body and I, How to Cross a Road and Littering were some of the topics in the syllabus. The teacher would talk for the entire period and all the learners did was to copy notes from the blackboard. The official pedagogy instilled responses such as fear, an absence of self-worth, low self-confidence and poor self-esteem, among others. For example, misbehaviour was dealt with harshly. Fear of the teacher, fear of asking questions, fear of failing and even the fear of talking in class formed much of the prevailing tradition. These emotions militated against any positive conception of school and created a servile mentality lacking any personal dynamism. In the morning when I was preparing for school, the voice that echoed in my mind was one that reminded me

of how much I hated school and that I could not wait for the school day to end. This problem of (teacher) domination was nothing compared with the other conditions that I had to tolerate throughout the school day. Caloma (2011) asserts that under such conditions the learner is shaped into **someone else** through control and dependence. The teacher's display of, and obsession with, power gave rise to anti-school emotions that pervaded and subjugated my inner consciousness. In other words, as a learner I was not seen as an intellectual in training, but rather it became a struggle against the forms of power that transformed me into an object or instrument in the sphere of knowledge and consciousness.

Addyman's (2009: 120) rationalisation that lived space has a direct influence on the self can be related to my experience (in the classroom) as a Physical Science teacher at that point in my life. The teacher was perceived to be an authority figure more powerful than God, so to speak, and constantly projected his/her power on us by always walking around with a cane or some other instrument with which to intimidate us. Foucault (1972) remarks, that such a practice by the teacher does not awaken consciousness, but rather reinforces power. Sometimes, when there was a visiting inspector at the school, the learners were cautioned to behave in a particular manner, for example, to sit still, not to talk or walk around in class. Difficult learners were sent to another class for that particular period to make the teacher look good. Moreover, only certain children were allowed to raise their hands to answer questions, and if they did not know the answer, they were told to raise their left hand to guide the teacher.

In Grades 1-9 (previously Sub-A to Standard 7) Mathematics and Science were compulsory subjects. There was no major difference between primary and high school with respect to teacher pedagogy, except for the volume and depth of the content that was covered each year. In 1990, when I was in Grade 10, Physical Science and Mathematics were relatively unpopular subjects among high school learners. In Grade 10 these two subjects were optional and only learners with a special aptitude and good results in Mathematics in Grade 9 (Standard 7) were allowed to take Physical Science. Physical Science and Mathematics were therefore seen as very difficult subjects. The subject combinations had different streams, of which the Science 7 and 15 (S7 and S15)

streams were the most popular combinations. The S7 stream allowed the learner to take Physical Science with Mathematics, Biology and Accounting, whereas in the S15 stream Accounting was replaced with Geography.

Owing to limited resources and a shortage of qualified Physical Science teachers, rigorous selection criteria were imposed if learners wanted to enrol in Physical Science. Consequently, some parents would fight with the principals and Science teachers to allow their children admission to the Physical Science class. This class was usually referred to as *die slimkoppe* (the intelligent/clever learners). They were considered the cream of the crop of every school and were prepared for careers in medicine, engineering, dentistry and similar professions. The learners were given the option to complete either the Higher Grade (HG) or Standard Grade (SG) curriculum. In most cases the teacher decided for the learners which grade they would do. As Higher Grade had high failure rates, the teacher would opt for most of the class to do Standard Grade, so that the teacher/school would have high pass averages. Both grades followed more or less the same syllabus, except that in certain areas the Higher Grade learners would delve deeper into the topic/content. They were exposed to higher-order cognitive thinking in terms of Bloom's taxonomy (Bloom, 1956). Standard Grade focused on the conceptual understanding of scientific processes with less complicated calculations in Physics or Chemistry. The learner's choice to do a subject on the Higher or Standard Grade also had implications for university admission, as discussed later in this chapter.

The high school I attended was classified as a historically disadvantaged school. Physical Science classes were restricted to 25 to 30 learners because of limited laboratory facilities and other resources essential in the Physical Science classroom. At the time there were no computer facilities, so the internet and software programmes, such as Crocodile Physics and Crocodile Chemistry, did not exist in our school. Non-governmental organisations (NGO), such as Kanya, the Zenex Foundation, Primary School Science Project (PSP) and the Goldstar Foundation – which currently support teachers and learners with programmes such as Mindset Learning – were not active yet. Our teacher would spend his classroom time transmitting the official state syllabi to us. The only resources used in the Science classroom was the textbook (by Brink and Jones,

1987), a piece of chalk and a duster. The core of this teaching method was to mould learners to think as the teacher thinks. Learners were viewed as passive receptacles and trainees, and the teaching and learning method was unidirectional. The diagram below (Fig. 2.1) illustrates this moulding process:

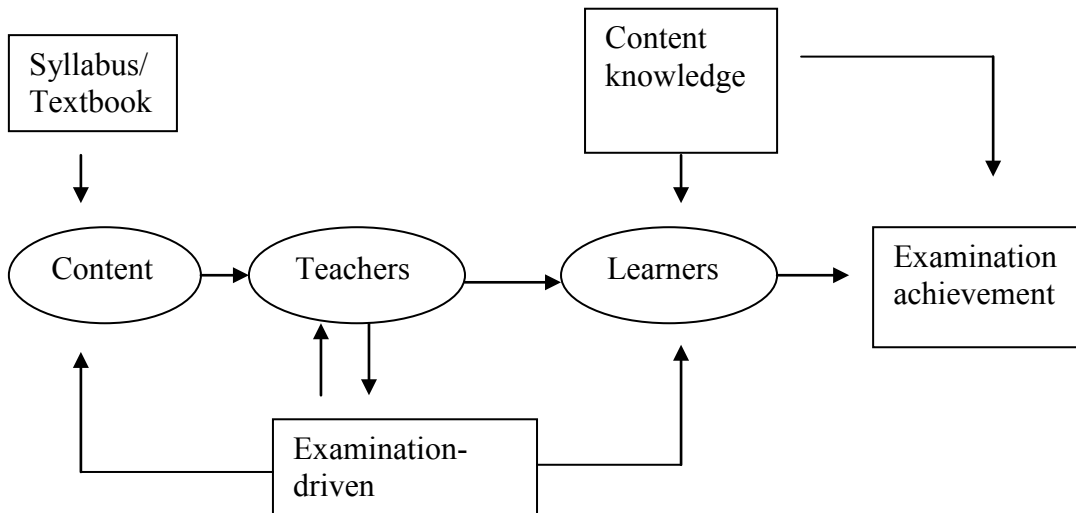


Figure 2.1: A diagram of the didactical approach of my Physical Science teacher

As illustrated in Figure 2.1, the teaching of the content was confined to the core syllabus and textbooks, and directed at passing the examination. The actual teaching included very little practical work and no link was made between the learner's daily life experiences and the content (subject integration). In addition, the subject content presented to the learners appeared to be in an implicit form related to low-order cognitive skills. As this diagram focuses only on the transmission of content, it does not include the nature of the relationship between the teacher and the learner, which was very poor and neither developed cognitive knowledge nor promoted a positive attitude to learning. This form of education was termed **gutter education** and was later (in the 1950s) introduced as the policy for black learners known as **Bantu education** (Kallaway, 2011). It was said to be the direct result of state policy, poor teacher preparation and a lack of resources.

During this phase of my life and exposure to gutter education, I was largely ignorant of the differences in the distribution of both human capital and material possessions

between those classified as white, coloured, Indian and black. I also did not realise that learners had the power to change these conditions of teaching and learning. Similarly, I was unconscious of the atrocities of apartheid and could not make meaningful connections between apartheid policies and state pedagogy.

Owing to this system of inequality, my peers and I experienced Physical Science to be a very dull, irrelevant and fragmented body of knowledge. If any practical work was done, it was only to confirm the known. During practical activities any data I collected that deviated from the textbook were considered wrong. Furthermore, I was not allowed to question the validity of the data obtained by the scientist whose work we investigated or how he arrived at his data. Instead our teacher conditioned us to accept the data and outcomes as if they were cast in stone. This created intellectual borders in my thoughts and consciousness that limited my understanding of the processes of science or how a scientist works. The teacher was entirely in control of all activities during practical work and slowly I became whom he defined me to be, just to please him. In this regard Hall and Burns (2011:52) write: *People tell others who they are, but even more important, they tell themselves and then try to act as though they are who they say they are.* The teachers' influence on me created a consciousness from within that I had to become whom they wanted me to become. However, the teacher strategically succeeded in silencing my inner voice of resistance as my only motivation for doing the work was to be promoted to the next grade (called a standard at the time). The only prestige attached to doing science was the hope of becoming a doctor, dentist or scientist, even though my philosophy of science at the time was inconsistent with what a real scientist does.

Only a few learners referred to historically as 'Coloured' individuals were allowed to enrol for courses in Medicine and Engineering under the apartheid regime. Such careers were reserved mostly for whites and in the Western Cape these career paths were offered only by the Universities of Cape Town and Stellenbosch. One needed special written permission from the House of Representatives¹ to enrol for these courses. At

¹During the apartheid era the administration of education for the various races in South Africa was managed by different institutions in the Tricameral Parliament, namely the House of

that time the state used a quota² system to enrol students for such courses. Given the very few available options, I decided to enrol for a Bachelor of Science (BSc) degree in Biochemistry and Medical Microbiology at the University of the Western Cape. Even there, the selection criteria were very high for learners coming from historically disadvantaged backgrounds as one had to have obtained at least a B on Standard Grade or a C on Higher Grade in Physical Science.

My first experience in the Chemistry laboratory at university is still fresh in my mind. On the first day each student was assigned to his own work station and given an inventory list to check the work-station equipment. I was afraid and embarrassed as I had not been exposed to most of the equipment during my high school career. In my acute embarrassment, I **confirmed** that everything was there without checking carefully. Afterwards, this became even more embarrassing as I was expected to work with the equipment. Once a week in the afternoon two to three hours were devoted to Chemistry and Physics respectively for practical work. I panicked every day that we had to do practical work. Consequently, what were supposed to be fun activities became painfully boring, because my only motivation was to complete them successfully. The negative mindset I developed about practical work, which had started in high school, was enervating. What sometimes saved me from this intensely negative mindset or the embarrassment of not knowing what to do was the laboratory technician demonstrating the proper use of the equipment. I used to feel relieved when I could submit my report, irrespective of whether it was right or wrong, as long as I could confirm the textbook data to get out of the science laboratory. Even at university the same principle of **confirming the known**, as in school, applied.

This negative mindset towards practical work prevailed for most of my career I continued to fear practical work. Most of my peers actually cancelled their registration of the subject because their fear turned into hatred of the subject. They complained

Assembly (for whites), the House of Representatives (for coloureds), the House of Delegates (for Indians) and a separate department for blacks called the Department of Education and Training.

² The quota meant that only a fixed number of students were allowed to enrol for the courses. For example, if there was space for only 10 students, the eleventh prospective student's application was automatically rejected.

about struggling with incomprehensible concepts and of being made to feel like fools because they did not understand the work. The content was mainly presented in theoretical terms, without making any real-life connections or suggesting how it could be applied in practice. We would sit passively in the lectures, while the lecture notes would be conveyed from the lecturer to us without any understanding on our part. The learning of scientific skills had been subjugated to a mechanical transmission of knowledge. My objective as a student was to pass each and every course to get my degree, leave the university and earn some money. I vaguely remembered some of the content when I returned after a long holiday, and I now realise that it was knowledge that I had memorised without making any real-life connections. The majority of science teachers and lecturers throughout my career taught didactically most of the time. Instead of being fascinated by unravelling the secret mysteries of the universe, as should have been the case, I experienced science to be a little more than a dry list of formulas and rules.

What might be needed today is for science teachers to focus on the processes of science rather than the facts, and to guide the learners to become critical co-investigators in this fascinating pursuit of knowledge. The facts of science are naturally intimately related to every step and breath we take, yet they are often taught without stressing the real-world applications. Often this is due to oversight, laziness, syllabus anxiety or simply ignorance on the part of the teacher.

2.3 My professional career

After I could not find a suitable job as a black BSc graduate, I decided to enrol for a higher diploma in education (HDE), specialising in the method of teaching Physical Science and Biology. In 1999 I started teaching Physical Science in a school for what were referred to as historically disadvantaged learners. For most of my career I continued to teach in historically disadvantaged schools with sometimes inadequate or no laboratory facilities and resources. Most of the learners came from broken or dysfunctional families, with little or sometimes no parental support. Even though my career began with a sense that my work was socially meaningful and would yield great

personal satisfaction, this feeling slowly dissipated as the inevitable difficulties of teaching interfered with my personal life. The feeling of no longer being socially useful emanated from being exposed to traditional teaching methods (as a learner) followed by entering the teaching profession as a teacher and having to adopt an outcomes-based education approach. During my lessons I would unconsciously resort to traditional forms of teaching, where I viewed the learner's mind as a blank slate. Also, I dominated the lessons using the chalk-and-talk approach without involving the learner. Furthermore, my lessons were mostly directed at preparing learners for the examinations. Unconsciously I was silencing the voices and creativity of the learners. My teaching approaches were framed with what Spiegelberg (1960) describes as one's historical roots reaching out. My historical roots refer to the ways in which I was taught and trained as a learner of Physical Science. Cohen (1990) would argue that I was still trapped in my old ways of learning. He points out that teachers often have difficulty adjusting their old ideas, beliefs, practices and ways of doing things. I realised that to change was going to be a very difficult task.

At most schools where I taught teachers would complain about the NCS and the difficulty of applying the new vision of OBE with its emphasis on group work, learner-centeredness and OBE lesson plans. Outcomes-based lessons require teachers to turn their classroom into domains and spaces of debate. In such an environment the voice and worldviews of the learner are valued. Almost all corridor conversations had the same theme: **Does this administration know what it is doing?** Other teachers despairingly asked: **How can one teach in these conditions with children who do not want to learn? With all our rights having been taken away from us, for example, no longer being allowed to use the cane, what other options do I have?** Those teachers who were politically oriented or who were highly ranked union officials would make statements such as: The union must do something about this, because we did not get any training and were not consulted in the curriculum-construction processes. Hence they refused to take ownership of the curriculum. In other words, they were complaining about how unprepared they felt, the fact that they had not been adequately prepared to use OBE, and that they had not been consulted in its design.

The classroom after OBE was introduced became a private domain where each teacher had to find his/her own way and followed a closed-door policy. Even though OBE was already in full swing, traditional teaching methods still prevailed. For example, lessons were textbook oriented, very structured with no room for learner involvement and no use of resources. In most schools where I taught the chalk-board and duster were still the principal resources. Even though some schools had up-to-date technology such as internet access, computer rooms and state-of-the-art laboratories, their lessons remained dry, uninteresting and inappropriate for learner needs. More significantly, the old curriculum continued to be dominant despite criticism by teachers that it was too shallow, simplistic and unchallenging. Most of the teachers I worked with believed that OBE would never succeed in their schools and communities. Some even refused to attend workshops, but complained about poor training programmes; others openly rejected OBE. I kept on asking myself what was wrong; what could be the reasons for the negative attitudes? The problem was definitely much deeper than the lack of resources most teachers complained about, or the complexity of the obscure jargon used in OBE. Something was missing; the question was **what**. I kept reflecting on the question: Why do most teachers complain about the old behaviouristic curriculum (NATED 550) and criticise the old regime, but refuse to accept the new changes (such as OBE) and their associated challenges in the shift to the new education system. This is one of the questions that this study intends answer.

My biography captures in writing the images of my past experiences. In Costandi's words, *like the human eye*, past experiences are personal and loaded with meaning:

The eye is a curious thing; it is not passive, not merely a piece of physiology practical and utilitarian; it is not just a hunk of living matter, gristle, tendon, blood. It sees. It has more skill than the foot or hand. When it takes an image in, this act appears to be simple. The eye has experience, knowledge and has cut out territories and reasons why it sees... (Brand, cited in Costandi, 2010:86).

This biography recounts my thoughts and feelings related to my experiences with the subject Physical Science as a child up to adulthood. It also represents my epistemic disposition and the construction of my knowledge with regards to Physical Science that

resulted in my developing a particular perception and conscious awareness of the subject. By articulating my experiences, I also address the knowledge I hold about the subject and use my life story reflexively as a source to understand what teachers experience on a daily basis. Like many other Physical Science teachers, my teaching activities mainly consisted of planning and delivering the curriculum.

This biography bears witness to the fact that the life of a Physical Science teacher (and many other teachers), as well as the environments within which they work is very complex and not just simply a process of planning and delivering a lesson. My experience as teacher in historically disadvantaged schools motivated me to undertake this research journey into delve into the lived world of teachers who experience and teach in similar schools. This is because deep down inside of them is a world that is silenced by the external pressures of a curriculum (NCS or NATED 550³), or departmental policy makers, or advisors that only they themselves understand and live in.

Although the research question stems from my own life, I now want to describe the socio-political context in South Africa within which the study is located. The development of Physical Science as a school subject in South Africa has a very long history coupled with many challenges (which I will discuss later in this section) and it is this context in which the NCS developed that I will discuss next. The NCS emanated from the historical development of the subject and all the teachers taking part in the study were part of the history of the subject, both as teachers and/or learners. At the time they started to work as teachers, the NATED 550 curriculum was the only legislated policy document. They are currently working with the FET NCS, which has now replaced the NATED 550 curriculum.

³ In the NATED 550 science curriculum the focus was on aims and objectives (as opposed to learning outcomes and assessment standards under the NCS) giving teachers clear guidance about what they need to achieve. No direct teaching description was given in the Nated 550 Curriculum except that learners must follow teachers blindly without questioning the accuracy of the content. Practical work was expected to be performed without a formal write up. The science teaching approaches of teachers were more theoretical and content driven than learner-centeredness.

2.4 A historical overview of Physical Science as a school subject

The subject of Physical Science has a long history, both locally and internationally. In this section, I will:

- comment on the historical development of the subject internationally;
- explore how the subject found its way to the shores of Africa and subsequently to South Africa;
- discuss the impact of educational transformation in South Africa on the new developments in the subject;
- comment on how these changes in the curriculum impacted on teacher pedagogy; and
- examine the underlying principles and influences that guided the ideology and vision that shaped the intrinsic and extrinsic values attached to the subject.

A school subject is an ever-changing discipline (Popkewitz, 1987). Combining subgroups and traditions through vociferous critique and compromise influences the direction of curriculum change (Goodson, 1983). According to Rosenthal and Bybee (1987), the direction of curriculum change is influenced by three primary aims, namely: i) the knowledge aim, ii) the method aim, and iii) the personal/social aim. The knowledge aim refers to the goal of the subject that directly determines the content knowledge to be taught. The method aim centres on the delivery of the content. The different methods of curriculum delivery are based on the most effective ways in which learners learn, so that teachers can follow pedagogies that foster and aid learners in learning and understanding the content. The personal and social aims relate to issues such as the appropriateness, relevance and utilitarian nature of the curriculum. Rosenthal and Bybee (1987) contend that the degree of relative emphasis between the respective aims varies in response to historical and social forces. Physical Science has always been regarded as a high priority subject, where the historical, political and social forces determine in which direction the pendulum must swing when it comes to curriculum change. In this regard Naidoo and Lewin (1998: 729) write: *When new needs emerge, science and technology is the key to meeting those needs.*

Physical Science first emerged as a school subject in Britain in the early 19th century, with at least three hours per week allocated to the subject in the schooling system (Goodson, 1994; Ogunniyi 1986:112). According to Goodson (1983), in the early 19th century the science of the common things was the forerunner of high school Physical Science. He states that its subject content was secular and drawn from things which interested the learners such as, for example, the description of people's clothing, how clothing was manufactured at the time, the goods which people consumed, the nature of products and many more. Back then in Europe Physical Science, which is a combination and an integration of the disciplines of Physics and Chemistry, was taught as two separate subjects. Le Grange (2008) indicates that in 19th century Britain Physics and Chemistry were the leading subjects at the time. He further postulates that the growth and development of science as a school subject in 19th-century Britain can be linked to the high **intrinsic value tied to the subject**. Furthermore, the subject had many benefits due to its strong utilitarian potential (Le Grange, 2008:89). In Le Grange's view, the utilitarian importance and value of Physical Science (Physics and Chemistry) , during the Industrial Revolution was evidenced by inventions such as the steam engine, the telegraph, the internal combustion engine and the aeroplane. Goodson (1983) describes the developments associated with the Industrial Revolution as follows:

The spectacular achievements of the Mechanical and Physical Sciences during the Industrial Revolution and its aftermath appealed to the imagination of a generation immensely interested in the development of industry. All pointed to the utilitarian value of knowledge of Physics and Chemistry for boys, if not girls (1983:15).

All of these factors pointed to the utilitarian nature and advantages of Physics and Chemistry. According to Ihde (1976:740), it was natural that Chemistry would rise as a unique discipline on the European continent, since Europe was the focus of intellectual activities and developments. He avers that the economic, social and intellectual developments in Europe were linked to the rise of new sciences.

Goodson (1994), on the other hand, notes that Chemistry suffered a great setback early in the 19th century, when it changed from being a compulsory subject to an optional subject as the supply of teachers decreased. He further argues that in 1859 this decline was the direct result of the slashing of grants for science teaching, and that in 1862, with the Revised Code and payment by results policy, all targeted financial resources for science were withdrawn. This was an early setback for a successful initiative in mass science education.

The history of Physical Science as discussed in the sections above in Britain and the developments in the field in the USA have the following implications for Africa and South Africa:

- Physical Science has been and will always be shaped by socio-historical factors and not just developments in the field of science;
- Tracing its history helps us to understand and interpret current developments in the subject; and
- Physical Science as a subject is central to economic and social development.

2.4.1 Physical Science education in Africa

Ogunniyi (1986:111) states that Physical Science was introduced into Africa in the late 19th century, when Western science was introduced to schools on the continent. At primary school level learners were exposed to the discipline of science by being introduced to subjects such as Nature Study, Hygiene and Agriculture. At high school level the subject was introduced as separate disciplines (Chemistry and Physics), as was the case in Britain and the USA. Ogunniyi (1986) contends that the subjects were taught dogmatically, that is, removed from the daily experiences of the majority of the African people. The West used Physical Science to establish capacity building in the interests of creating independent sustainability on the African continent. This should be understood within the context of the strong colonial influences of the 19th century. Le Grange (2008:91) avers that the educational developments of the 19th century in the West strongly influenced schooling in Africa and South Africa, and set the pattern for the way in which Physics and Chemistry were taught.

Ogunniyi (1986:116) argues that the Physical Science curriculum in the early 19th century in Africa was in the form of a syllabus that was mainly examination-driven. It served a highly academic purpose that was irrelevant to the people of Africa. He points out that the content of Physics and Chemistry was *dry, uninteresting and obsolete* (Ogunniyi, 1986; 111). New ideas in science did not gain any prominence in the schools and among the populations of the African people. Moreover, Kalamathan (cited in Ogunniyi 1986:112) reports that the type of science that was taught in the Northern States of Nigeria could not even prepare learners for careers in science teaching. Asenuga (cited in Ogunniyi 1986:113), who investigated the conditions under which Physical Science was taught, expressed serious concerns about their inferior, inadequate and untidy quality. Revolutionary changes to the Physical Science curriculum were drastically needed in Africa.

The call for revolutionary changes to the Physical Science curriculum stemmed from the fact that the curriculum had no relevance to African people. It was only in the mid-20th century, when most African countries such as Nigeria, Kenya and the Ivory Coast achieved their independence that small strides were made in the subject to meet the needs of their people. According to Chaytor (1980), various ministerial conferences, such as the ones held in Tananarive in 1962, Addis Ababa in 1961 and Lagos in 1964, set out to equip learners with desirable scientific knowledge, skills and attitudes. By 1960 many African countries were making concerted efforts to produce effective science and technology policies. Later that year, at a conference on Science and Development for New States, Israel advanced new ideas to explore and apply modern curriculum techniques in the educational systems of Africa (Ogunniyi, 1986:113). This was followed by innovations from the USA to foster further development of science in Africa. According to Yoloje and Bajah (1981), the innovations and support from outside the borders of Africa had the following advantages for the teaching of physical science:

- The content became more meaningful, appropriate and relevant;
- It promoted experimentation in curriculum development; and

- External examining bodies not only used syllabi from their own subject panels, but also the new curriculum that had emerged from curriculum-development centres.

To promote the further development of the subject in Africa, countries such as Kenya and Nigeria paid their Physical Science teachers more than their humanities counterparts (Ogunniyi 1986:113). Others, such as Ghana and Uganda, paid their Physical Science and Mathematics teachers incentive bonuses. Furthermore, the development of the subject also benefited from international scholarships for courses in Physical Science provided by Israel, the USSR, the British Council, the USA, Canada and Germany, among others. This also stimulated industrial growth in Africa.

This brief history of the development of Physical Science in Africa over the last two centuries was not without problems. This happens to be the current situation in Africa despite, as Ogunniyi (1986: 113) pointed out, following the independence of most Western African countries in the 1970s, the West African Examination Council and the East African Examination Council took over the Cambridge overseas partnerships. The following section will discuss the development of the subject of Physical Science in South Africa.

2.4.2 Physical Science introduced in South Africa as a school subject

In South Africa the subject was born out of a combination of historical, intellectual and social developments. In all of these areas the main historical principle was the strong European influence on the subject (Rosenthal and Bybee, 1987). The reason for the strong European influence was the fact that, in the 19th century the subject was already well established in Europe. For example, all the resources such as the laboratory equipment came from Germany and the textbooks came from England. Le Grange (2008) corroborates this by pointing out that prior to the 1930s textbooks were available only in Dutch and English. The literature does not specifically state when Physical Science was introduced into South African schools. However, according to Walters (1964), Physical Science was introduced (not yet established) in the Cape Province early in the 20th century. In addition, he points out that when Physical Science was initially introduced in the Cape Province, it was as two separate disciplines, namely

Chemistry and Physics. He argues that the initial content was in the form of a soft science (that is, less complicated with little focus on the abstract nature of science) and the curriculum neither stimulated nor challenged gifted science learners.

The establishment of the Physical Science curriculum in South Africa came about when the Russians launched Sputnik in 1957, when more emphasis was placed on the improvement and development of the subject. Sputnik I had an impact not only on the South African curriculum, but also on the entire American civilisation (Walters, 1964). Stalner (cited in Walters, 1964:15-16) writes:

On the 4 October 1957, the Russians put an earth satellite, Sputnik I, into orbit. This dramatic event was immediately noted around the world. The feeble and uninspiring beep-beep emitted by that 184 pound ball caught the ear of more people than the blast of the Hydrogen bomb. No one was more astonished than the American public to have a positive demonstration that scientists working in the lab are ahead of us not only in most advanced theories but in the practical application to a working model.

Sputnik I became the catalyst to improve the development of the subject in America. Although the single greatest impact on science was the atomic bomb, Sputnik I was taken as evidence that America was not doing enough to develop the capacity of its citizenry in science. Developments in America, according to Walters (1964), also encouraged the South African education department to improve the quality and delivery of the Physical Science curriculum.

Prior to the Sputnik I event in 1957, all the different disciplines of science were delineated in the Physical Science curriculum. This resulted in a shift in the knowledge aim of the subject. Firstly, all the different disciplines in science such as, for example, Astronomy, Geology, Physics, Chemistry and Meteorology, became part of the Physical Science curriculum. Physical Science became an eclectic course and the major focus was on the utilitarian nature of the curriculum. Furthermore, more interest was shown in and more financial provision was made for learners who were gifted in Mathematics and Physical Science. At the establishment of the Transvaal Science Teachers' Association in 1962, Dr SM Naude (a scientist) stressed the importance of physical

science (Walters, 1964). It was a matter of concern to him that in South Africa more than one million rand was spent on special education for children with disabilities, but no money at all on special education for above-average children. As a scientist, Naude considered this to be an indirect but nevertheless extremely effective form of national suicide (Walters 1964:18).

This outcry resulted in the establishment of various science bodies in order to:

- give more attention to learners gifted in science;
- promote collegiality among teachers to strengthen the quality of the subject;
- lay a solid foundation for learners with Mathematics and Physical Science (Chemistry and Physics); and
- encourage institutions to make their voices heard about the improper treatment and loss of gifted science learners.

Nationally this was the start of the development of science advisory boards for the then Minister of Education, who was responsible for establishing quality in Physical Science education. Moreover, this further developed into the three-stream system of the Transvaal Education Department and the junior secondary syllabus of the Cape Province. Attempts were made to address the strongly reductionist overlay of the content in the curriculum, which focused only on concepts and principles that were far removed from the everyday activities of the learners. What was absent – and equally important from a pedagogical perspective – was an understanding of the moral issues involved in the impact of the curriculum on the environment and on social relations. Next I shall discuss the impact of apartheid education on the development of the subject.

2.4.3 Physical Science under the flag of apartheid education

Le Grange's (2001) thesis on the pedagogical practices of teachers reports that one of the main influences on South African education (including Physical Science) was the introduction of Christian National Education (CNE) and the philosophy or *science* of

Fundamental Pedagogics (FP), doctrines which legitimised apartheid education. Enslin (1984) points out that CNE was promulgated as a policy for white Afrikaner learners in 1948, with the aim of educating blacks for unequal participation in economic and social life. Enslin (1984) avers that **the native** should not be given any academic education, since there would be no one to perform the manual labour in the country. In this regard Mumford (cited in Kallaway, 2011:14) writes:

The white man desired native education in order to train human tools for his economic and administrative machine and to make more efficient servants of the natives, whereas the natives desire the same education in order that they might attain an equality with and even challenge the white man in his own sphere.

The ideology of the Afrikaner nation⁴ was to create a separate inferior education system for black people. As a consequence of this, according to the Reconstruction and Development Report (RDR) of 1994, blacks suffered severe deficits in the area of Mathematics and Physical Science education. Without laboratories and equipment, it was impossible to make Physical Science exciting and practical. Fundamental Pedagogics (FP), according to Le Grange (2001, 2008), emerged in 1944 and became very significant as CNE came under educational scrutiny. The word **fundamental** has its origin in the Latin verb **fundare** which means **base**. According to Kilian and Viljoen (1974:13), FP may be typified as foundation pedagogics, because it deals with the grounding of pedagogics in the reality of universal life. It refers to speculative conceptions which have no practical value for educational practice. It is embedded in a philosophy that promotes the systemisation of knowledge; hence Kilian and Viljoen (1974:15) argue that in pedagogical thinking the notion of knowledge as a rigid system is scientifically unacceptable. Pedagogical thinking compartmentalises knowledge and promotes a behaviourist philosophy. In such a system learners are perceived to be empty vessels waiting to be filled, that is, they are seen as the passive recipients of knowledge.

Le Grange (2001: 57) believes that FP was used as the underlying doctrine of instruction in Afrikaans-medium universities, historically black colleges of education,

⁴ *Afrikaner* refers to a group of white settlers of European and specifically Dutch descent who came to the southernmost tip of Africa. In South Africa they imposed colonial rule, values and culture on the indigenous populations. They also became independent and developed their own language, Afrikaans, one of the fastest developing languages in the world.

and in historically black universities to promote particular pedagogical practices. He further argues that by employing this methodology, the fundamental pedagogue would supposedly soon learn to understand the phenomenon of education by undertaking radical reflection on the educational situation (Le Grange, 2001: 67). In so doing, the pedagogician would bracket out extrinsic aims and beliefs, thereby causing the political to become forbidden, with no legitimate place in the realm of science. This resulted in teachers not questioning the content of the syllabus and adopting the belief that the curriculum was value neutral. In such a system the emphasis was on content and demanded a pedagogical practice that focused on the product and not the process of how knowledge came into existence.

These ideological beliefs of CNE and FP endorsed/confirmed a nation deeply divided on the basis of race. Naidoo and Lewin (1998:732) report that South African education was separated into schools within the Republic of South Africa and the so-called self-governing territories of Venda, Ciskei, Transkei and Bophuthatswana (which were later reincorporated into the new South Africa). Within the boundaries of the Republic of South Africa the education system was administered through four main departments: those of the House of Assembly (DET-A) for those classified as white, the House of Delegates (DET-D) for Indians, the House of Representatives (DET-R) for coloureds, and a separate department for Africans (blacks), the Department of Education and Training (DET). In addition, some provinces were further divided into their own educational systems. There were heavy investments made in schools and tertiary institutions for the minority white population. Enrolment or participation of African learners in Physical Science at school was kept at a minimum. The African racial group was the most impoverished (Naidoo and Lewin 1998:730; Ogunniyi 1986:112). In 1990 only 44% of Physical Science teachers were qualified to teach Science (Naidoo and Lewin 1998:733). The following table illustrates the capitation per student, pupil-teacher ratios, teacher qualifications, the success rates for each education department, and the difference in performance and investments.

Table 2.1: Resource allocation and performance in 1989

Description	DET-A (White)	DET-D (Indian)	DET-R (Coloured)	DET- (African)
Student capitation in Rands	33 600	2 600	2 100	750
Overall teacher-pupil ratio	16:1	21:1	25:1	41:1
Percentage under-qualified teachers	2%	4%	43%	87%
Proportion of students passing with school-leaving certificate	0.85	0.84	0.30	0.14

Source: Naidoo and Lewin (1998:732)

Because of the high proportion of unqualified Physical Science teachers (as seen in Table 2.1), teaching in schools classified (under the Group Areas Act of 1966) as coloured (43%) and black (African) (87%), the Physical Science curriculum under apartheid rule was delivered to learners in an excessively theoretical and old-fashioned way (Nganu, 1991). Kahn (1993:8) contends that the teaching was teacher-centred, strict, inflexible, and dominated by the examinations. The syllabi were outdated. At a conference held in Johannesburg in September 1993, the ANC expressed its view that the Science curriculum was very abstract and had very little to do with the everyday experience of learners. Too much emphasis was placed on facts and memory skills. The end result, according to the Foundation of Research and Development (hereafter FRD) (1993), was that 47% of whites chose Physical Science as a school subject, compared to 14% of Africans. Moreover, the pass rate for whites was as high as 90% on average, and for blacks lower than 10%.

This influenced the university entrance of blacks, with about ten times more of their white counterparts completing degrees in the sciences, despite the fact that whites

represented less than 10% of the population (Naidoo and Lewin, 1998:733). During the apartheid era several criticisms were levelled against the existing structures, which discriminated against the majority of the learner population studying Physical Science. It was evident that Western philosophy was still dominant in the approach to the subject at the time. Many of these factors arose from historical neglect. Major innovations and interventions were required to replace the apartheid structures and the negative images and myths related to the subject. Teacher-centred pedagogies focused on transmission learning with no regard for constructivist pedagogy. As a result, many studies – see, for example, Ogunniyi, 1986, 1996; Naidoo and Lewin 1998 – indicate that learners hated Physical Science and perceived it to be a very difficult subject. Therefore, they only studied the content in order to beat the system and pass the final examination. The quality of Physical Science teaching was often measured by how well teachers could manage and ridicule the learners. The learners had no voice in the classroom as a result of the intensity and focus on theory and the syllabus was also very extensive. Furthermore, time constraints limited the teachers' chances of doing practical work, as the teachers' main aim was to finish the syllabus in order to prepare learners adequately for the final examinations. In the next section I shall consider the extent to which things might have changed since the demise of apartheid.

2.4.4 Post-apartheid Physical Science education

South Africa's first democratic election in 1994 led to a large number of new policies on education. The 1995 White Paper I on Education and Training articulated the need to:

... raise the worker's level of general education and skill, to support the introduction of more advanced technologies, to overcome the inheritance of racial and gender stratification in the workforce and to achieve, effective worker participation in decision making and quality improvement (Department of Education, 1995:6)

New policies and documents have been developed since 1991 with the aim of improving the quality and quantity of science and technology education. What emerged from these documents was that a high quality of planning and provisions was needed to

assist those schools most heavily affected by apartheid. Moreover, these documents indicate that in most schools the Physical Science curriculum was of a poor quality and wasteful of resources. Naidoo and Lewin posit that more than 80% of the African population were denied access to Science teaching, since their schools did not offer Physical Science as a high school subject; they write:

The poor quality of science education and poor performance of African students are ascribed to the legacy of apartheid policies. Such policies inflicted on the African student a curriculum which many perceived as largely irrelevant to their needs, difficult to the point of impossibility given the learning context, and taught by large numbers of unqualified science teachers in schools with few or no laboratories and science equipment (1998:737-8).

This state of affairs necessitated major intervention strategies to improve matters by opening new Science streams in schools, upgrading the qualifications of Science teachers, developing schools that did not yet offer Physical Science, increasing investments in facilities, and developing a new curriculum in Physical Science more relevant to learner needs. This newly proposed curriculum was introduced as one using an outcomes-based approach, called Curriculum 2005 (C2005), to reflect the year of its full inception across all the grades.

C2005 demanded an outcomes-based approach to teaching. Not only was the teacher-centred pedagogies replaced with learner-centred pedagogies, but the 42 school subjects were replaced with eight learning areas. According to Le Grange (1998), these learning areas combined the old subjects, ostensibly to promote a more holistic learning approach. The new National Qualifications Framework (NQF)⁵ divided the education system into three bands, namely GET, FET and HET. GET included only Grades 0-9, whereas FET included Grades 10-12 and HET involved tertiary qualifications.

In March 1997 OBE was introduced in the GET band, with Natural Sciences as a compulsory subject combining Biology and Physical science. In the initial version of

⁵ NQF: National Qualifications Framework is a framework on which the standards and qualifications, agreed to by the education and training stakeholders throughout the country, are registered. It was established by the South African Qualification Authority Act (No. 58 of 1995, Government Gazette No 1521, 4 October 1995).

OBE, in the GET band, nine learning outcomes (LOs) were proposed for Natural Science. Teachers experienced many problems and in 2002 a revised version was proposed to simplify the implementation of the curriculum. The revision process followed a period of vociferous debate and fierce contestation (Stoffels, 2006:4). Most of the problems were the result of poor resources such as lack of textbooks, inadequate technology and equipment, and lack of facilities and laboratories. This resulted in the nine specific learning outcomes being replaced with three broad learning outcomes. Learning Outcome 1 (LO1) dealt with scientific investigations and problem-solving skills, and Learning Outcome 2 (LO2) dealt with what learners should know (concepts, laws and theories). These two LOs were in line with the proposed pre-C2005 syllabus, but for the first time they were phrased as outcomes and not as inputs. Learning Outcome 3 (LO3), which focused on the application of scientific knowledge in the real-life context, was ignored in the pre-C2005 syllabus.

The next band after GET is FET, where Physical Science becomes optional. Learners have a core subject combination of four subjects and three electives, of which Physical Science is one. FET became policy in 2004 and was implemented in 2006 for the first time. One of the major changes that took place was a shift in subject content. For the first time topics such as two-dimensional motion and two-dimensional momentum were included in the Mechanics section. Furthermore, other new materials in the Physics sections included lasers, the Doppler effect, two- and three-dimensional waves, electrodynamics, electronics, the mechanical properties of light and electromagnetic radiation. The topics remained unchanged in the Chemistry section, but they became more intensive and extensive. By extensive I mean that the focus is more on depth and the application of the theories of science. For example, Organic Chemistry was extended to include both macromolecules (theory) and the chemical industry (application of the use of macromolecules in industry). Moreover, Electrochemistry included both the electrolytic cell and the electrochemical cell, whereas the pre-C2005 syllabus included only the electrochemical cell.

Solving such problems requires a solid grounding in Mathematics. There appears to be no sense for the two subjects to be separate (as was the case in the past), because the teaching and learning of the Physical Science content has many content links with

Mathematics with regard to problem solving, relationships in formulaic usage and the system of international units. This inevitably requires an increase in the teacher's and learners' active participation in higher-order thinking skills. Drawing on my experience and knowledge of Physics and Chemistry, I believe that the subject matter of the new curriculum can only be taught by an experienced subject specialist who is well versed in the knowledge content of both disciplines. As Barnes, Clarke and Stephens (2000) cautions, any lack in credibility with respect to the quality and efficiency of the content, or in the ways in which the outcomes are addressed, would derail the reform agenda of the new curriculum.

Jansen (1999) and Stoffels (2006) argue that the sudden change in curriculum was a consequence of the long phase of non-intervention under the apartheid regime. The change signified a break with the past and aimed at freeing learners from the legacies of apartheid education. In the NCS policy for Physical Science, each LO is accompanied by assessment standards (ASs) which describe the ways in which learners attain these outcomes. According to the NCS policy document (2003), ASs are vehicles of knowledge, skills and values through which the learning outcomes are addressed. Table 2.2 below illustrates the LOs and ASs in order to shed light on the extent to which Physical Science is structured in the new curriculum.

Table 2.2: Assessment standards for Physical Science for the respective learning outcomes in the FET phase.

	Learning Outcome 1: Scientific inquiry and problem solving (LO 1)	Learning Outcome 2: Construction of scientific knowledge (LO 2)	Learning Outcome 3: The nature of science and its relationship to technology, society and the environment (LO 3)
Assessment standards	Planning and conducting an investigation	Recalling and stating concepts	Integrating science with technology, Mathematics
	Accurate and reliable collection of data	Explaining interrelationships between facts and concepts	Impact of science on ethical and moral arguments
	Interpreting data and seeking patterns and trends	Applying scientific knowledge	Impact of science on the environment and social development

(DoE Policy Document, 2003)

The ASs in Table 2.2 are applicable to all the grades (10-12) in the FET phase (Department of Education, 2003; 2006). However, each AS has its own criteria for the attainment of skills in the respective grades. For example, in Grades 10-11 (for LO1) a learner is expected to conduct a scientific investigation and collect data for interpretation. In Grade 12 the learner must conduct and design an experiment so as to collect data to draw inferences from, and interpret the data to verify or falsify a particular hypothesis. The attainment of these skills (LO1) is evident when a learner uses scientific reasoning to explain the verification or falsification of his/her hypothesis. LO2 focuses on the construction of scientific knowledge, whereas a Grade 10 learner is only expected to state the basic prescribed scientific knowledge (Department of Education, 2003). In Grades 11-12 learners must define and discuss the basic prescribed scientific knowledge. Each of the concepts builds upon the previous one, from one grade to the next, which is consistent with the goal of conceptual progression.

Bennet (2002: 83) points out that conceptual progression are desirable in a curriculum: *as it represents elements of curriculum implementation and delivery that are crucial in synchronising policy, teaching, assessment and learning.* Thus, as learners progress through the FET phase, their knowledge of scientific concepts is strengthened. In this way the NCS clearly deviates from the goals and legacies of the apartheid syllabus and curriculum.

When the shift from apartheid education to C2005 was made and the new NCS document became policy, a particular kind of teacher was envisaged – teachers now had to play the role of facilitators to guide learners to new knowledge. Furthermore, it required a teacher to take into account the learners' preconceptions and worldview presuppositions about a scientific concept in the syllabus. This raises the following questions:

- What is happening in the classroom, considering that most of the teachers who are actively involved in the teaching and learning process have been trained in the talk-and-chalk tradition?
- Is there any difference in the pedagogical practices of these teachers – in other words, has any change taken place in the way science is presented to learners?

Science should always be viewed in a utilitarian way (Ogunniyi, 1986, 1996). It should be useful to learners in their everyday lives and help them to understand the world around them, develop their thinking, achieve good examination results and find work. When the imagination of the learners (in studying Astronomy, for example) is stimulated or challenged by the practical component of the work, they must be able to see its intrinsic value. Is this kind of pedagogical practice taking place in our classrooms? If not, what are the reasons for the resistance to change? These questions will give us insight into what went wrong in the past and prevent a repetition of the same sequence of events.

Teaching Physical Science in South Africa today in my view consists not only of conveying knowledge, but also of implementing the methodology used to communicate the knowledge to learners. Two of the research participants taking part in this study

taught Physical Science under apartheid (following the NATED 550 curriculum) and in the post-apartheid period (NCS). The other participant was trained as a learner and pre-service teacher of Physical Science under apartheid, but has to teach in the post-apartheid dispensation. A historical overview of the development of Physical Science alerts one to the fact that the transition of the practices of the teachers in the study, from the NATED 550 curriculum to the NCS, was not going to be a smooth one. This might possibly be a direct result of the teachers' struggle to unlearn their old methods of teaching. Under the apartheid curriculum the role of the teacher was one of a transmitter of knowledge, and in the NCS the role is one of a facilitator of knowledge. In both teaching traditions (under the old and new curricula) the historical and socio-political developments of Physical Science influenced the way the teacher perceived the subject. How the teachers respond to the implementation of the NCS is what I will be monitoring. These rich descriptions of what they possibly might have experienced under apartheid and the subsequent changes associated with the post-apartheid curriculum they had to make provide the platform for understanding possible challenges they might face when it comes to the implementation of the FET NCS, which forms the crux of the study. At a time of major curriculum change in South Africa (the shift to the NCS) it might be important to research the teachers' understanding of the NCS and the way they attempt to implement it. Research done by Lelliott et.al (2009) advocates the need for such studies. Studies focussing on other aspects of science teaching have been conducted in South Africa. For example, Adler, Pournara, Taylor, Thorne and Moletsane (2009) investigated the impact of research on policy and practice and pointed out the necessity to examine the practices of teachers. Additionally, a myriad of studies in science education investigated how teachers respond to the implementation of a new curriculum (Kriek and Basson, 2008; Bansilal and Wallace, 2008; Coetzee and Imenda, 2012). However no single study investigating the lived experiences of science teachers using a phenomenological framework have been done in South Africa. This phenomenological study therefore is the first of its kind in South Africa, concerned with the teachers' implementation of a new curriculum and how they respond to the challenge of the implementation process.

In conclusion, I must indicate that there are many research and philosophical traditions one can draw from to conduct the study. Presenting my experiences and biographical data was a demonstration of the ontological stance I am maintaining in this study. Therefore in the next section I will define phenomenology and in discussing its key components I will demonstrate its relevance to this study.

2.5 Phenomenology

Phenomenology is both a theory and a method. In this section I will only focus on the theory of phenomenology. The theory of phenomenology has a very long prehistory (Maharana, 2009: 2). Maharana (2009: 2) avers that over the centuries both Western and Eastern philosophers attempted to arrive at a phenomenologically true understanding of what the **nature of consciousness** is with special focus on whether consciousness is 1) pure, self-revealing and non-intentional, 2) exclusively intentional, or 3) both self-revealing and intentional. Eighteenth-century scholars trace the movement of phenomenology back to Kant and Hegel. Even though there are different views in the literature reported about the theory of phenomenology, the **fathers** of phenomenology all agree that phenomenology is the study of consciousness.

A myriad of scholars of phenomenology regard Edmund Husserl as the father or what Groenewald (2004: 3) calls *the fountainhead of phenomenology* in the twentieth century (Weimin, 2008; Devenish, 2002; Groenewald, 2004). Husserl was a student of Franz Brentano (Bernet, 2002: 330; Holloway, 1997: 117), who started the movement on the *intentional nature of consciousness*. According to Brentano, consciousness is the *unitary connection of intentional representations that are accompanied by a pre-reflexive internal consciousness* (Bernet, 2002:330). For Husserl, consciousness far exceeds factual knowledge and points towards the truth about objects.

Husserl developed the theory of phenomenology with the aim of finding the foundation of all knowledge. To Husserl it is in the foundational epistemology where truth lies. It is the foundation that makes things true and provable, a concept that goes beyond

arithmetic (Burua, 2007:2). Eagleton (1983:54) points out that it was during World War I that Husserl started this philosophy on phenomenology. Eagleton (1983:54) writes:

...science seems to have dwindled to a sterile positivism, a myopic obsession with the categorizing of facts; philosophy appeared torn between such a positivism on the one hand, and an indefensible subjectivism on the other; forms of relativism and irrationalism were rampant, and art reflected this bewildering loss of bearing.

To Husserl (1859 – 1938) the beliefs on which knowledge rested needed to be questioned to find a truth that lies beyond positivism. Husserl (1970) objected to the following notions about how truth is defined:

- He objected to relativism. Relativism is the notion that truth is relative to a place, time or people;
- He objected to perspectival truth. Husserl militated against the belief that truth depends on who you are and how you see things and their position. According to Husserl knowledge must not be perspectival but simply true;
- He objected to scepticism. It is the incapacity to validate truth. Scepticism is the notion that we do not know what the world is like. Or even if we know what the world is like, we cannot know what we know;
- He objected to historicism. Husserl asked: are truth and knowledge relative to a particular historical period? For example 12th-century scholars argued that the world is flat, which was regarded as the truth for them based on the empirical evidence that existed at the time. Today scientists argue otherwise, namely, that the earth is round, but it is not to say that it is the truth for them. For modern society, the fact that the earth is round is no longer truth;
- He objected to factual knowledge and the positivistic mindset. Husserl argued that Mathematics cannot be based on facts, hence creating uncertainty.

Emanating from the questions and objections raised by Husserl, he argues that it is in terms of our minds that nature needs to be expressed (Sadala and Adorno, 2003:1). According to Husserl, certainty can only be expressed as a notion in the consciousness

(Burua, 2007: 3-4). Groenewald (2004: 4) writes: *to arrive at certainty, anything outside immediate experience must be ignored*. It is by adopting this approach that the external world is reduced to the content of personal consciousness. This phenomenon is what science and common sense knowledge fail to express or acknowledge. Natural science and common sense knowledge are purely empirical and Husserl aims to provide a non-empirical, non-naturalist explanation of experience. In this sense Burua (2007) argues that everything about us refers back to the mind – the realm of consciousness. It is this looking into the mind that formed the basis of phenomenology. Husserl argues that whatever we want to prove must be proved on the basis of the things which are evident to us. According to Husserl, truth is given (Husserl, 1970; Derrida, 1967). The key word in the search for truth is *given*. The word ‘given’ here means: truth is not subject to interpretation, nor is it a matter of construction. An example here is experience as presented. Husserl’s main argument regarding phenomenology is that we can frame the world through experience (Derrida, 1967; Husserl, 1970; Van Manen, 1990). Therefore a phenomenologist can be regarded as a *worker on, or researcher of, experience*. Through experience the phenomenologist aims to explain the flowing life of consciousness as it occurs. The research question under investigation in this thesis is based on the subjective experiences of Physical Science teachers. Therefore I will now turn my attention to *subjectivity* and *experience* and their importance in phenomenology.

2.5.1 *Subjective experience*

Without a subject (living person/body) there can be no lived experience or place. There appears to be a nexus between subjectivity (the self), place and time. To Merleau-Ponty (cited in Addyman, 2009) subjectivity always happens somewhere. Addyman (2009: 113, citing Casey) pointed out:

To tie, the knot, between body and place is so thickly Gordian that it cannot be neatly severed at any one point. Merleau-Ponty teaches us that ... the human body is never without place or that place is never without body.

Merleau-Ponty avers that to the phenomenologist subjectivity is not **a-cosmic** but is [or takes] a place in a world or what phenomenologists call the **lived space**. According to

Addyman (2009), Merleau-Ponty pointed out that without the body's asymmetry, places will be turned into neutral sites. Bachelard (cited in Addyman, 2009: 121) noted *that an understanding of the self can only be attained by studying the places that the subject has travelled*. Bachelard referred to the sites to which the individual has travelled the latter as a *topoanalysis* (Addyman, 2009: 121). Topoanalysis is *the systematic psychological study of the sites of our intimate lives* (Addyman, 2009: 121). Our lives are a culmination of experience that cannot be separated from lived space (Vandenberg, 1997). This nexus between space and experience has received overwhelming attention over the years leading to a new discipline in phenomenology.

A phenomenologist has a strong interest in experience. Phenomenology is considered to be the philosophy of experience. The word *experience*, according to Readers Digest Universal Dictionary (1987:1508), means: *the apprehension of an object, thought or emotion through the senses or mind*; another definition refers to *the active participation in events or activities leading to the accumulation of knowledge or skills* (Encarta electronic dictionary). The first definition provides two domains, within which experience can take place, namely the physical (seen world) and metaphysical world (unseen), for example fear, or emotional trauma or pain. To understand a concept one needs to look at the epistemological foundation of the concept, according to Husserl.

Philosophically, according to Merleau-Ponty (cited in Stoller, 2009: 709), *experience is the most immediate source and last measuring stick of all experiences*. In other words, phenomenology is not a science based on experience but rather a science derived from experience (Stoller, 2009: 709). To the phenomenologist experience is an object of phenomenological investigation. Therefore the structure of experience is of importance to the phenomenologist, so that the flow of the experience can be described as given. In a very narrow way the flow of experience is situated within a historicity of experience. According to Stoller (2009: 10), the crux of the phenomenological theory of perception centres on an object being perceived in relation to the horizons in which it is found and from which it stands out. The concept of horizons refers to the unperceived or hidden aspects of an image. For example, in every three-dimensional structure or object are hidden dimensions. Similar to the hidden dimensions of an object one's consciousness

holds the hidden structures implicitly. These implicit thoughts represent the fundamental perceptions that frame one's knowledge. This implicit knowledge that ensures the unity of my perceptive experience prevents my perception from breaking up into fragments of distinct experiences. According to Stoller (2009: 710) this incidental consciousness of other possible perceptions is based on the reference structure embedded in any given perceptual experience. Stoller points out:

There belongs to every external perception its reference from the genuinely perceived sides of the object of perception to the sides also meant – not yet perceived, but only anticipated and, at first, with a non-intuitional emptiness (Stoller, 2009:710).

This reference structure is important to the facet of experience. That is to say that experience encompasses not only what is experienced at a given moment, but also that which will be potentially experienced. In essence perception is partial and depends upon a certain perspective. At the level of basic perception the things seen are always more than what is really and actually seen. Husserl provided an epistemological viewpoint on phenomenology, but despite the great volumes of research literature on phenomenology, there are also different disciplines within the field of phenomenology. Theoretically the different disciplines constitute existential, empirical, hermeneutical, psychological, transcendental, classical, etc. dimensions. In the next section I want to focus on how Husserl's work was further developed by other scholars.

2.5.2 *Heidegger on phenomenology*

Heidegger was a student of Edmund Husserl (Lavery, 2003). According to Tan, *et al.* (2009: 4), Heidegger (1889-1976) adopted an ontological stance towards phenomenology, with a focus that leans more towards the nature of *being* rather than *becoming to know*. Heidegger believed that consciousness is not separate from the world but is a formation of historically lived experiences. As McConnell-Henry, *et al.* (2011: 29) argue, Heidegger believed that we are all self-interpreting beings – that to live is to listen and to derive meaning. Heidegger attempted to understand shared meaning amongst humans and what a culture gives a person from birth as a way of understanding the world. Heidegger was an advocate of ontology and argued that one

cannot separate ontology from phenomenology. Context, defined as time and space, cannot be ignored according to Heidegger. His work extended Husserlian phenomenology in a way that aligned epistemologically based consciousness with ontologically based consciousness. In an epistemological stance towards describing phenomena the emphasis is on *a way of knowing*. Heidegger's notion of phenomenology is very inductive and descriptive in nature and focuses on, or recognises, the subjectivity of experience.

The crux of Heidegger's thesis is the nature of being. He introduced the concept *dasein*, according to Geanellos (1999:114). Ricoeur (cited in Tan *et al.*, 2009) defines *dasein* as *the essential nature of human beings*. Groenewald (2004: 4) provides a clearer description of *dasein* as meaning 'being there', and as the dialogue between a person and his/her world. The essence of Heidegger's work focused on the **lived-world or the world of experience**. Heidegger's work was further developed by Merleau-Ponty by using both conceptual frameworks provided by Husserl and Heidegger and postulated the discipline of existential phenomenology, which I will discuss next.

2.5.3 Merleau-Ponty on existential phenomenology

Merleau-Ponty, according to Sadala and Adorno (2003: 2) extended the work of Husserl and Heidegger. Merleau-Ponty proposed the term existential phenomenology. To him existential phenomenology is not only *the rigorous science of the search for essences, but it is also a philosophy that sees people in a world that already exists before any reflection*. Merleau-Ponty's search was to understand people as 'beings' in a situation in which they exist. As Sadala and Adorno (2003: 2) note:

Merleau-Ponty deals with the body, the body itself, the body lived, by which I can be in the world and relate to other people and things. For him the body is our anchor in the world, or our general means of holding on to a world.

Merleau-Ponty points out that lived experience is situational, it occurs in a particular space and time. The situation or action speaks for itself and cannot be prejudged or viewed through the eyes of the researcher or spectators. Experience is a text whereby

the reader expands the borders of understanding instead of understanding the borders. Therefore the aim of the phenomenologist is to describe the phenomena as accurately as possible, refraining from preconceptions and pre-reflexive notions. As Groenewald (2004: 4) pointed out *the phenomenologist is concerned with understanding social and psychological phenomena from the perspective of the people involved*. The question that now proceeds from Husserl, Heidegger and Merleau-Ponty's work is how does one interpret experiences without any preconception, prejudgement or any form of pre-reflection? Before I attempt to answer this question I will first turn my attention to the significance of all the concepts described so far on the historicity and description of the development of phenomenology and the educational situatedness of the philosophy towards my study.

2.5.4 *The educational context of phenomenology*

The focus of this research is on the personal consciousness of teachers. What is it that goes on in their minds as they go about their everyday business of engaging with the subject Physical Science? This quest demands insight into their knowledge and personal philosophy in order to gain an understanding of what it is the teacher experiences. The phenomenon that this research is interested in is the implementation of the Further Education and Training National Curriculum Statement (FET NCS). The teacher is the **being** and the context (situation) is the school. Merleau-Ponty's search was to understand people as *beings* in a situation in which they exist. My aim as researcher is to understand how the teacher experiences the FET NCS for Physical Science. To capture the lived experiences of teachers is to allow them to tell their own stories of what they encounter in the science classroom **on their own terms on a daily basis**. Fidelity to the phenomenon as it is lived means apprehending and understanding the experience in the lived context of the person living in the situation (Wilson, 2002).

Wilson's interpretation of lived experience is developed by Gunter (1974), who affirms that phenomenology provides an entry point into the subjective experiences of teachers investigating the nature of **why teachers do what they do** in the context of the person living through it. In this study existential phenomenology as posited by Merleau-Ponty

(1964) refers to the teacher's consciousness of his/her reality. It is what the teacher is conscious of that drives his/her mental state, of what to do, when to do it, how to do it, and what works in a given context. In other words, what does he/she aim to achieve in the classroom? Put differently, what are his/her intentions when he/she teaches a topic in Physical Science? Gunter (1974: 7) proposes that: *real knowledge of a phenomenon can only be discovered within the relationship of intention*. For example, is the teacher's teaching a process of rule-following manipulation (such as the FET NCS) or a representation of how he interprets the FET NCS in his own world? One can delve a bit deeper by asking whether he/she is teaching to prepare learners for the examination, or is the focus of their teaching on understanding the processes of science. The processes of science expose learners to the abstract world of science, where the objective is not the product of science, namely, the facts, but rather the processes of science.

2.5.5 *Framework of interpretation*

Before I expound on my analytical framework, I think it is important to unpack the research question for the sake of clarification and understanding of exactly what this study aims to achieve. The research question is: **What are the lived experiences of Physical Science teachers when they implement the FET NCS?** The phenomenon is the implementation of the FET NCS for the subject (Physical Science). This question is concerned with describing or reporting the teachers' lived experience in the Physical Science classroom. By researching the lived experience I am trying to understand the phenomenon (NCS) through the lives of teachers. My focus is on what they are conscious of when they teach in a context where the NCS is being implemented? I chose to focus on the NCS as it is the only prescribed document that guides teachers in their teaching of Physical Science in South Africa. The NCS determines **what, how and when to teach** for each grade. This document forms the epicentre of the teachers' work. It is here where the key concern of this study lies.

In the last decade the teaching landscape in South Africa underwent considerable change. First, teachers had to deal with the shift from a behaviourist philosophy (under apartheid) to an outcomes-based approach (in the new democracy). Researchers

throughout the country have provided a plethora of empirical evidence pointing to the fact that most teachers were unprepared for the curriculum changes that took place in post-apartheid South Africa (see Stoffels, 2006; Jansen, 1999). My intention from the onset was to investigate how teachers experience (feelings, beliefs, values) these changes to the curriculum (NCS). By collecting data (open-ended semi-structured interviews) I will be looking for the teachers' pre-reflexive experience. This experience is the origin of the whole reflexive process of knowledge in their world. My secondary aim is not just to describe their experiences, but also what the teachers are conscious of (feelings and thoughts) about the reality of their teaching world and how they respond to the call for curriculum change. A related aim is to understand their perception of reality and how it impacts on the lives of their learners.

To summarise, the objective of the research question is to understand what teaching the NCS is like for them, without having any presuppositions of their experiences. Firstly, I will use Husserlian phenomenology to provide a descriptive narrative for each teacher. Coupled with hermeneutical phenomenology using the work of Heidegger (1962), Merleau-Ponty (1964), Ricoeur (2009), and Sadala & Adorno (2003) I will use an ideographic portrait to write an interpretive narrative of each research participant.

2.5.6 *The theory of interpretation*

The aim of the study is to uncover meanings within the lived experiences as described by the research participants. By so doing, I might provide an understanding of the realities Physical Science teachers face on a daily basis regarding the implementation of the NCS. Hermeneutical phenomenology differs from Husserlian phenomenology by focusing more on the ontological rather than the epistemological disposition, where understanding is conceived as a mode of *being* (Taylor, 2000: 653). According to Ricoeur (cited in Taylor, 2000: 653), hermeneutical phenomenology is how:

man (sic) learns about himself only through his acts, through exteriorization of his life and through the effects it produces on others. He comes to know himself only by detour of understanding, which is, as always, an interpretation.

To stay within the boundaries of the hermeneutical phenomenological paradigm of interpretation requires regular interpretation, which focuses throughout on: thoughts about the research objective, any decisions that were made (especially of a methodological nature) as well as the researcher's understanding and its development through the research process. Therefore field notes will provide depth and detail to each interview conducted rather than being set aside as part of the interpretive process. This is referred to as the hermeneutical circle (Tan *et al.*, 2009: 5). Before I delve into the complexities of the data explicitation process, I will first provide a succinct explanation of the theory of hermeneutical phenomenological interpretation. According to Tan, *et al.* (2009), hermeneutical phenomenology is the process whereby human experiences (in this study, the teachers' experiences) are interpreted and described to gain an understanding of the nature of their lived experiences. Hermeneutical phenomenology is both a theory and a method. As Tan, *et al.* (2009: 2) writes:

Hermeneutics is the art and science of interpretation, especially as it applies to text. Phenomenology is the study of the essence of a phenomenon as it presents itself in lived experience in the world.

Fundamental to interpretive theory is an understanding of the text (Geanellos, 1999: 112). In this study **text** refers to the transcripts of the participants. Ricoeur cited in Tan, *et al.* (2009) pointed out that interpretation is the hinge between language and lived experience. In order to align the philosophical underpinning and research method I chose both Husserlian and Heideggerian phenomenology to explicate the open-ended, face-to-face, interviews. Laverly (2003: 9) argued that for Heidegger interpretation is critical to the process of understanding human behaviour. Tan, *et al.* (2009: 7) echo Ricoeur's interpretive epistemology that *text is discourse fixed in writing*. Ricoeur's theory takes into account language, reflection, understanding and the self (Geanellos, 1999: 113). According to Geanellos (1999: 113), Ricoeur asks the question *through what means is textual understanding possible?* In this endeavour Ricoeur grafts the traditional function of hermeneutics, that of textual interpretation, onto its contemporary ontological insights. According to Ricoeur (cited in Taylor, 2000), interpretation is found inside the phenomenological circle formed by the juxtaposition of interpretation and interpreter. The latter aspect of Ricoeur's theory nullifies the objective split,

thereby making it possible for researchers to explicate inter-subjective knowledge. Seeing that text is obtained by transcribing the lived experience captured through interviews Ricoeur cautions the researcher not to subjectify text (Tan, *et al.* 2009). Ricoeur's objective here was the objectification of the text, because Ricoeur (as cited by Geanellos, 1999: 113) argued:

methodologically, objectification of the text allows researchers to move beyond the notion that only one understanding is meaningful or correct, that of the research participant.

The only way to achieve objectification through text is what Ricoeur calls *distanciation* (Tan *et al.*, 2009:7), which is what I will attempt to explain next.

2.5.7 *Text and distanciation*

Text is discourse fixed in writing that displays the specific historicity of an individual's lived experience. The essence of Ricoeur's theory as explained by Tan, *et al.* (2009) is to delve into the complexity of the text with the aim of deriving meaning from it. However, the meaning must only reflect the research participant's notion of reality removed from any preconceptions or prejudgments by the researcher. One way of reflecting the research participant's notion of reality free of any preconceptions of the researcher, is to attempt what Ricoeur calls *distanciation* (Geanellos, 1999; Tan, *et al.* 2009).

Distanciation (separating space between things) has its origin in Gadamer's philosophical principles of: (i) historically effected consciousness, namely that understanding is situated in history and influenced by history, and (ii) fusion and horizons – understanding that emanates from the juxtaposition of text and the interpreter's ideas. According to Geanellos (1999: 113), there appears to be a thin line between understanding and misunderstanding of text as interpretation is always linked to a person's historical consciousness. According to Ricoeur (as cited in Geanellos, 1999: 113), it is a person's historical consciousness that needs to be deduced in interpreting text. Therefore the interpreter (researcher) needs to stand separate or

distance him/herself from the text (Geallenos, 1999; Taylor, 2000; Tan, *et al.*, 2009). As Geallenos (1999: 113) writes, *methodologically, distanciation objectifies the text and need not to be confused with objective knowledge.*

Ricoeur organised his discussion of distanciation around four vital aspects: (i) text as a relation of speech; (ii) text as structured work; (iii) text as the projection of a world; and (iv) text as the mediation of self-understanding. I will explain each of the individual modalities between text and distanciation separately.

a) Text as a relation to speech

Text as structured work is where the dialogue (interview) between the researcher and the participant is transcribed to text. The transcription of speech to text results in meaning that becomes more important than the actual words. *Live text*, as Tan, *et al.*, (2009: 7) refers to it does not and cannot recreate the interview scene, because the non-verbal cues and psychosocial dimensions cannot be included in the text. Distancing the text from speech causes a deviation in the relationship between language and the subjective concerns of both the writer and the reader (Geanellos, 1999; Tan, *et al.*, 2009). The question now is how does this relate to the practical task of interpreting my data? What remains here is only the language of the interview. Hence it is not possible to recreate the event of the interview in fixed text; however, the nuances, voice projection and non-verbal cues are captured by the researcher through the use of field notes to add awareness, meaning and feeling to the interpretation. However, the researcher is totally dependent on the text, even though distant, to capture the participants' lived experience when explicating the data.

b) Text as structured work

According to Tan, *et al.*, (1999: 8) Ricoeur here highlights three characteristics of the construct, text as work: (i) a work is a sequence longer than a sentence; (ii) a work is submitted to a form of codification that is applied to its structure or it can be adduced to literary genre; and (iii) the uniqueness of a work relates it to the individual. In *text as*

work the written word makes the text or the sequence of words open to an unending or unlimited reading of interpretations. This is where the unfounded information (or third party account) becomes inevitable and the discourse becomes unrestricted.

c) Text as the projection of the world

The third modality of **distanciation** is text as the projection of the world. It is also referred to as *the world of text* according to Tan, *et al.* (2009: 8). Reflected in live discourse is the presence of context or reality that is common to the speaker and his/her audience. Here the text is no longer bound to context, but it is detached from the world (context) in which it was produced (Geallenos, 1999: 113). Furthermore, the text is read within different socio-political, historical and cultural traditions. This links up closely with Heidegger's theory of ontology, which construes understanding as a structure of being-in-the-world (Taylor, 2000). Here the interpreter's inner world meets *a unique world of each text to create a new picture or understanding of a possible world in the consciousness of the interpreter* (Tan, *et al.*, 2009: 8). In the interviews that the researcher conducted the interviewee and the researcher share some common attributes, in that both come from a teaching environment. Even though participant and researcher may share the same sentiments, they have different experiences, because what the participant expresses is related to his/her own uniqueness of experience and pre-understanding. This opens up a new world of understanding of meaning emanating from the interpreter's experience as opposed to the participants experience.

d) Text as the distanciation of self-understanding

The emphasis here is on the separation of text from the subject (author or interviewee). This refers to the context of the text and how it is seen or understood by the interviewer (researcher) (Geallenos, 1999: 113). In essence the focus here is on the mediation of the text as represented by the interviewer. Thus these four forms of distanciation allow the interpreter to approach the text without concern for authorial intent, allowing the text to become appropriated. I will now turn my attention to appropriation of the text.

2.5.8 *Appropriation*

Appropriation as a philosophical construct has its roots in Gadamer's concept of tradition (Geanellos, 1999). Tradition, according to Gadamer (as cited by Geanellos, 1999), refers to a world of shared history, language, culture, beliefs and values which he considers to be ahistorical. Through contributing to and sharing in tradition people tend to feel valued and find their level of acceptance and belonging. Tradition is something in which we are socialised or sociologically engineered through engaged living. Appropriation of textual meaning is acquired in a similar way (Geanellos, 1999: 114). It is making something your own; hence the interpretation becomes your story, your view or your text. Tan *et al.* (2009: 8) write as follows about appropriation:

the interpretation of text culminates in the self-interpretation of a subject (the interpreter) who thenceforth understands himself differently, or simply begins to understand himself ... A process of understanding which includes appropriation is an event, set in a particular time frame.

By so doing, we open ourselves to a whole new world of understanding others better. Geanellos (1999: 114) argues that methodologically interpretation allows actualisation of the meanings of a text to occur through interpretation and, as a result, claiming something that once was alien to oneself. Accordingly, appropriation and distanciation provide dialectic of interpretation between the known and the alien.

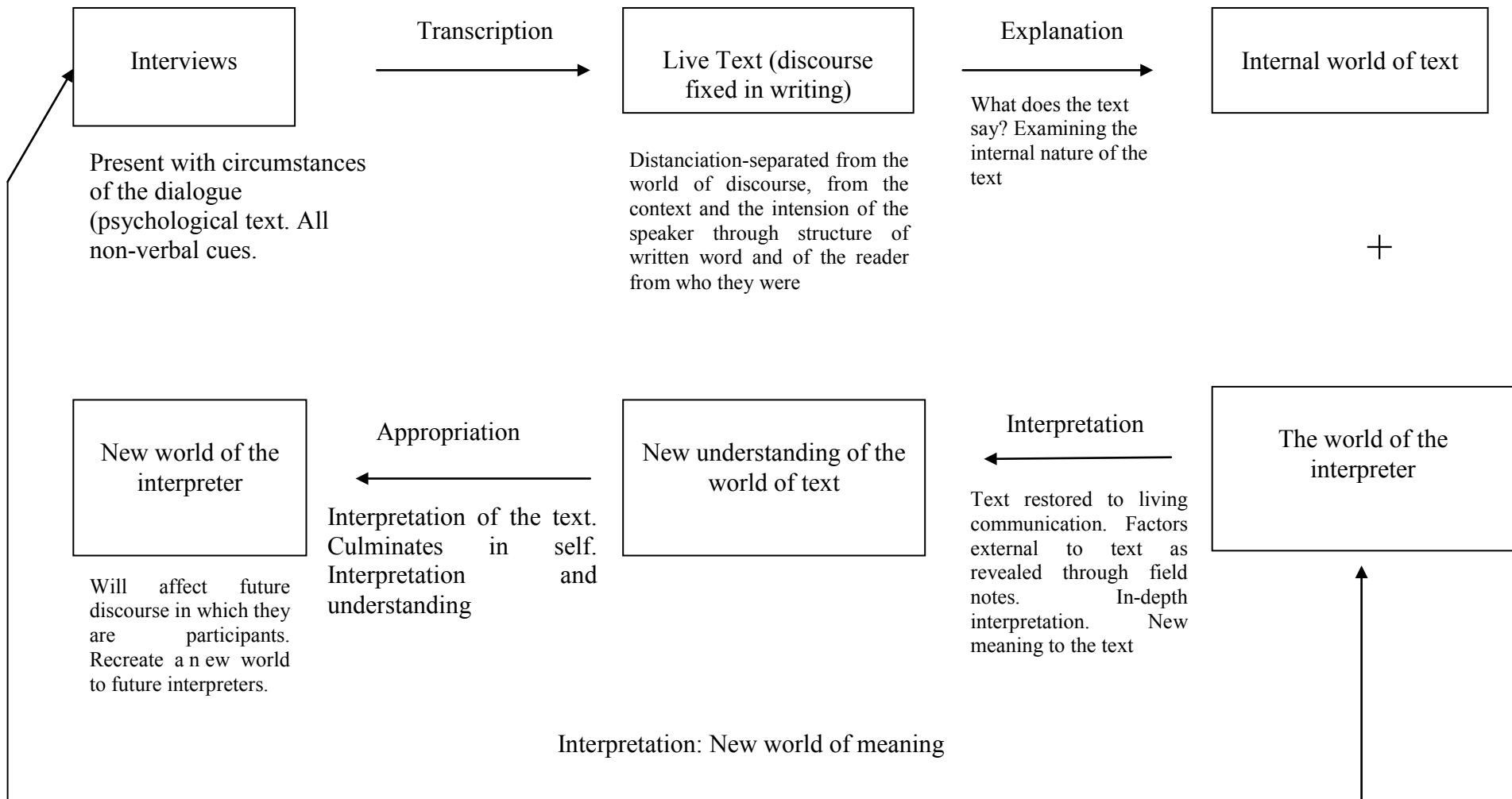


Figure 2.2: A diagram of Ricoeur's theory of interpretation

2.6 Understanding and interpretation

So far I have looked at the importance of objectification through distanciation and appropriation when researchers interpret the data obtained through the use of interviews. After the transcription process, the discourse between interviewer and interviewee is converted to live text. Text consists of words, phrases and sequences. This is where the researcher works within the boundary of language to make sense of the world in which the research participants live (Derrida, 1967). Derrida uses the concept ontico-ontology, when he refers to the transcendental space between reality and truth.

According to Geanellos (1999: 114), the foundation of language as discourse cannot be separated from expressed and unexpressed text. The expressed text refers to the live text (fixed discourse) and the unexpressed text to the non-verbal cues and psychological nature of the person. Tan *et al.* (2009) refer to the continual back and forth movement between the texts as *the hermeneutical arc*. Tan *et al.* (2009: 9) cite Heidegger and highlight the importance of the hermeneutical circle when they write:

Ultimately the correlation between explanation and understanding [which incorporates the process of appropriation], between understanding and explanation, is the hermeneutical circle.

Explanation refers to what the text says, while understanding refers to what the text talks about (Geanellos, 1999: 114). According to Tan *et al.* (2009: 9) a researcher can look at text from two angles: (i) the internal nature of text, and (ii) the internal and external nature of text. The internal nature of the text focuses on the meaning of words as the reader understands the text, which is not in congruence with what the interviewer and interviewee intended the text to mean. Here the text has no external world, no context and no consideration of who the author is. This creates a very naive meaning to the interpreter of the text (Geanellos, 1999). This refers to the explanation part of the text.

The second way of looking at text occurs by combining the world of text with the world of the reader (internal and external world). This is where interpretation adds understanding to the

world of the interpreter. Here the interpreter takes into account factors such as the author's background, or the field notes obtained in working with the author to create a context. This creates a deeper or more mature level of understanding.

Much (2006: 51) identifies three levels of text analysis in what he calls the critical linguistic semiotic model (CLSM). The three levels of text analysis according to the CLSM consist of surface analysis, narrative and the in-depth level. The surface analysis of text (or level 1 analysis) creates what Geanellos (1999: 114) calls a naïve understanding. At this stage words are used to create meaning and at this stage no attempt will be made to interpret the text. This is where the importance of the transcribed data and field notes becomes apparent. It involves the coding of words or phrases into units of meaning (UOM). The units of meaning are where the individual's statements are scrutinised for the parts that are related to the research question (Sadala and Adorno, 2003: 5). At this stage of the analysis all parts in the transcript that are unrelated to the research question was removed from the text. Here the researcher reports the text as presented in the transcripts to develop a descriptive portrait of the participants words without any preconceived ideas of what he might think the participants intended to say.

The naïve understanding sets the stage for the narrative. This is where the researcher moves constantly back and forth between individual words and the whole of the text in search of deeper understanding (Geanellos, 1999; Sadala and Adorno, 2003; Tan *et al.*, 2009). Here the UOM is coded to form the key ideas. The closely connected ideas, developed from the key ideas, are grouped and the researcher seeks for patterns and trends to create his/her main themes. This is where the construction of personal experience is addressed. In this section the researcher focuses on the main ideas and creates a number of subthemes. This level of analysis is almost identical with thematic analysis (Luborsky, 1994). However this particular level of analysis is based to a large extent on the internal nature of the text. Here consideration is given to the reader's understanding of the meaning of particular words as well as to his/her experience or involvement with the participants in the study. Level 2 analyses set the scene and the foundation for a level 3 analysis.

The level 3 analysis refers to the in-depth understanding of the text. This analysis section depends almost entirely on the knowledge areas (Tan, *et al*, 2009). The knowledge areas refer to the beliefs, perceptions, feelings and experience the researcher might have about the participants. This, is where the preconceived ideas and understanding of the researcher about the participants is mixed with the text. At this stage the researcher experience with the participants (seeing the world through his/her eyes) in order to put more meat to the bone in the level 2 understanding. This is where the contradictions and ambiguities in the participants' statements are handled. Moreover it is this is where the confluence of all the participants' views under different perspectives shows convergence (Sadala and Adorno, 2003). The in-depth analysis reveals the hidden/concealed meaning embedded in the consciousness of the participants. It is the extraction of these ideas that will form the interpretive narrative taking into account both the ontological and epistemological dispositions of the participant's responses

2.7 Summary of the chapter

In this chapter I presented a biography of my life as a learner, student and teacher of Physical Science. Furthermore I explained how my experiences with the subject shaped and influenced my perception of the subject. My emphasis here was more on the sociological and political influences and its impact on my learning of the subject. It is important for me to look at the socialisation aspect to delve into the reasons for doing this study/research in favour of others. My personal experience with Physical Science was instrumental in my decision to investigate the lived experiences of other Physical Science teachers and how they experience the implementation of the NCS.

The NCS is the only school curriculum document with legal standing in South Africa. I discussed the NCS in detail, focusing on aspects such as the LOs, ASs, COs, DOs as well as the philosophy that underpins the document. To put the NCS into perspective, I provided a historical overview of the development of Physical Science as a school subject to draw attention to the fact that the NCS has both a historical and political dimension attached to it. The NCS is a very important element in this study, as I will compare the views and beliefs of my research participants about their teaching experiences of the subject with that of the prescribed policies

stipulated in the NCS. This will become critical in Chapter 5, which deals with the data explication process. I ended the chapter by providing the epistemology of phenomenological research using the work of Husserl, Heidegger and Merleau-Ponty as the lenses through which the experiences of teachers are investigated. Phenomenology has both a theoretical and methodological underpinning and, even though I have already touched on some methodological issues with regards to phenomenology, I will focus on these methodological aspects in more detail in the next chapter.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

In Chapter 2 I discussed the theory of phenomenology and touched on some of the issues relating to the methodology. In this chapter I will focus only on the methodology of phenomenology and sketch all the orientations relating to the data-construction processes related to the research question. Special attention is drawn to aspects such as the research framework, the research design, instrumentation and ethical considerations, which will provide credible and transferable results to answer the research question effectively. I will explain and describe my interpretation through engagement with the literature on the epistemology of the methodologies employed.

In any study the researcher's conceptual framework influences his/her selection of a suitable method. According to Smyth (2006: 2) the choice of method, whether qualitative or quantitative, must be congruent with the philosophical and theoretical groundwork of the study. Qualitative research, according to Grundy (1987), aims to understand the richness and depth of subjective human experiences. Similarly phenomenology aims not only to understand human experiences, but to reveal the truth about human experiences and to bring meaning to these experiences. The strength of this method is embedded in the ability of the researcher to reveal the breadth and depth of human experiences from the research participants' perspective. This interrelationship between the researcher and the research subject forms the basis of the research world, and the foundation of an interpretive inquiry (Smyth, 2006: 3). In an interpretive paradigm the description of the findings that emanate from the data must reflect the perspectives of both the researcher as well as the subjects, and does not rely only on the researchers' articulated view. If the researchers' articulated view reflects the ideals and judgements of the subjects being researched, the research becomes trustworthy.

This study sought to investigate the **lived experiences** of FET Physical Science teachers as they engage with the implementation of the NCS. In short the study aims to determine the teachers'

challenges, emotions, beliefs, perceptions and convictions about the NCS. In order to capture lived experiences, phenomenology as a methodology is most appropriate to access and describe the lived world of teachers as revealed through interviews. In the next section I will explain how I found my methodological way and why phenomenology is the most appropriate choice as a research methodology for my study.

3.2 Challenges in finding my methodological way

This journey is guided by a single research question. This research question investigates the lived experiences of Physical Science teachers in three different high schools in the Northern District of Cape Town in the Western Cape. What spurred this research question was a curiosity about what it is that teachers are conscious of when they engage with a subject such as Physical Science. This interest not only led me to investigate the consciousness of Physical Science teachers, but also helped me to understand my own practice as an ex-Physical Science teacher. To put **consciousness** into perspective, I want to know the truth about what teachers think and what they do when they are doing it. Put differently, what goes on in the mind of Physical Science teachers when they teach? This question is very important, because it might give meaning to why teachers do what they do and behave the way they do in the Physical Science classroom. The answer (truth) to this question could deepen learning and understanding of Physical Science teachers performing their work in historically disadvantaged schools in South Africa. Furthermore, in such inquiries one becomes present to another human being and one understands how Physical Science teachers function, through their behaviour and action, in their teaching world.

Researching lived experiences as a novice researcher is not an easy journey, because the emphasis is on the relationship between **being and the being**. Being in philosophy means **what it is to be** (Groenewald, 2004). The question of *being* itself is almost always divided between who and what. In this study **the who** refers to the teacher and **the what** refers to the NCS. As I searched the literature for a trustworthy and credible method to gain access to the mind of the teachers through their lived world, I discovered the theory of phenomenology. Phenomenology

is both a theory and a methodology but, more importantly, the science of human experiences. Phenomenologists are workers of experience.

Phenomenology can be a **landmine** or a **fieldmine** to many researchers, especially novice researchers. Apart from the great volumes of research literature on phenomenology, there are also various types of disciplines each underpinned by a different methodology. Theoretically the discipline of phenomenology includes, amongst other things, existential, empirical, hermeneutical, psychological and transcendental dimensions. Furthermore, each discipline has a specific methodological perspective. The perspective is the assumptions, the values and paradigms that give impetus to the method employed. As Tan *et al.* (2009: 2) propound, *unless there is clarity and accountability of method, it is difficult to assign the degree of rigor.*

Devenish (2002: 3) notes that *it is possible ... to articulate a methodology without genuinely knowing how to carry it out.* I searched the literature for a research design on phenomenology with a step-by-step explication of how it can be implemented. As I read the work of Husserl, Heidegger, Merleau-Ponty, Ricoeur and others, I found their methodology sections often poorly described in the execution of their studies. For example, Husserl's method consisted of two aspects: (i) **epoché**, which is the notion that the researcher must bracket out his/her natural standpoint; the natural standpoint is the belief in our heads that all our experiences are intentional acts caused by natural things in the human body; and (ii) **essences**, which refer to the essentialities of the phenomenon. Husserl's famous slogan of *returning to the things themselves* encapsulates both these aspects which is a passageway to delve into the **ideitic resduums** (subconsciously held ideas) to uncover the intentional acts of each participant (Spanos, 1976; Groenewald, 2004; Tan, *et al.*, 2009). Spanos (1976: 457) writes:

Inquiry, as a kind of seeking, must be guided beforehand by what it sought.
So the meaning of being must already be available to us in some way.

Spanos's (1976) research is not clear about a specific method as to how Heidegger constructed/generated his data. Similarly, almost every article on phenomenology, with respect to the methodology, emphasises the importance of the researchers' role to bracketing themselves out when they work in the field to construct phenomenological data. This latter concept I found

very difficult to understand, as I am used to working within the boundaries of qualitative or quantitative research. For most part qualitative and quantitative researchers look past bracketing of the self and fail to recognise the uniqueness of each individual. Their findings are based on their views and perceptions of the researched.

It was only after I read a paper by Groenewald (2004) entitled “A phenomenological research design demonstrated” and a paper written by Devenish (2002) “An applied method for undertaking phenomenological explication of interview transcripts” that I could address the empty and hollow misunderstandings and misconceptions of how to construct my data. In addition, through constant reading of books and journal articles, the pieces of the phenomenological puzzle started to interlock and make sense. In the next section I begin to map my understanding by first distinguishing between the terms ‘methodology’ and ‘method’. Although the two terms are often used interchangeably, Van Manen (1990) points out that it is important to distinguish between them.

3.3 Research method and research methodology

According to Van Manen (1990), the term *methodology* refers to the philosophical framework which underpins the fundamental assumptions and characteristics of human science. It describes the theory behind the method, which refers to the mode of inquiry. According to Gay (1981), a research method describes the specific procedures of a particular research study. In addition, he argues that each method has a unique purpose and its application entails a unique set of procedures and concerns. According to Dilthey (cited in Van Manen, 1990:43):

human science studies ‘persons’ or beings that have ‘consciousness’ and ‘act purposefully’ in and on the world by creating objects of ‘meaning’ that are ‘expressions’ of how human beings exist in the world.

Van Manen (1990) argues that the key to quality research depends on the methodology employed. Researching human beings involves description, interpretation and a self-reflective or critical analysis. This study is concerned with **subjective lived experiences**. According to

Husserl (1970), phenomenology is the science of experience as **given**. 'Given' means it is not subject to interpretation or construction', but is knowledge that emanates from an objective standpoint. Even though Husserlian phenomenology focuses on describing the lived experiences of people, in this study I will not only provide a descriptive narrative of each individual, but also an interpretive narrative. I will move beyond Husserlian phenomenology and employ Heideggerian phenomenology, using hermeneutics, as a passageway to unveil concealed meanings embedded in the research participants' transcribed texts. In so doing, I will provide an interpretive narrative of each teacher, while remaining within the phenomenological circle. My aim in choosing phenomenology as the methodology is my search for subjective **truth of the participants' daily realities** and not merely facts, as is the case with quantitative research.

The aim of phenomenology is not to taxonomise natural phenomena and probabilistically explain behaviour as found in a quantitative design, but to explain and understand lived experiences. A phenomenologist is a non-empirical scientist. The phenomenologist performs a human science study similar to a geometer – someone who contemplates what a triangle is and figures out the essential features that are hidden. In this way a phenomenologist searches for the hidden/concealed meaning and intensions that exist in the mind of the person (Spanos, 1976: 457). In other words, the phenomenologist goes deeper than the positivist who simply searches for facts. The phenomenologist searches for *a truth* about objects or **beings**. In the next section I shift my attention to clarify the difference between quantitative and phenomenological research.

3.3.1 Phenomenology-quantitative research debate

As a mathematician, Husserl, the founder of phenomenology in the 20th century, was a positivist. His interest in philosophy grew from his pursuit to understand the foundation of arithmetic. He was concerned with what made arithmetic true or provable. Husserl argued that arithmetic was not empirically true, because it cannot be proven, and he was searching for a method that went beyond mathematics. This argument was one of the aspects that gave rise to phenomenology. Husserl's main argument was that the positivist looks at facts and mathematics could not be based on facts. For example, 12th century scholars believed that the earth was flat. Their perception was based on empirical evidence available then. Hence one cannot say that they were

wrong, but one can only argue with absolute certainty that the knowledge back then was true for them because reality was unknown (Selly, 1996: 838). Because of the unknown nature of reality, one cannot say that one is right. In other words, positivist knowledge changes all the time as the context changes over time. Furthermore, one can also point out that 12th-century knowledge is not true for us (modern humans) anymore, because new empirical evidence changed our perspective on knowledge.

In Husserl's view phenomenological results are more trustworthy than positivistic facts. Also, the information can be described as more credible and transferable than positivistic notions of knowledge, because it is how we perceive the world that represents each individual's reality. A fundamental assumption of phenomenology is that there are a number of different representations of reality and as a result truth becomes floatable or precarious. Truth is expressed reliably in the mind of individuals and it is the truth about what goes on inside the mind of people in which phenomenology is interested. Kant argues that the mind structures the way reality can appear to us. He points out that reality has to conform to the mind rather than the mind trying to conform to reality (*Stanford Encyclopaedia of Philosophy*, 2010). Next I want to focus on phenomenology as a research methodology.

3.3.2 *Phenomenology as a research methodology*

As discussed in previous sections, methodology is broader than method and it provides the philosophical basis for a method. According to Wilson (2002), the methodological position describes the researcher's view of the nature of reality, which to the phenomenologist is one of inter-subjectively constructed meaning. The methods employed in phenomenology include, amongst others, conceptual analysis, linguistic analysis, hermeneutical method and praxis, and formal logic (Wilson, 2002).

Phenomenology is a broad concept. Researchers can choose from a variety of approaches, because there are many different phenomenological philosophies, each with its own philosophical underpinning (Finlay, 2009: 4). Therefore, there are different forms of data collection/construction. The choice of form depends on the types of phenomena that are under

investigation and the type of knowledge the researcher seeks to obtain. Rather than being fixed in stone, Finlay (2009: 4) argues, the different phenomenological approaches are dynamic and undergo constant development. Its flexibility and adaptability are among the advantages of using phenomenology as a method of inquiry. All the variants of phenomenology have the same focus on describing lived experiences of inter-subjective life worlds. To a lesser extent, phenomenology investigates consciousness and the intentional relationships between persons and situations.

As the aim of this research is on the lived experiences of three teachers teaching in different high schools, narrative accounts derived from interviews will be adopted as an appropriate method (explained in Chapter 4, subsection 4.3.1). Through interviews one might discover that some teachers, in different schools, experience the same challenges with the NCS, but cope with them differently. In other instances one might find that the structure of the teachers' lives is determined by the problems they experience in the schools with the curriculum or other issues, hence their lives are experienced through these problems. In other words, these challenges have to do with the concept of organisational structure, coping mechanisms or strategies, from which a problem life or a normal life may emerge out of the analysis (Wilson, 2002).

3.4 Sampling

In this section I distinguish between sampling and the different sampling methods. As this study aims to investigate the inter-subjective experiences of teachers in a particular setting, purposive (also termed deliberate) sampling was used. Cook and Campbell (1979) pointed out that purposive sampling is a useful way of collecting data if it is carefully constructed. They argue that the use of purposive sampling as a sampling method depends on the nature of the research question under investigation. This study aims to investigate Physical Science teachers' subjective lived experiences in selected high schools in the FET band, thus purposive sampling was an appropriate way to collect data. According to Datallo (2010), purposive sampling can be used to achieve the following goals:

- To study a subset of the population (e.g. teachers);
- To collect primary data; that is deliberate sampling for a pilot study that can be used to guide a larger study;
- To collect secondary data, which entails selecting a sample from an existing set of data; and
- To select a small subsample and closely examine typical and unusual or extreme elements.

A total of three Physical Science teachers were purposively selected to participate in the study. In selecting the participant teachers I considered an array of factors, including age, race/ethnicity, gender, region, and teaching experience (for full details of sample see Chapter 4, subsection 4.3). My previous experience as a Physical Science teacher in disadvantaged schools guided me to sample Physical Science teachers who teach in similar environments. Two of the participants selected in this study have a wealth of experience in working with the NCS and the NATED 550 curriculum. The other participant received his schooling under the NATED 550 curriculum, but only worked with the NCS. The majority of teachers in South Africa were schooled and trained under the NATED 550 Curriculum and were expected to change to an outcomes-based approach in post-apartheid (post-1994) South Africa. Therefore, it will be interesting to know how many teachers have undergone a paradigm shift from NATED 550 to OBE, which is one of the principles on which the NCS is built. Also all of the participants should be able to talk about the impact of the NCS on their teaching by addressing issues such as: (i) what it meant for them, and (ii) how they experienced the NCS within their own lives.

All participant teachers teach in schools where learners come from diverse backgrounds. Two participants teach in the Northern District and one teaches in the Eastern District of Cape Town in the Western Cape. The Northern District is rated one of the most successful districts in the Western Cape based on teacher commitment and learner performance in the province. For example, in the last five years the Northern District produced outstanding Grade 12 results in the Western Cape. Most schools situated in the Eastern District, on the other hand, struggle to be as consistent with the Grade 12 results as in the Northern District. These schools might provide

rich data in its fullest breadth and depth about the daily realities these teachers are faced with when it comes to curriculum implementation.

One of the key criteria in using phenomenology according to Taylor, 2001: 653) is that participants must communicate freely and comfortably, so that the data can speak for themselves and will not be constrained by a deductive methodology. Geanellos (1999: 113) notes that, in so doing, teachers tell their own story and share their unique lived experiences. In the next section I will deal with the issue of instrumentation in greater depth.

3.5 Instrumentation

Most of the time qualitative researchers, especially in education, collect data that are often linguistic in nature. In qualitative research this is important for the following reasons: (i) linguistic data directs us to understand ourselves through reflection of the self from particular positions at specific times, and (ii) it frees us from trying to write a single text in which everything is said to everyone.

I searched for different ways in which the data could be constructed in order to remain true to the phenomenological paradigm. The literature on phenomenology points out that interviews and field notes are considered to be the best ways of collecting data. Interviews allow teachers to divulge their lived experiences and give them an opportunity to reflect on their practices as teachers by allowing them to tell their own stories about their experiences (Geanellos, 1999; Taylor, 2001; Sadala and Adorno, 2003; Groenewald, 2004; Geanellos, 1999; Tan, *et al.*, 2009). In the next section I will devote attention to these two methods and in Chapter 4 (subsections 4.3.1 and 4.4) how I applied these instruments in the field.

3.6 Interviews

According to Nijhof (1997), researchers use interviews as a looking glass through which they enter the world of the research participants with the aim of capturing their lived experience. Knapik (2006: 2) argues that researchers not only enter the lived world of research participants, but they also learn about and gain insight into people's lived experiences. Interviews can take place one-on-one or in groups depending on the aim and the underpinning philosophy of the research design. Today different types of research interviews are conducted in qualitative research, including focus group, unstructured, or semi-structured interviews. Each interview type has its own objective and its unique underpinning philosophy. Price (2003: 1) summarises how the research philosophy directs and guides a particular choice of interview. Table 2.0 presents the research philosophy of open-ended interviews and how each interview type is influenced by its specific philosophical considerations.

Table 3.0: Research philosophy and open ended interviews

Philosophy	Influence
1. Ontology:	To what extent does the researcher believe that an objective reality exists beyond that constructed by individuals involved? Concerns about interviews are directed by premises about whether what is being collected corresponds with reality or in some sense a construction of reality.
2. Epistemology:	To what extent does a researcher believe that reality can be constructed through a data-gathering process such as interviewing? For example, are interview data representative of respondent's beliefs and values, or are they a construct of what the respondent believes the researcher should hear.
3. Inquiry:	What is the role of the researcher? To gather data dispassionately, or to engage with the respondent in constructing an account of the phenomena (ethic or epic inquiry)?
4. Deduction or induction:	Is the role of research to test or create theories? Inductive interviews that are open in style may be used to map the phenomenon, whilst deductive interviews partially structured may be used to assess the significance or volume of phenomena.
5. Data-gathering analysis:	Interviews may be guided by an incremental analysis of data from previous interviews or conducted with no prior review of past transcript data. Interview data may be seen as an outcome (result) or recourse.

(Source: Sadala and Adorno, 2002)

Table 2 represents the different underpinning philosophies that guide an interview. It not only explains how different interviews guides and direct researchers, but also on how the questions must be framed or structured. In Husserlian (1970) phenomenology the focus during the interview is on the epistemology that drives the individual's ideas. Heideggerian (1962) phenomenology, on the other hand, focuses on the ontological dimension, that is the individual's existence in the world and his representation of reality. The epistemological notions of individuals provide understanding and comprehension of human existence as it is lived on a daily basis. Here the focus is on the life world without resorting to any categorisation or conceptualisation and often includes questions that elicit responses and information that are often

taken for granted by other research paradigms. In such a framework the researcher shifts away from questions and responses of what he anticipated pre-reflexively, i.e. what he wanted the participant to say. Interviews with the focus on ontology, on the other hand, are interested in the concept *dasein* (Heidegger, 1962 cited in Lavery, 2003:7). *Dasein* is translated as the mode of being human or the situated meaning of a human in the world. In such a paradigm the focus is on context and how humans think about the world and **how they come to know**.

This study is interested in both the ontological and epistemological notions of the lived experiences of the individuals. Therefore it is underpinned by a phenomenological perspective; as Groenewald (2004: 4) and Tan *et al.* (2009: 3) point out, phenomenology captures lived experiences. Through interviews participants give the information researchers require to answer their research question. In phenomenology the focus is on the **consciousness of being**. Consciousness is directed at a participant's, experience, feelings, beliefs and convictions about the phenomena in question (Groenewald, 2003: 12).

Long, open-ended, unstructured interviews are among the most widespread data-generation methods used in phenomenology. This method provides the research participants with the opportunity to tell their own story about how they feel and what they think about specific phenomena. This type of interview is not only a dialogical process, but it also involves a process of power whereby the researcher can draw the respondents into his/her research agenda and focus. Price (2003: 1) cautions researchers about how intrusive questions should be introduced, as they are the key to conducting a successful interview. On the other side of the power line, the respondents also have the power to retract or hold back responses and information if they do not trust the interviewer (Measor, cited in Le Grange, 2001). Furthermore, interviews can become very problematic in a post-modern or poststructuralist society (McConnel-Henry *et al.*, 2011: 4) because of the nature of being or ontological assumptions. Therefore, researchers must deal epistemologically with the participant teachers' responses. Price (2003:1) writes:

Because grounded theory, phenomenology, ethnography and critical theory (all commonly adopted perspectives in nursing research) shape the focus of research, the ways in which the researcher operates, interviewing is profoundly influenced by research philosophy.

The research paradigm, therefore, is just as important as the contextual difficulties of conducting research in the field (Price, 2003).

3.7 Interview techniques

Artful interviewing takes place when the researcher knows and understands the ways in which people's thoughts, beliefs and actions correspond with each other. As such, the *laddered technique* is advocated by Price (2003: 3). This technique selects the most appropriate level of questioning or researcher response to respondent dialogue; it is based on the idea that both share a common goal or notion of what is most intrusive during discourse. Researchers cannot presuppose the impact a question might have on the respondent. For example, which question will generate interest or discomfort during an interview? Laddered questions operate on three levels, namely (i) inviting descriptions, aimed at setting the scene, and making the respondent feel that the researcher is interested in what he/she has to say or offer; (ii) knowledgeable or invasive questions are asked later in the interview, when the respondents have shown signs of relaxation or comfort. This involves questions such as: What do you think? How do you feel? By showing empathy, sensitivity and interest to the participant's responses, trust is established between the researcher and respondent. This technique sets the stage for the next level of questioning, namely, (iii) questions of personal philosophy. These are the most invasive questions. These questions focus on beliefs, values and deep-seated feelings. This is the core to the respondent's personal identity. Asking questions at this level is akin to asking questions about who are you and may leave the respondent feeling that the researcher is judging them. Furthermore, any movements, facial expressions or statements made by the interviewer can affect the responses obtained.

Finlay (2009: 2) cautions researchers when they adopt a relational phenomenological approach to any embodied dialogical encounter during interviews. He cites Merleau-Ponty (1964) and argues that there is a reciprocal insertion and intertwining of one in the other. Moreover, Finlay (2009: 2) argues that a relational approach may lead to ambiguity, uncertainty and unpredictability in the interview. To prevent this, I will follow Finlay's (2009) advice and not

become preoccupied with my participants' own experiences of the encounter. By preoccupied here I mean not being in any way judgemental, hence distancing myself from the participant teachers' recounts of their lives. As the goal of the study investigates the inter-subjective experiences of FET Physical Science teachers, I will pay attention to the teachers' embodied selfhood and his/her lived relations with others, for example, peers, learners and parents. I will also pay particular interest to the teacher being-in-the-world of the Physical Science classroom by placing myself inside the minds of the teachers as I will attempt to view the world through their own experiences without any form of bias. Careful attention will also be given to how they conduct themselves in the interview from which I will be capturing my field notes (for details on how the interviews were conducted see Chapter 4 subsection 4.3.1).

3.8 Field notes

Field notes (also called memoing, according to Myles and Huberman, 1984:69) as a method are an important source for phenomenologists to construct data. Field notes data are a secondary data-construction process. Field notes refer to sense data that the researcher records while in the field constructing his/her data. It refers to what the researcher hears, sees, experiences and thinks in the course of the data-construction process.

Emerson, Fretz and Shaw (1995:1) advocate that through the use of field notes the researcher turn direct experiences and observations into vivid descriptions. Seeing that my main and primary source of data construction was interviews, I had to be alert and keep an eye open mind for non-verbal cues (namely, the length of the pauses between responses, facial expressions, attitude and behaviour) displayed by all research participants during the interview process.

The best way for me to do this was to pay close attention to the actions and behaviour of the participants, as field notes reflect some form or knowledge of what goes on in the mind of the individual. These field notes were descriptive in nature, as I reflected on each interview immediately after it took place. At times I would make notes during the interviews to keep the field notes fresh. Lofland and Lofland (cited by Groenewald, 2004: 15) caution researchers that,

when they record field notes, the best time to write notes *is no later than the morning after*. In this particular study I only took **theoretical notes**, which (according to Groenewald, 2004: 15) are an attempt to derive meaning from the non-verbal cues that emanated from my interviewees. This refers to how I **felt** and **experienced** the interview process (as guided by the non-verbal cues) with the research participants (for more detail on how I formulated the field notes see Chapter 4 subsection 4.4).

Field notes have a twofold function, namely, (i) as a part of the data-construction process; and ii) as a part of the analysis section, because they involve the researcher's interpretation based on observations. This is where the phenomenologist needs to be cautioned in the way he/she reflects and presents the field notes. According to Husserl, it is important to bracket out the researcher's views and values from the way the data are constructed or interpreted. The voice of the participant in the data-construction process is central in a phenomenological framework. Phenomenology focuses on the consciousness of the mind or experiences as given by the research participant and hence the researcher must bracket out anything outside or inside himself to explain the essence of each participant's intentional objective. To remain true to the phenomenological paradigm I devoted careful attention to the way I structured my field notes.

3.9 Ethical considerations

This study engages with all aspects of research, namely research questions, the choice and design of the research methods, the analysis of the data, the presentation of the findings, and possible recommendations. Each aspect demands an ethical approach, whether institutional or in everyday space. Sultana (2007: 1) reminds researchers of the disjuncture between everyday behaviour in the field and the university's institutional framework that aims to guide good ethical practice. Cahill, Sultana and Pain (2007: 308) point out that the notion of ethics is multiple and contextual, and it is best understood in a specific place and space. As this study involved two institutions, that is, the University of Stellenbosch and public schools, I will now turn my attention to the ethical framework inherent in these aspects. I shall elaborate on the ethical considerations in Chapter 4.

3.10 Institutional ethics

Researchers must at all times be aware of, sensitive to, and comply with ethical issues when conducting research or when they find themselves in the field constructing data. This study involved two institutional legal bodies, that is, the University of Stellenbosch – under whose auspices the research is conducted – and the Western Cape Education Department – the employer of the research participants (namely, the teachers). Consequently, I requested permission from both institutional bodies. Institutional ethics boards include university boards, professional associations, policy makers, ethics committees, institutional review boards (IRBs) and other structures (Elwood, 2007: 329). Most researchers are therefore required to adhere to the ethical rules and protocols designed by these institutions. Each institution determines its own criteria for ethical practices (Elwood, 2007: 330). The institutional ethics of the University of Stellenbosch operate from the top down, through fixed codes and rules defining everything from what to say and/or do (and not to say and/or do) in recruiting participants, to when and how to conceal participants' identities and what activities can and cannot be undertaken. Only after permission was granted by the Research Directorate of the WCED to conduct the research in the respective schools was I able to submit a written application to the ethical committee of the University of Stellenbosch with all the relevant documentation. (See Chapter 4, subsection 4.2 explaining the whole protocol and the challenges I faced to gain access to the setting).

3.11 Establishing trustworthiness in phenomenology

This study is situated within a phenomenological paradigm which lies within the boundaries of qualitative research data-construction methods. It is perhaps wrongly described as emanating from the naturalistic tradition, as it has far more in common with the positivistic/post-positivistic paradigm, about which Rolfe (2006: 307) writes:

The phenomenologic researcher asks the question: what is the essence of this phenomenon as experienced by these people? The phenomenologist assumes there is an essence that can be understood, in much the same way as the ethnographer assumes that cultures exist. The phenomenologist investigates subjective phenomena in the belief that essential truths about reality are grounded in the people's lived experiences.

Guba and Lincoln (cited in Morse, Barrett, Mayan, Olsen and Spiers, 2002: 2) substituted reliability and validity with parallel concepts of trustworthiness containing four aspects: credibility, transferability, dependability and conformability. According to Rolfe (2006: 306), credibility corresponds with the positivist concept of internal validity; dependability relates more to reliability; transferability is some form of external validity; and confirmability is largely an issue of presentation. Datallo (2010) asserts that transferability refers to how well findings travel to other participants, times and places. Morse *et al.* (2002: 2) point out that within these methodological strategies for demonstrating qualitative rigor, audit trails, member checking, categorisation, or confirming results with participants, peer debriefing, negative case analysis, structural corroboration and referential material adequacy must be achieved. But what does each of these methodological strategies with regards to trustworthiness mean for this study?

I followed Rolfe's (2006) idea of member checking (individual teachers) to provide credibility to the constructed data. Member checking entails the researcher returning to each respondent to confirm his or her responses. In line with Rolfe (2006), after each recorded interview was transcribed I accessed two of the three participants to check their transcripts. I could not manage to have one of the participants to check his transcript as he complained about how busy and overloaded he was with administrative responsibilities at work. The two participants who read through their transcripts did not raise any major concerns about the content of the transcript.

Furthermore, in line with Rolfe (2006), another strategy I used in this study to ensure rigor and quality was to use peer checking as an alternative way of establishing credibility to ensure the data have been correctly analysed. Peer debriefing was undertaken throughout the study. My supervisor, two of my colleagues and a postgraduate student constantly interrogated the research process. The constant questioning of the data-construction process, findings and assertions provided valuable insight into claims I made about the study.

3.12 Summary

This chapter described and discussed most parts of the research perspective. It focused on (i) the research design; (ii) the theory of phenomenology as a qualitative methodology, (iii) sampling

and, more specifically, why purposive sampling was used; (iv) the different types of instruments (interviews and field notes) and why they were found to be suitable as methods for data collection; and (v) ethical considerations. The chapter argued that the methodology adopted will produce the most reliable data to capture and present the subjective lived experiences of FET Physical Science teachers. The value and importance of phenomenology as a qualitative methodology are also highlighted throughout the chapter. Phenomenology as a research methodology comes from the position that we can learn and know about another's experience within a subjective space. This opens a zone of ambiguity and uncertainty where unforeseen meanings are uncovered.

In the next chapter I will focus on (i) how I gained access to the respective schools, (ii) a detailed description of the subjects in the study; and (iii) detailed information regarding the interviews I conducted and the field notes I compiled.

CHAPTER FOUR

THE RESEARCH SETTING

4.1 Introduction

In Chapter 2 I provided a biographical account of my experiences as a Physical Science learner, a university student and a teacher. More specifically, I presented the impact of the historical, social, political, psychological and philosophical aspects on my experiences and how this influenced my perceptions of Physical Science. This account was followed by another salient point, the history of Physical Science as a school subject. This section provided a brief overview of the development of the subject and how the history of my country influenced the teaching of Physical Science. The subject Physical Science is central to this research; hence I found it necessary to describe how teachers perceived the subject. In other words, I investigate what teachers are conscious of, especially their perceptions, when they teach the subject. As Bentz and Shapiro (1998: 96) state, the radix of phenomenology is to understand phenomena in their own terms. Furthermore, I provided an analysis of the NCS by highlighting the philosophical underpinnings of the Physical Science curriculum as well as a discourse analysis of the content. Here I emphasised the nature of the subject matter knowledge and the goals of science teaching.

In Chapter 3 the focus was on the methodological perspectives and theories that underlie these perspectives. Phenomenology, which forms the crux of my study, can be regarded as both a theory and a method. I continued by justifying phenomenology as the most appropriate research methodology to answer the research question effectively. I concluded the chapter by addressing the issues relating to ethics and its role in research.

In this chapter (Chapter 4) I focus on the following aspects: first, how I negotiated access to the research setting for the data construction process; second, I provide a rich description of each participant teacher and the schools in which they teach; the third aspect focuses on the setting of the data-construction process. Here I concentrate on meeting the teachers, conducting the interview and developing a framework for transcription explication.

4.2 Negotiating access to the research setting

One of the key challenges facing most social science researchers (especially neophytes) is the data-collection/generation/construction process. Firstly, it is time consuming and, secondly, it is very difficult to gain access to the research settings because of the teachers' heavy workloads and the tight time frames in which they live and work. Therefore, the timing of the data construction process is critical, because it can delay any research project for weeks, months or sometimes as long as years. Scourfield (2011: 2) cautions researchers about access by pointing out that social science textbooks vary in how much time is devoted to or lost in trying to gain access to the research setting or in my case the schools. Similarly, Scatzman and Strauss (1973) argue that it is not the construction and analysis of the data processes that researchers must worry about, but the preliminary problems associated with gaining entry into the settings. Gaining access to the research setting is a preliminary step to the **data-construction or data-generation process** (Gough, 1999; Le Grange, 2001).

The persons through whom entry or consent into the research setting is gained are called gatekeepers (Bailey, 1996). A gatekeeper, according to Neuman (2000), is the person/institution that gives researchers formal or informal consent to access a research site. In order for me to continue with the data construction process I required written consent from the following gatekeepers, namely:

- i) Western Cape Directorate of Research;
- ii) Headmasters/principals;
- iii) Teachers and
- iv) University of Stellenbosch.

Each gatekeeper listed had to be dealt with ethically (as discussed in Chapter 3). To stay true to the ethical requirements, I used informed consent, because Burgess (cited in Le Grange, 2001: 94) notes that informed consent is at the core of ethics. Le Grange, (2001: 94) cites Reisner to explain the principle of consent:

The voluntary consent of the human subject is absolutely essential. This means that the person involved should have legal capacity to give consent; should be so situated as to exercise free power of choice, without the intervention of any element of force, fraud, deceit, duress, overreaching or any other ulterior form of constraint or coercion; and should have sufficient knowledge and comprehension of the elements of the subject matter involved as to enable him [sic] to make an understanding and enlightened decision.

Bailey (1996) argues that deception can be counter-productive. Hence whatever I did methodologically, the words of Reisner and Bailey echoed incessantly through my mind, keeping me ethically aware. My first step was to gain access to the schools. I drafted a letter to the Directorate of Research (Western Cape Education Department) requesting permission to use the respective schools for the data-construction process (for full details see Appendix A). In this letter I made reference to the names of the respective schools I targeted, as well as the length of my stay at the schools. This process took approximately four weeks before a positive outcome was communicated. The consent agreement communicated to me by the Research Directorate was based on the following conditions (for full details see Appendix B):

- i) Teachers were under no compulsion to assist or to take part in the research;
- ii) The study was to be conducted from 16 August to 15 September 2010; and
- iii) No research can be conducted in the fourth term as schools are preparing and finalising syllabi for examination.

Upon closer inspection of the Directorate's consent, I required additional consent from the principals of the respective schools as well as the selected participating teachers. Based on Bailey's (1996: 11) recommended items, I drafted a summary of the entire research project stating briefly: (i) the purpose of the research; (ii) the procedure to be followed; (iii) the participant's right to stop (or withdraw) from my research at any time; and (iv) my assurance that the school programme would not be interrupted. Other ethical challenges I addressed were the schools' and teachers' anonymity and confidentiality, and that constructive relationships with the teachers and learners would be assured. This three-page summary of the research project was delivered personally by hand to the principals of the respective schools. A copy was also handed to the teachers personally. Because of the heavy administrative burdens of principals, there was

no response received after one month. After numerous telephone calls, emails and visits to the schools, it took at least another month for school principals to draft the required letters of consent providing me access. It is through Buchanan, Boddy, and McCalman (1988) that I learned that one needs to allow enough time to negotiate access to any research setting. Furthermore, they advise that one needs to use friends and relatives wherever possible to speed up this process. Even though they make a useful suggestion in this regard, they do not explain what to do if friends and family are not in a position to help.

After finalising the first ethical step to gaining access (granted by the Directorate of Research and the respective principals of the schools), I submitted my application for ethical clearance to the university ethics committee. This process required the following documentation:

- i) A signed application for ethical clearance;
- ii) A copy of an informed consent form;
- iii) A copy of my instruments;
- iv) A copy of a letter from the WCED granting institutional permission for the study; and
- v) A copy of the research proposal.

This process took another month after submission to deliver an outcome. The ethics committee has to work through 1 500 applications per annum. The committee ensured that the researcher considered all ethical issues such as informed consent, anonymity, confidentiality and dissemination of data. Amidst mixed feelings of frustration, anger, despair and elations as a result of the long waiting period, I was finally ready to meet the Physical Science teachers of the participating schools for the data-construction process. These mixed feelings of despair and frustration were stirred up more as yet another disruption occurred, this time beyond my control. During the period August to September 2010 all the selected teachers in my research took part in one of the biggest industrial protest actions, commonly known as a **teachers' strike**. This placed my research in limbo for two months. This was also the period for which permission was granted (by the Directorate of WCED) for my data-construction process. This process of negotiating access is nicely summarised by Wolf (2004: 196), who asserts that *there is no patent recipe as to how a way into a field should be sought and found*. To me it felt as if my entire

research study was being sabotaged by the constant delays of gatekeepers and the teachers' strike. What inspired me during this period were the words of Wolf (2004: 197) who alerted me that *researchers must develop immune reactions to any disturbance or threats in their research*. This implies that one must react the same way as the body responds to threats of infection. Put differently, one must neutralise anything that disrupts one's study programme.

Finally, after the strike ended the research participants were swamped with work as they had to catch up for the time lost during the strike. This delayed my research again, taking me into 2011. After contacting the participating teachers at the beginning of the year to schedule my visits for the data-construction process, they complained about how overloaded their timetables were, how they were busy preparing for the year and how the athletics programme disrupts the school timetable and the disorder it creates for almost the entire first term. At this stage of my research I felt as if the teachers did not understand the urgency of data construction process. I did not prepare myself psychologically with how to deal with the difficulty of gaining access to the schools. Most participating teachers finally agreed after numerous telephone calls, emails and personal visits to meet with me early in March of 2011, which according to them is the end of a very busy period for sports and other disruptive activities at school. It is during this period that things start to settle down and where the normal teaching for the year starts to take place. With normal teaching I mean that the full duration of each lesson is used. In other words, the official length of each period is adhered to. During January and February these schools shortened their periods to accommodate learners who had to practice for the athletics which is regarded as a high-priority event.

What I learned during this period is how difficult it is to gain access to schools – something that I really underestimated and took for granted during my planning sessions. Drawing from my personal experiences as a Science teacher, I thought this was going to be a very easy and straight-forward process. Hence I want to alert future researchers and novice researchers to the challenges I faced in negotiating access to the schools. Furthermore, time lines and time frames can be easily sabotaged by gatekeepers and participating teachers. The knowledge produced by this narration of my personal lived experiences during this stage of my research provides a basis on which researchers must plan their data-collection processes. In the next section I focus on the

research setting or more specifically the schools. I aim to provide a rich description of the participating teachers and the schools in which they teach. One cannot divorce the teacher from the school in which he/she teaches – doing this would be like separating a tree from its soil. This research initially intended to sample five Physical Science teachers, but because of the challenges I faced (as described above) my sample was down-scaled to three teachers. In the next section I will describe the teachers and the conditions under which they teach.

4.3 Describing the research setting

This study is concerned with capturing and describing the lived experiences of three Physical Science teachers. In order to provide a rich descriptive report on the latter, data were constructed to provide rich and thick descriptions. The rich descriptive report of subjective experiences (of teachers) emanated from the data constructed within a phenomenological tradition. On an ethical note, the names of the participants and the schools in which they teach are not mentioned, but pseudonyms are used. Much (2006:1) writes, *where permission is not given by research participants, their identities must be protected by pseudonyms or initials*. The three key participants in this study were Colin, Edwin and Thabo. Boyds (2001) regards two to ten participants as enough in phenomenological research to reach saturation. Also, Creswell (cited in Groenewald, 2004: 11) recommends long interviews with two to ten participants for a phenomenological study. For reasons beyond my control (as discussed above) I chose a combination of convenient and purposive sampling to select three Physical Science teachers. The following subsections discuss the geographic location of each school and the contexts within which each research participant teaches.

4.3.1 Geographic location of the study

South Africa is divided into nine provinces with a total of close to 7 000 high schools in total. Out of the nine provinces, I decided to conduct this study in the Western Cape as shown in Figure 4.1. The reason for selecting the Western Cape was convenience in terms of (i) time, (ii) economics, and (iii) accessibility.



Figure 4.1: Map of the Western Cape: location of study.

The Western Cape is one of the leading provinces with regards to Grade 12 examination results. For the better part of the last five years the Western Cape produced the best pass averages nationally and the top achievers in the country. It is also rated by the National Department of Education as the most organised province when it comes to school management and leadership. It is with this background in mind that I chose to conduct the research in the schools listed. In the next section I provide details on the locations of the schools in the Western Cape and the context within which the research participants teach.

4.4 Description of contexts within which the respondents teach

a) Edwin

Edwin teaches in a school situated in Elsie's River. Elsie's River is situated approximately 25 kilometres away from the Cape Town Central Business Centre and is bordered by the famous **Else river**, also previously known as the **Else kraal river** on the south, which runs through the

suburb and a railway line to the north separating the historically white area under apartheid from the **coloured area**. Most of the people residing in Elsie's River were forcefully removed from various areas (such as, Maitland, Oakdale, Durbanville and Parow) and relocated to Elsie's River. The industrial area bordering Elsie's River on the eastern side provides work to many uneducated, low-skilled and illiterate people from the area. Figure 4.2 provides pictures of the conditions in which the people of Elsie's River live.



Figure 4.2: Edwin's community

Many of the people who were forcefully relocated to Elsie's River in terms of the Group Areas Act of 1966 were crammed into red brick semi-detached housing schemes and flats, whereas others had to stay in shacks because they did not have the financial means to build houses for their families. These shacks slowly disappeared as the government provided sub-economic houses to people in exchange for their land. Today, even though we no longer live in officially racially segregated communities, people are still suffering as a result of the social ills caused by legal apartheid. This 'melting pot' resulted in the creation or establishment of many **shebeens** (illegal liquor stores) as people struggled to make a living, to find work and to provide for their families. Furthermore, for many years Elsie's River was home to gangs such as the Americans, Walk Proud and the feared Scorpions. Beets (2009:1176) states that this *melting pot* generated the many social ills which posed serious challenges to teachers. Edwin teaches the learners who come from this neighbourhood.



Figure 4.3: (Edwin's school)

The school where Edwin teaches is a focus school for business subjects. The school has a quintile rating¹ of 4 and a poverty index rating² of 2. The school is home to 1 500 learners, who receive instruction in both English and Afrikaans, even though the majority of the learners are English mother tongue speakers. The school is also one of the oldest schools in the Northern suburbs of Cape Town and was approximately 48 years old at the time of the site visit. The following is summary of the management structure for School E

¹ Quintile scores are calculated based on national census data for school catchment areas (EA) based on the income, unemployment and educational levels of the residents. Quintiles rates range from 1-5, where Q1 means poorest schools and Q5 least poor. Poorer schools get a bigger subsidy per learner from the National Department of Education. For example, in 2008 a Q1 school received R778/learner and a Q5 school R129.

² The poverty index ratio accounts for the intensity of poverty. In other words how poor the poor are.

Table 4.3: Management structure of Edwin's school

	2008	2009	2010
Staff Est: # Principals	1	1	1
Staff Est: # Deputies	2	2	2
Staff Est: # Dept Heads	8	8	8
Staff Est: # Educators	50	50	50
Staff Est: Total	61	61	61
Number of Learners	1 535	1 513	1 524

Edwin's school is well resourced and, like many other schools, developed a very good academic reputation of learner pass averages in Grade 12 over the years. Since 1994, and especially from 2000 onwards, the school has struggled to maintain the academic excellence established in previous years. The school's Grade 12 results were very poor during the last five years, specifically in Physical Science. One of the reasons for the academic dip could be because parents have been enrolling their children in **Model C** schools (as they are referred to historically), which have better resources and provides a healthier learning environment to learners. The following table provides the qualifications of the teachers at Edwin's school teaching the subject.

Table 4.4: Qualifications of the Physical Science teachers at Edwin's school

Characteristics	
Gender	
Male	1
Female	
Qualifications	
BEdgen	
BSc	
BSc + HDE	1
Experience	
Less than 5 years	
Between 5 and 10 years	
More than 10 years	1

Edwin, an Afrikaans mother tongue speaker who was 48 years old at the time of the interview, holds a BSc degree from UWC, having majored in plant pathology and zoology. Edwin has 25 years teaching experience and has been at the school for more than 15 years, teaching either Natural or Physical Science. His science laboratory has the latest science equipment, such as air tracks, computer software programs (such as Crocodile Physics and Crocodile Chemistry) and internet access. Despite the abundance of resources, the school has struggled over the last three years to achieve a fifty per cent pass average in Physical Science. The school has strong ties with Stellenbosch University, which provides extra support in preparing learners for the final NSC examination.

Edwin teaches Physical Science across all the grades in the FET phase. He has two Grade 12 classes (one Afrikaans group of 38 learners and one with 35 English learners). In Grade 11 Edwin has 43 Afrikaans learners and 41 English learners, and in Grade 10 43 Afrikaans learners and 35 English learners. Edwin teaches the subject in both languages. In South Africa Afrikaans and English are the only acceptable languages of instruction for Physical Science, because the NSC is written only in English and Afrikaans for Physical Science.

b) *Colin*

Colin teaches in a high school in Cravenby. Cravenby can be described as a buffer between Ravensmead (nearby coloured community) and Elsie's River. This is also the reason why most of the learners attending the school come from Ravensmead and Elsie's River. The people in Cravenby share the same social and political history as Ravensmead and Elsie's River with regards to the establishment of the area. It can be described as a **coloured¹ Muslim community established under the Group Areas Act of 1966**. The school has approximately 1 300 learners and a staff profile of 35 teachers. The school hosts both primary and secondary learners as the school offers admission from Grade 1 to Grade 12.



Figure 4.4 (Colin's school & community)

The school buildings and infrastructure are well maintained and in a very good condition, even though the school is more than 35 years old. The school has a quintile rating of 4 and a poverty index rating of 2. The school has the following management structure:

¹ Coloured people are referred to people of mixed-race parentage rather than, elsewhere, to refer to African peoples and their descendants; a person of mixed descent usually speaking Afrikaans or English as their mother-tongue.

Table 4.5: Management structure of Colin's school

	2008	2009	2010
Staff Est: # Principals	1	1	1
Staff Est: # Deputies	2	2	2
Staff Est: # Dep Heads	4	4	4
Staff Est: # Educators	28	28	58
Staff Est: Total	35	61	61
Number of Learners	1313	1345	1306

Even though Colin's school is well maintained, it lacks a **well-resourced laboratory**. As a result the school lacks the science equipment that could create an environment conducive to science teaching. A well-equipped science laboratory might stimulate the learners' interest as well as support practical tuition. The learners' performance in Physical Science over the last three years in Grade 12 was 88% in 2008, 36% in 2009 and 66% in 2010.

Table 4.6: Qualifications of the Physical Science teachers at Colin's school

Characteristics	
<i>Gender</i>	
Male	1
Female	
<i>Qualifications</i>	
BEdgen	
BSc	
BSc + HDE	1
<i>Experience</i>	
Less than 5 years	
Between 5 and 10 years	1
More than 10 years	

Colin is a 62-year-old teacher now approaching retirement. He is an Afrikaans mother tongue speaker, with five years of teaching experience and holds a BSc degree with

Chemistry and Botany as major subjects. After being retrenched in 2000, he completed his HDE specialising in Physical Science and Mathematics. He later completed his Honour's degree and Master's degree in science education. He entered the teaching profession with a wealth of experience gained in the private sector, where he worked as a laboratory technician for an oil refinery. Colin is also part of a science research group that meets twice a month to discuss research issues relating to science and science education. He is a member of a Curriculum and Materials development group that meets twice a month. The group's research focus is to produce teaching and learning materials focusing on indigenous knowledge. Colin is a member of the Southern African Association for Mathematics, Science and Technology Education (SAARMSTE) and attends national conferences, seminars and postgraduate research schools offered by SAARMSTE to assist novice researchers with their research projects. Colin teaches Physical Science to Grade 10 to 12 learners at his school in both English and Afrikaans.

c) *Thabo*

Thabo teaches in a school situated in an informal settlement in Kraaifontein in the Eastern District of Cape Town. The community within which the school is situated is a fairly newly established community which developed in the 1990s. An informal settlement in South Africa is also referred to as a shanty town. It is a community that is housed in self-constructed shelters in conditions of informal land tenure, a dense proliferation of small shelters constructed from diverse materials (as shown in Figure 4.5 below). These shacks were built almost on top of each other and this leads to severe health and social problems. It is the learners from this community to whom Thabo teaches Physical Science.



Figure 4.5 (Thabo's school & community)

The school has a quintile rating of 3 and a poverty index ratio of 1.2. The learners in this school cannot afford school fees, thus the school obtains most of its revenue from the Education Department. Finance is therefore a major constraint for the school and management cannot afford resources to create an stimulating environment for science teachers. In the words of the participating teacher, Thabo: “The school plans to renovate and install new science laboratories and equipment, but is waiting for donors and the department”. The following table presents the management structure of the school:

Table 4.7: Management structure of Thabo’s school

	2008	2009	2010
Staff Est: # Principals	1	1	1
Staff Est: # Deputies	2	2	2
Staff Est: # Dep Heads	5	5	5
Staff Est: # Educators	34	34	34
Staff Est: Total	42	42	42
Number of Learners	1554	1590	1515

The following table provides the qualifications of the teacher(s) teaching the subject.

Table 4.8: Qualifications of the Physical Science teachers at Thabo's school

Characteristics	
<i>Gender</i>	
Male	1
Female	
<i>Qualifications</i>	
Diploma	1
BEdgen	1
BSc	
BSc + HDE	
<i>Experience</i>	
Less than 5 years	
Between 5 and 10 years	
More than 10 years	2

Thabo's school has over 200 Physical Science learners in Grade 12. Thabo was 38 years old at the time of the interview and teaches two Grade 12 classes with 45 learners per group and 2 Grade 11 classes of 40 learners per group. Thabo has a three-year teaching qualification, which he obtained at the then Peninsula Technikon (currently Cape Peninsula University of Technology (CPUT)) majoring in Mathematics and Physical Science. During his training as a Physical Science teacher the focus of the content in Physical Science was more aimed at high school teaching and hence the course was aligned with Grade 12 Physical Science as opposed to the traditional university graduates who did a BSc in education, which was more advanced. Thabo is currently studying part time for his Bachelors in Education degree (BEdgen) in Mathematics and Physical Science at CPUT. In the last three years approximately 20% of Thabo's grade 12 Physical Science learners passed each year.

4.5 Meeting the teachers

This section of the study demonstrates the actual data-construction process. Here I attempt to provide an overview of the pre-interview arrangements as well as the actual focus of the

interviews and the setting within which the interviews took place. The interview questions are also discussed and the justification and aim of each question provided.

4.5.1 Conducting the interviews

As mentioned in Chapter 3, this study employed two data-construction methods, namely interviews and field notes. An appointment to meet with the teachers was scheduled two weeks in advance. I arrived at least two hours early, before the scheduled time for the interview took place. The two hours gave me ample time to ensure that the venues and equipment needed were available. Venues were arranged in advance to ensure that they were free from background noise and disruptions that could jeopardise the depth, quality and robustness of the interviews. I came prepared with an audio-recorder with fully loaded batteries and a set of spare batteries, as suggested by Easton, McComish and Greenburg (cited in Groenewald, 2004: 15), who cautioned that equipment failure can seriously derail any research undertaken. In addition I had a separate file with divisions for each interviewee for field notes, any sketches that the participant made during the interview, or any additional notes or information that the participant offered me during each interview.

The data-construction process was a direct interaction with the participating teachers. A face-to-face semi-structured in-depth phenomenological interview was conducted. This approach allowed the participants to communicate freely as they told their stories of how they experienced the NCS and its associated implementation. One of the benefits of this approach is the richness and the depth of insight gained to answer the research question that is being investigated. Each interview was recorded in a new file on the audio-recorder and each was started by clearly marking each interview recording (listing the name of the participant, school, venue and date of the interview).

The questions asked during each interview were similar and in the same sequence across all the interviews. All questions asked during the interview were framed by the theme of how they experience the implementation of the NCS. I focused on this question until responses reached saturation point. I covered almost every dimension with regards to their consciousness of the NCS. I followed the Husserlian approach when conducting the interviews. Husserl's approach (Van Manen, 1990) is to stay true to the phenomenological paradigm, which involves two steps, namely, (i) **epoché**; and (ii) **eudetic reduction**. These

terms were discussed in Chapters 1 and 2. For more details on the aims of phenomenological interviews refer Chapters 1 and 3.

The time taken to conduct each interview varied from teacher to teacher. Some interviews took one hour and twenty minutes, whereas the others were on average approximately one hour long. Drawing closer to the interview questions, I focused all my attention on issues such as their experiences, feelings, beliefs and convictions that they might hold regarding the NCS. Here I started the interview with knowledge questions, where my focus was on the **self**, where they grew up, where they completed their school careers, their first interaction with the subject at school level, where they completed their university careers and how they ended up in the teaching profession. This latter question focused on the establishment of their professional identity and their views on the subject. The second phase of questions aimed to get into the heads of the participants and captured how they described their experiences with the subject (namely the shift to the introduction of the NCS, the training they received in implementing the curriculum, how they felt about, and what they think of, the NCS). Phenomenologically, issues such as learning outcomes, assessment, the type of teacher envisaged and whether or not textbooks are aligned with the expected content they are required to teach spoke directly to the research question. Here the teachers' fears, convictions, emotions, beliefs and so forth were revealed. Van Manen (1990) cautions researchers that sometimes the researcher can easily become so absorbed in the data-construction process and he or she may fail to reflect what is really happening. Therefore it is important for researchers to focus on the complexity of making sense of human experience as the situation unfolds.

Each audio-recorded interview enabled me to listen to the responses of the interviewees. I did not interrupt the interviewees at any point whilst they responded to the interview questions. Each recording was transcribed and converted to text. When I transcribed the interviews, I considered, in the text, the feelings and meanings the participants communicated to me.

4.6 Field notes

During the interviews careful consideration and attention was given to the actions or behaviour of the each participant. Here I focused on the length of the pauses during and

between questions, the positions or gestures they (participants) made when asked questions. Groenewald (2004: 15) writes that the researcher must exercise extreme discipline by recording interviews and notes as comprehensively as possible without any bias or **judgemental evaluation**, for example, of issues such as what happened and why? He argues that field notes must be drawn up no later than the morning after the interview. Also the non-verbal cues, the silences, and the word selection or repetition of certain words during a response. I made a list of field notes on words based on hunches, impressions and feelings I got while the participants responded to my interview questions. These notes were made during the interview and the next morning at the latest as I reflected on the individual participant's responses. Huberman (1984) pointed out that field notes must be dated so that the researcher can correlate them with the data.

As alluded to in Chapter 3, field notes are not only a form of data construction but are also part of the explication section. Field notes are already in a finalised and pure form that does not need interpretation. Field notes compel the researcher to clarify each interview setting and the mood within which the interview took place.

4.7 Explication framework of interview data

Husserl's work on phenomenology was entirely focused on the theoretical and philosophical aspects. He left no recognisable step-by-step approach or formula to practically explicate the data of human experience. My biggest concern here was: what do I do with this avalanche of rich, raw and unprocessed data in the form of statements concerning the underlying inter-subjective intuitions or consciousness of the respondents. Van Manen (1990; 53) notes that *the notion of data is ambiguous within the human science perspective* and adds that *data speaks of objective knowledge*. Put differently, I had data that were objectively constructed and required an objective interpretation. The question now was: What do I do with the data to make it speak for itself?

4.7.1 Data explication process

As I delved into the work of other phenomenologists such as Merleau-Ponty, Spanos and Ricoeur in search of a formula for how to work with the data, I found that almost each one focused on the **being aspects**. Furthermore, their work is loaded with **philosophical constructs** and reasoning that did not answer my question, which is: How do I present the

data in a phenomenologically acceptable way? I found the answer to this question in the work of three scholars on phenomenology that guided my explication process, namely Devenish (2002), Sadala and Adorno (2003) and Groenewald (2004). Their focus was on the construction of themes and how to seek for transformed meaning derived from the natural meaning obtained during each interview.

Devenish (2002) describes Giorgi's method which involves the following four steps:

- The researcher must have a sense of the whole interview. After the interview is fixed in writing, the researcher must read the transcript over and over until he captures some main ideas that point to some level of understanding about the crux of the interview.
- This step is followed by the development of meaning units on the phenomena under investigation. This main focus here involves the importance of the researcher being distanced from the text. In other words, instead of being biased or having preconceived ideas of what the data say by looking for verification (as in the logical research method), the researcher must follow the practice of discovery – like a detective at a crime scene.
- The research participant's language must be expressed in psychological terms with the aim and focus of answering the research question. Here the natural meaning unit (NMU) should be interpreted for its essential meaning, which is restated by the researcher in terms of the suitable discipline of psychology
- Structuring the narrative. This involves the synthesis of the transformed meaning units into a consistent statement of the structure of learning. Here the researcher synthesises and integrates the ideas and insights contained in the transformed meaning into a consistent description of the psychological structure of the event.

In his doctorate Devenish (2002) adapted his data explication method from Schweitzers model, which was informed by Giorgi's model (as discussed above), where the main themes were represented in a succinct and coherent manner. I used the model presented below to work with my raw data. The model I used is a combination of Devenish's (2002), Van Manen's (1990), and Sadala and Adorno's (2003) explication process.

- I adapted Sadala and Adorno's (2003) ideographic summary box to summarise each interview. Here the direct words of the participants are used.
- The first step involves the development of a concise and succinct biography followed by a descriptive and interpretive narrative of each participant's story. The descriptive narrative, according to Much (2006:51), explores and report how the story unfolds from its opening to its closing statement. It is important to summarise the whole story so that the reader can get a sense of the participants' response.
- Each interpretive theme was enlarged and extended to a more specific theme that highlighted both what goes on inside the mind and the classroom of each participant.
- I used the formula created by Devenish (2002) to establish priority themes, **frequency** × **intensity** (intensity refers to a strong descriptive word).
- Consideration was given to the important phenomenological steps of bracketing and appropriation (see Chapter 2 and Tan *et al.*, 2009) in order to identify the invariant structure of experience.

In the next section I will turn my attention to the process of transcript analysis.

4.8 Transcript analysis

I identified from the transcripts the extracts of the data that were informative in some way and sorted the important phrases and important messages that were hidden in the mass of the interview. This involved an iterative process, which is a continuous back and forth movement between texts, as described by Tan *et al.* (2009) in their definition on appropriation. This was done until I was sure that the themes and categories I used to summarise and describe my findings were truthful and accurately reflected. Here Devenish (2002: 5) guided my analysis:

- The first glance at the transcript entails reading or analysing it with the core meaning in mind that points towards the experiences of the teachers and how this relates to the research question;
- The second step involves the construction of keys ideas with categories and subcategories that focus on the research question. These categories will expand as more and more new insights emerge from each interview transcript.

- All natural meaning units are obtained through distancing by the researcher not to push the data too much towards his/her bias as he/she engaged with the transcripts. Each NMU contains a single meaning;
- Each NMU was numbered according to the research key;
- I captured the essence of each NMU to generate meaning by removing all unnecessary items;
- I developed central themes based on the experiences of the research participants and the key aspect here was to look for multiple references that occur at least four times in the text;
- I placed central themes with phenomenological comments in numbered boxes for ready reference;
- This was followed by the writing of a succinct descriptive and interpretive narrative of each teacher's experiences with the NCS.

Summary

In this chapter I provided a succinct overview of the lessons to be learned when researchers construct their data. In addition, I presented the issues relating to the ethical considerations that I had to adhere to, as required by the University's ethics committee. Furthermore, this chapter paints a picture of the environmental factors and background of each teacher as well as the settings within which they teach. I also explained the objective of the interview questions and described the setting of each interview conducted. I concluded the chapter by drafting my framework for analysing my transcriptions. In the next chapter I will present and discuss my data.

CHAPTER FIVE

DATA EXPLICATION

5.1 Introduction

This chapter focuses on analysing and explicating the interview data on the lived experience of each research participant. In addition, all recollections of their experiences, descriptions of experiences and reflections on experiences are examined to reveal meaning, as Merleau-Ponty (1964) puts it, *as it is* without offering a causal explanation. Furthermore, I attempt to open up the question: how do their experiences give meaning to the implementation of the NCS and consequently their pedagogy? According to the phenomenologist Husserl, the slogan *the things themselves* refers to the concept of returning to the concrete (Groenewald, 2004: 4). Derrida (1967: 194) writes: *the phenomenologist is self-effacing before the originality and primordially of meaning is established*. Fidelity to the phenomenological paradigm dispels any debate which seeks to reach a conclusion that finally resolves any question about a phenomenon in question. In this chapter I seek to provide meaning through iteration by continuously revisiting and re-describing the teachers' experiences from different perspectives and vantage points. As Derrida (1967: 194) writes:

There are layers of meaning which appear as systems, or complexes, or static configurations which must obey both the legality proper to and the functional significance of the structure under consideration. Other layers [are] more profound, sometimes more superficial...

Each participant in this study was provided with a pseudonym to ensure anonymity as is customary in the research process. To preserve the accuracy of each participant's response, their statements are presented as closely as possible as reported in the transcriptions from the session recordings. In all cases English was the secondary language of the participants. Two participants spoke Afrikaans as their primary language. One participant spoke isiXhosa as his primary language.

5.2 Constructing meaning

This chapter is divided into three sections. Each section reflects an analysis of each individual participant's experiences with regards to the research questions. In each section I use both descriptive phenomenology and interpretive phenomenology by writing a descriptive narrative followed by an interpretive narrative to provide meaning to each participant's experiences. Descriptive phenomenology, which was developed by Husserl, has a more epistemological base (Taylor 2000: 651). Also, descriptive phenomenology is primarily more interested in the question: **what do we know as persons?** Husserl's philosophy was more focused on the descriptions or meaning embedded within **human experience**. Husserl argues that the things that make a phenomenon what it is exist in conscious experience and through conscious experience the individual is present to the world (Koivisto, Janhonen and Väisänen, 2001: 260). This form of analysis is based on de-contextualisation. In line with this concept, each transcript was studied inductively to arrive at an understanding of first principles which I communicated descriptively. The concept of first principles entails placing more emphasis on the participants' descriptions [direct words] of his/her experience with the phenomenon as expressed in his transcript (direct words of the individual).

Interpretive phenomenology, on the other hand, differs from descriptive phenomenology in that it leans more towards an ontological approach. Understanding is located in what it means to **be**. Interpretive phenomenology provides more insight into understanding the situation within which individuals find themselves. Taylor (2000: 653) describes Ricoeur's notion of interpretive phenomenology as: *He [a person] comes to know himself only by detour of understanding, which is, as always, an interpretation*. Descriptive phenomenology is more interested, according to Heidegger, in *how things and phenomena come to think themselves in us* (Østergaard, 2008: 96). Merleau-Ponty (1964) points out that our relationship to the environment is primarily a doing aspect, not a knowing relationship. After giving a descriptive account of each participant using the transcript analysis described in Chapter 4, I provide an interpretive account of the data as this adds rigor to my analysis. This includes, among other things, reflections on the interview, non-verbal communications and the emotional effect of the interview on interviewer (researcher).

5.3 Explication process

The explication process is based on the participant's responses to the interview questions (labelled Appendix D). The interview design I used was an open-ended, semi-structured interview, in which each participant was interviewed for approximately one hour. The interview schedule was divided into two sections that aimed to determine the following:

Section 1 (Items 1-7 see Appendix D)

- To obtain general information about the respondents' life-world with reference to his/her history and upbringing under an apartheid government;
- Specific information as to why the respondent decided to become a teacher, focusing more on the socio-political conditions at that time;
- The influence of family members on career choice and subsequently his/her choice of becoming a Physical Science teacher;
- Obtaining information of the respondent's first encounter with the subject and his/her Science teacher. This is necessary as it is the start of an identity formation process. Here the quality of the curriculum set the scene for his/her future teaching of the subject.

Section 2 (Items 8-31 see Appendix D)

- Obtaining specific information concerning the changes teachers had to make to implement the new curriculum (FET NCS);
- Obtaining specific information concerning their perceptions about the new curriculum and its impact on their teaching;
- Obtaining specific information concerning their perceptions about the new curriculum and its impact on their pedagogy;
- Obtaining specific information as to whether they regard their work as socially meaningful;
- Obtaining specific information on the epistemic drive of their teaching;
- Obtaining information on their understanding of a good textbook to guide their everyday practice of teaching the subject;

- Obtaining information in order to build an overview of the respondents' overall experience in teaching Physical Science;
- Obtaining information about how they redefine the future of Physical Science as a school subject in contemporary South Africa;
- Obtaining information about their views on what they perceive to be the best ways of teaching and learning.

Each interview transcript was scrutinised and related items and responses grouped together to *untangle the knotted fish line of data* (Devenish, 2002: 15) in an ordered and meaningful way. The data gathered produced up to 90 pages of raw data. Next, I provide the analysis of each participant individually.

a) *Colin*

I started by reading Colin's transcript to get an understanding of the language he used, based on his **choice** of words. At this stage I tried to place myself in Colin's mind to try and live through his [and every other participant's] experiences from the inside, in an attempt to comprehend the meaning he expressed as he intended during the interview. The diagram below (Table 5.1) focuses on the first section of the interview (items 1 – 7). Column 2 represents Colin's responses transformed into psychological language with an emphasis on the phenomenon of pre-teaching experience. I found these transformations necessary, because psychological aspects elucidate depths appropriate for an understanding of the events that took place in his life. In this analysis Colin's (as well as Edwin and Thabo's) descriptions were retained verbatim as far as possible.

Colin's transcript analysis

Section 1(items 1 -7)

Table 5.1: An ideographic analysis of Colin's statements

Item no.	Units of meaning (reported in Colin's own words)	First elucidations	Researcher's note
1	I am 62 years old with 6 years teaching experience. I worked in the oil industry as a laboratory technician for 25 years and became retrenched. I hold a BSc degree in Chemistry and Botany. Politically I could only study at UWC due to apartheid. I ended up in the teaching profession through fate.	Colin brings a wealth of experience to the science classroom. He is well qualified to teach Physical Science. His choice of career (teaching) was to survive as he had no little hope of finding another job at age 57. Politics and our history dictated his future. He refers to fate as the main reason for entering the profession Fate can be considered a call we have to answer (Nkomo, 1990).	He had not teaching experience under apartheid. The NCS requires practical application of knowledge (LO 3) which he brings. Teaching for him was never an option. He grappled with the oppression and is critically conscious of the impact of apartheid on his life (Nkomo, 1990).
2/3	After working in so many other science-related fields and could not find a permanent job I enrolled for a HDE in 2005	He never intended to become a teacher. The long detour to teaching resulted in him bringing a wealth of practical knowledge that he obtained in the field to the world of teaching. The NCS emphasises the importance of making strong links with the science used in industry and related processes to make science more meaningful to the learners.	According to him teaching was the only career choice that afforded him financial security at his age. The learners could consider him both a father figure and a confident teacher in PS. Higgins (2010) supports the view of Colin's choice as wanting to dignify his new career by searching for fulfilment of his full human existence.
4/5/ 6/7	I did not do P S as a school subject. I studied in the 1960s and did General Science till Grade 8. My passion for science I developed from my father, who fixed	He had no experience of PS during his school career. His motivation for doing science was intrinsic because of his father's passion. In	Thomas and Pedersen (2003) state that a common maxim in education is that teachers teach the way they were taught. Cohen (1990) suggests that his old ideas,

	<p>broken radios and electronic equipment. PS was not compulsory to enter for a science degree. The general science we did was very traditional such as teacher talk, transmission knowledge and examination driven. My parents could not send me to a school that offered PS because of our poverty situation. Coloured people were not allowed to study science under apartheid.</p>	<p>both areas of his life (both pre- and post-apartheid) he pointed out that his life was shaped by the political climate that prevailed in the country. The fact that he entered the profession so late might impact on his mode of delivery resulting in him reverting to the old way of chalk and talk.</p>	<p>beliefs and practices might still be alive in him</p>
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5.4.1 Biographical descriptive narrative of Colin (age 62)

My intention in providing a biographical narrative is to convey personal and unique events in Colin's [and every other participant's] life experiences. Furthermore, I capture his [their] unique history as a child[ren] to glean clues about his [their] upbringing to better understand (and later interpret) his [their] experiences. In so doing, I aim to provide an understanding as to why he [they] responded in a certain way. Through Colin's biography I also provide specific dates of events, his thoughts and details of his inner life. The narrative form of the biography reveals patterns of experiences through which one can (re)construct his history, or as Merleau Ponty (1964) puts it, we live in a body at a specific time and place.

Colin is a 62-year-old male. He was born and raised in Beaufort West, approximately 450 km to the north-east of Cape Town. He classifies himself racially as a coloured individual and attended school in the 1960s. He did not enrol in Physical Science at school as the subject was reserved for whites and some non-whites at that time. Only selective historically coloured schools offered the subject and his parents could not financially afford to send him to such a school (Green and Naidoo, 1998). He writes: *I am one of the lucky people that did not do Physical Science as a school subject in the old Standard 10 (today Grade 12)*. He continues:

... however, our poverty situation did not allow me to be able to go to any other school to do that, so, ... but we were promised that time that you could go into studying science even if you didn't have Physical Science based on the fact that you had Physiology.

His love for science developed as a young boy watching his father fixing broken household goods and equipment such as radios and televisions. His father sometimes even built radios from old scrap materials. His father was known as the local handyman in town *as he (Colin's father) enrolled in the British Building industry and studied through them to equip himself*, Colin recalls. He describes his father's philosophy as believing in trying out new things, as he echoes his father's thought: *... you must try out new things, you should explore*. This, Colin recalls, intrigued him. He was constantly engaged in personal dialogue with himself about how things work. He was always asking questions, for example: *How did the sound come out of the radio, or isn't there a human being inside the radio or how did the radio station pick up the signals it generated*. All these questions baffled him. The latter inspired him to enrol for Physical Science through a correspondence college called *Success College*. He registered for courses in Physics and Chemistry. He did not elaborate on how well he performed in these courses, because he did not write an examination on the content but used

it as a form of self-development in preparation for studies at university. Colin could not describe his first experience with the subject Physical Science at school or his teacher's teaching style (1965-1967) because the subject was not offered at his school. However, the only insight he provides is that he regards himself as very fortunate for not doing the subject at school. The reasons for referring to himself as fortunate in this regard could be the poor quality of science teachers, lack of resources and the fragmented nature and structure of the content. This will be addressed more in detail under the interpretive narrative of Colin's responses.

Colin matriculated in 1967 and enrolled for medicine at the University of Cape Town (UCT). This institution (UCT) was not open to non-whites (in 1968) because of the extension of the university bill (ironically titled) that was passed in the late 1950's. When people of colour had the potential to study at UCT (because of good results in Grade 12), they had to apply to the Department of Coloured Affairs, then, for permission to enrol. Colin describes this as follows: *Well, ... I got in because of good pass marks a general good pass mark, a good pass mark in math's and a good pass mark in Physiology and a good pass mark in Biology.* He explained further by saying *UWC at that time did not offer ... they did not offer physics, they didn't offer medicine and engineering.* The University of the Western Cape (UWC) was the only university in the Western Cape that was open to non-whites. He then dropped out of UCT because *my very first year at UCT showed me that is not where I wanted to be.* From there he went to UWC, where he enrolled for a Bachelor of Science degree majoring in Chemistry and Botany. The subject Chemistry opened doors for him in the oil industry, where he worked for 25 years.

After being retrenched 25 years later because of what Colin referred to as the *political climate*, he worked in many different science-related fields and places. After several years of instability in his career path, he decided to enrol for a Higher Diploma in Education (HDE) at UWC at the age of 57 in 2005. Even though Colin refers to himself as not being born to become a teacher, he explained the shift to the teaching profession as **fate** when he writes: *life has a strange twist and fate has it that thirty odd years later I am actually a teacher.*

5.4.2 Interpretive narrative

Underlying Colin's pre-teaching experience is a number of issues that shaped his life. It is through the latter that he develops a critical consciousness. Colin foregrounded and

crystallised the impact of apartheid rule, therewith highlighting his identity and consciousness. Therefore, the following themes are the reasons for him not wanting to enter the teaching profession and are important to the phenomenological analysis. The first is his frequent use of the terms ‘politics’, ‘coloured’ (with respect to race) and ‘schooling’. During apartheid the human self (Colin) was placed under subjection as a result of the political climate. He constantly referred to the role his father played in developing his **love for Physical Science** and he conveys the tension between education, politics and fate (future). Colin also had a higher-order knowledge of his future by referring to fate, which brings a sense of the self to the fore. Therefore I decided to use the following key terms for Colin’s responses to items 1-7 (as found in the raw data):

- His upbringing;
- Political influences on his life;
- Important people/role models;
- His sense of self;
- Fate.

In Colin’s transcript I searched for the essences of his consciousness by constantly internalising his life world objectively and heeded Ricouer’s caution of distanciation (cited by Taylor, 2000). His most pregnant expression (in items 1-7) is the influence of apartheid on his life. He used the terms **politics dictate** and **apartheid** very frequently throughout this section. The impact of apartheid rule and its effect on his development as a learner deeply burdened him in almost every dimension of his life. Higgins (2010: 1) avers that *the human condition is equal parts normative social history, philosophical social anthropology, and practical activity*. The relationship between these aspects (social history, social anthropology and practical activity) creates tension between the natural inner self and the phenomenological self. In terms of Merleau-Ponty’s philosophy, it is the nexus of time, space and body that makes up our condition (Addyman, 2009; Merleau-Ponty, 1964). In other words, this relationship between time space and body directly impacts the spiritual, physical, affective, emotional and cognitive domains of an individual. For example, as a child Colin was deprived of many things over which he had no control; of these, the most important was quality education which is **possibly** why he described/considered himself as **very fortunate for not doing Physical Science as a school subject**. Under apartheid, learners were made to believe that they were incapable of learning Physical Science (Green

and Naidoo, 1998). Colin's statements bring to the forefront issues of racism and power, and how they relate to the appropriation of knowledge and his perception of knowledge. He sums up this thought as follows: *So-called coloured people were geared to enter college or university to equip them to become teachers. Hence ... what would coloured people actually want to do with physics and chemistry?*

In their work phenomenologists such as Husserl, Heidegger and Merleau-Ponty demonstrate the link between one's experiences and consciousness. The languages people speak are often the mechanical drive of what Heidegger calls *dasein* meaning *to be* (Taylor, 2000; Groenewald, 2004). Colin's identity or psychological feelings about himself already developed during his childhood; these can be expressed as a combination of helplessness, powerlessness, anger and irritability with the education system under apartheid. Hall and Burns (2009: 51) point out that identity formation is influenced mainly by psychological conditions and theoretical orientations such as socio-cultural complexes through which individuals define themselves. Drawing from Colin's transcript, the social and cultural conditions under apartheid – including race, social status and academic goals – affected his perception of Physical Science negatively. The latter may also be considered as one of the reasons why he never intended to enter the teaching profession; hence, he constantly states: *I was never born to be a teacher.*

After exploring all other avenues with the aim of avoiding teaching to rebuild/reconstruct the setback of losing his job at age 57, Colin chose to become a Physical Science teacher. He describes his choice of teaching as **fate** dictating his life. Fate in his case can be considered synonymously as a gift, because fate is a call that demands one to respond. In other words, teaching came to him as a gift or as he stated, **a gift from God**. A gift is something one is worthy of and makes room for in life. His experience as a lab technician in the oil industry prepared him to become a teacher. Colin's verbal expressions appear to hold significance for pedagogy, because he has a good understanding of the processes of science which he brings to the science classroom.

His experience as a lab technician, road construction inspector and building site supervisor brings a practical dimension of teaching science into the science classroom that is aligned with the objectives of the NCS. For example, learning outcome 1 (LO 1) demands a good understanding of the processes of science, whereby teachers must investigate scientific problems. This skill formed part of his daily routine in the science industry. Furthermore, LO 3 focuses on the application of scientific knowledge which Colin offered learners wanting

to learn science in a more meaningful way that they can apply on a daily basis. His entering the education profession as a teacher created a new birth in the crisis of his history as he said:

I must say five, six years later I have not regretted that (teaching) because I realised the need for science teachers, I realised the need for people with a good sound knowledge of Physics and Chemistry... and also to be able to help our kids in a changing world for them to carve out a career for themselves.

The next section focuses on Colin's responses to items 8-31 in his transcript.

Section 2 (Items 8 – 31)

The National Curriculum Statement and implementation

Table 5.2: Ideographical analysis of Colin’s statements

Item/s	Units of meaning (Reported in Colin’s own words)	First elucidations	Researcher’s notes
8	Right now I am teaching: One Grade 12 class Physical Science/25 learners One Grade 11 class Physical Science/31 learners One Grade 10 class mathematical literacy/30 learners Two Grade 8 mathematics classes /45 learners per class	He felt overloaded with teaching and administrative responsibilities. He felt overwhelmed by the different subjects and grades he had to teach.	According to Wiener (1992), most of the issues regarding workload referred to by Colin are an external locus of control. He has little control over this. Due to a heavy workload, Colin might have less time to reflect on his teaching. Hargreaves (1992) points out that an <i>intensification of a teachers’ work might lead to self-regulating tendencies.</i>
9	The old system was too fragmented, it aimed at developing a certain section of the population at the expense of the other. I read in the old system R500 was spent on a white child and maybe R100 on a coloured child and R50 on a black child. The system had lots and lots of shortcomings. It (the curriculum changes) came at the right time. What would we have	The Ideological power struggle between racial groups (Nganu, 1991) resulted in an old-fashioned approach to curriculum design. The subject did not meet the social political and	Most of the views raised by Colin resulted from historical neglect of the subject. The focus of the apartheid curriculum was on how well teachers could ridicule and manage learners rather than

10	<p>done with thousands of <i>young people that were not equipped for the workplace</i>. We had problems where I worked in the oil industry to get suitably qualified people with backgrounds in Chemistry and Physics to work for the company (bold font reflect emphasis placed by Colin on this statement).</p> <p>OBE is still a mystery to me ... I know learners have to write tests during the year and in matric (Grade 12) it's all about the matriculation exams. The system is not one I looked forward to. In the new system learners have to construct their own knowledge, but the educator must set the scene for the knowledge they need. I think too many negatives went around it. Even today teachers still resist the change process and were not prepared to move away from that comfort zone. I try to practise OBE in a sense you give tasks and projects. The biggest challenge is resources. Learners from townships and our school have no access to libraries, computers and internet. Learners can't afford internet usage, putting all the pressure on teachers.</p>	<p>economical needs of the country. Instead, it was considered an inferior curriculum. There was no space or prominence provided for new ideas in the curriculum (Ogunniyi, 1986: 116; Naidoo and Lewin, 1998:729).</p> <p>Colin is not in favour of OBE as he came from a schooling system of teacher talk and learner passivity. It was in industry where he learned you must search for information and work hard when you don't understand something. He expresses frustration at having to carry the burden of preparing materials for learners to complete assignments and projects due to poor resources. He contends that resources and restricted access to money limit the implementation of OBE. He points out that</p>	<p>on developing their content knowledge. This concern could be conceptualised or described as a bureaucratically driven curriculum.</p> <p>It is difficult for him to change his perceptions and understanding of how learners learn. As Cohen (1990) described it, he is still trapped in his old ways of learning. As new curricula or methods are introduced, teachers reach out with their own professional selves. They have difficulty adjusting their old ideas, practices, and beliefs, etc. (Cohen, 1990; Jansen, 1999; Christie, 1999; Naidoo and Lewin, 1998)</p>
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<p>11/12/13/ 14/18/19</p>	<p>I don't. I cannot say that I'm on top of knowing each and every term. I understand the complex jargon used in the NCS such as critical outcomes (COs), developmental outcomes (DOs) and assessment standards (ASs)</p> <p>Assessment has become such a bore for teachers in the sense that it places a big workload on teachers. Teaching Grades 10-12 we have to do 8 assessment tasks for every grade. This includes 3 class tests and 3 exams. Schools are under pressure to show the department that they assess. I have a policy that every week they (learners) can expect a test on the week's or two weeks' work.</p>	<p>disadvantaged learners from townships suffer most. This problem reflected on his practice and motivated him to take responsibility to compensate for the lack of resources.</p> <p>Colin admitted to <i>understanding the concept of ASs but not COs and DOs</i>. This is because of the emphasis and high premium placed on assessment in his school. Assessment formed the heart of the NCS.</p> <p>He tests his learners frequently on content. Even though he argues the curriculum is examination-driven, he is forced to adhere to departmental demands.</p>	<p>Most of his colleagues at school or other teachers whom he knows still teach in the old-fashioned way. It is fair to say that Colin and his colleagues use methods with which they feel comfortable and therefore show a superficial inclination to implement OBE.</p> <p>Learning and teaching are internally rather than externally motivated as both parties (teacher and learners) must adhere to the departmental pressure for results.</p>
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15/21	<p>I think the matric exams have become the alpha and the omega. That means that the learners that are really interested in the class will take every opportunity that is given to them to prepare for any assessment or test. They (learners) understand the need for assessment.</p> <p>I think the NCS gave more meaning to terminology. This was simply hidden in the past and not spelled out clearly. In the past my encouragement came from teachers who wanted to know more and wanting to be on top of their game. They aimed to prepare learners for after matric or school - to be able to face the world and tackle projects or tasks head on. Back in those days teachers were not necessarily specialists and to ask for teachers to be specialists is a good thing but what do you do if you don't have a specialist.</p> <p>Well, it is difficult to say I have the qualities envisaged by the NCS. But I must be honest when I say I am involved in postgraduate studies and I believe it is necessary for me to do in fact school-based research. It certainly helped me in</p>	<p>He argues that the demands of the NCS are nothing new. It was always part of the old dispensation but given little terminological prominence.</p> <p>He aims to transform his practice through self-development by studying further. It appears as if there is a slight shift from</p>	<p>This concern may lead to the kind of teaching that results in mundane, oversimplified content and structure of his lessons. The danger is he has lost his autonomy to teach based on the needs and skills presented by learners.</p> <p>He views the NCS as a superficial cleansing and just a way of breaking with the past.</p>
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15/28	<p>understanding my learners better. I discovered here that learners have different ideas and conceptions of things and unless you as teacher can delve deep into their being and discovering through various means what conceptions they have, you will fail in your duty in helping them. I think you need to be a lifelong learner if you want to fit in with the NCS.</p> <p>The content of the work is to prepare learners adequately for university to handle the pressure that comes from studying. I think our syllabus is overloaded. The Grade 10 syllabus is not a problem, but Grade 11 is absolutely overloaded with new knowledge and as a teacher you are not doing justice to every topic. Out of 35 weeks per year you must at least spend 6 weeks on organic chemistry. As a PS teacher you cannot afford to spend more than 6 weeks on organic chemistry. But what does it mean; it means you are not covering the subject in depth.</p> <p>I do understand the content well. I make sure that I do enough research on my own. Even though Physics was not one of my majors at university I marked more physics examination papers in Grade 12 than chemistry. There is one topic that gives me problems; it is the work-energy theorem. There are so many variables learners have to bring in to handle such a</p>	<p>traditional to constructive pedagogy in his thinking, because he refers to how much he learned in his studies about the different ideas expressed by learners.</p> <p>He admits to having a good understanding of the content in the syllabus. However, he feels the curriculum contains too much work to be covered. There is a negative link between time, energy and content knowledge. He constantly refers to not doing justice to the topics.</p> <p>He admits that two topics in the Grade 12 syllabus are very challenging for him and even more so for the learners. Both topics are new topics introduced with the NCS and he questions the need for</p>	<p>Colin raises concerns which might lead to forms of teaching that result in mundane, oversimplified content and structure of his lessons. The danger that Colin alludes to is that he has lost his autonomy to teach based on the needs and basic skills of learner.</p>
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	<p>problem. Examiners give us certain formulae that are not in the examination paper. Unless the teacher is equipped enough to teach the topic, the poor learners are going to struggle in the exam. Another topic is the concept of capacitors.</p>	<p>topics of this difficulty level.</p>	
<p>23/24/ 25/26/ 27/29</p>	<p>I discovered there are so many textbooks on the market. I said to my learners right from day one, I can see the Physical Science textbook is useless - it just did not have the information required for learners to pass matric. I then discovered textbook writers were given a brief of what was required in the NCS document; however, since the time of completion or writing the textbook and the actual implementation of the NCS so many changes in the curriculum have taken place that the textbook writers did not meet. Right now my learners use the <i>Study and Master</i> textbook. My Grade 11s use <i>Focus</i> as <i>Study and Master</i> did not address certain issues. I think there is a gap between examiners and textbook writers. I wait for the day when examiners will sit down with teachers and say: look, this is what we are looking for.</p>	<p>Textbooks did not meet the needs of the learners to pass Grade 12. There is a misalignment between textbooks and NCS. <i>Study and Master</i> is given scriptural preference as it is a textbook that only uses a question and answer method. The old textbook by Brink and Jones was no longer used in the classroom. Teachers and examiners are not involved in textbook writing, even though examiners use a range of textbooks to develop question papers for the Grade 12 examination.</p>	<p>Textbook writers are not cognisant of individual learner differences and needs. Teachers simply do not have the time to design their own learning materials and notes to prepare learners adequately due to their heavy teaching loads and administrative responsibilities.</p>

30/31	<p><u>Colin's Grade 12 P S results over the last 3 years (2008/2009/2010).</u> In 2008 I had an 88% or 90% pass average. I must add that year (2008) that was the 1st FET NCS Grade 12 examination. It was a very difficult paper. That year I had a group of learners over the spread of 3 years and they were enthusiastic. They worked hard and comfortably passed Grade 10/11. In 2009 I had a 36% pass average. That year 26 out of the total of 40 should never have been in that class. Some of them that were in Grade 12 never passed PS in Grade 10/11. Some of these learners were pushed over to the next grade and that results in a bad reflection of the teacher. In 2010 I had a 66% pass average. I told our principal already in March that 12 of the 36 won't make it, since they failed in Grade 10/11.</p>	<p>In 2008 under difficult conditions, Colin had good passing scores for his class which he attributed to bright, hard-working learners. In 2009 his results declined to a dismally low 36% and he explained that this problem resulted from departmental pressure exercised on schools not to hold learners back even if they deserved to fail. He argued they were not able to cope in previous grades and hence this had a backwash effect on his results and subsequently on his performance as a teacher. In 2010 his pass average increased, but did not approach the 2008 level. Again, he attributed that result to learners who were not ready for Grade 12 and failed in previous grades.</p>	<p>A high premium is placed on Grade 12 results in South Africa, as the blame for learner poor performance are placed on the teacher's doorstep.</p>
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5.4.3 Descriptive narrative

The following key terms are established based on the basis of Colin's response to items 8–31 (Appendix D):

- Workload and teaching responsibilities;
- The shift to the new FET NCS;
- Implementation of the NCS;
- Understanding of the NCS;
- His notion of good textbooks to guide the teaching and learning process;
- Performance of learners.

(i) *The workload*

Colin teaches five different classes per week. Two Grade 8 Mathematics classes (with a total of ninety learners), one Grade 10 group (30 learners), one Grade 11 Physical Science class of 31 learners and one Grade 12 Physical Science class of 25 learners. In every grade Colin faces the demands of administrative and associated challenges such as research projects, assignments, tutorials, tests and examinations. He teaches a total of 35 periods per 5 day cycle out of a total of 40 periods. Most of his comments centred on his perception that there is too much content in the Physical Science curriculum. He mentions quite frequently the time constraint to finish the prescribed work in the course of the year and having to pay attention to all the other administrative issues. He described his concerns as follows:

I think our syllabus is overloaded ... The Grade 11 syllabus is absolutely overloaded with new knowledge with new work and as a teacher you are not doing justice to every topic. In grade 12 you do not have enough time to really go in-depth into a topic. But then what does it mean; it means you are not covering the subject in depth.

This statement made by Colin is aligned with Hargreaves' (1992) point that heavy workloads create little time for teachers to reflect on their practice. Also, teachers tend to neglect certain sections of the work that require in-depth research and preparation. This practice may result in teachers keeping learners busy with mundane tasks by cutting corners so that they can attend to administrative responsibilities.

(ii) *The shift to the FET NCS*

Colin entered the profession in 2006 after completing his teaching qualification (HDE) in 2005 at UWC. He did not teach Physical Science in his first year of teaching and was introduced to the subject in his second year of teaching, as the school did not have a suitably qualified candidate. In 2005 during his period of study the university curricula were aligned with the kind of teacher required to teach the NCS. Subsequently universities were preparing pre-service teachers like Colin on how to teach in an outcomes-based environment. Hence, Colin was one of the first recruits to enter the profession fresh from the farm and into the market place, as 2006 was also the inception of the FET NCS.

The year 2006 marked a very significant phase in our country's education system whereby the entire nation was being taught the same Physical Science Grade 10 content for the first time in history with prospects of a national examination in Grade 10. Exemplary/draft question papers were rolled out and a September trial examination was set to prepare learners for the final examination, which did not materialise as a national survey found that teachers were not adequately prepared for the curriculum. Colin summed this up as follows:

Hence I did my post-graduate certificate at UWC, the DOE in the Western Cape offered training to teachers during the June and September holidays because teachers were not prepared for the new curriculum. They had one week's training where they actually trained math's teachers. Mrs X, she arranged practical training sessions on a number of Saturdays and that is where I basically learned a bit more of some of the experiments and investigations that was required in the FET syllabus.

In Colin's response to the question he focused on how he feels about the new changes in education that took place in the country after the demise of apartheid, he constantly mentioned the negative impact apartheid rule had on his education. He said:

The old system was too fragmented it was aimed at developing ... a certain section of the population at the expense of the other population groups. For instance I know one time the figures that I read was that in the old system R500 was spent on a so called white child, whereas R50 was spent on black child and maybe R100 on developing a coloured child at school. So the old system definitely had lots and lots of shortcomings and had to be overcome and replaced ...

With respect to the curriculum, he felt the change process came at the right time. He described the situation as follows:

What would we have done with thousands of young people not equipped for the workplace? We had problems in the oil industry to get suitably qualified people to come and work with Chemistry and Physical Science backgrounds.

His arguments are supported by the literature in the work of Green and Naidoo (1998: 729), who refer to the nature of the curriculum as ‘second grade’, while other scholars refer to it as **Bantu education**, a term made famous by Verwoerd (Nkomo, 1995). Jansen (1999) and Le Grange (2001) also provide an insight into the impact of apartheid rule on education. Based on Colin’s responses to the question, he appeared to be an ambassador for the change process as he said: *I think the new dispensation really opened the doors for us.*

(iii) *Implementation of the NCS*

In this section items 11, 12, 13, 14, 18 and 19 (See Appendix 4) are grouped together to express Colin’s responses. The responses raised by Colin are associated with questions such as whether he feels adequately prepared to teach the NCS, how he feels about OBE and whether he understands the technical jargon associated with the NCS. Other questions allude to him practising OBE in his classroom and elaborating on the usefulness of the NCS in improving learners’ understanding of school Science.

In his pre-service teacher training programme he acknowledges that he received training in OBE. The following excerpt serves as evidence for this statement: *at university we were gradually prepared for the new curriculum (NCS) in a sense that the whole concept of OBE was stressed.* When he was asked how he feels about OBE and whether or not he applies it in his lessons, he said:

The whole concept of OBE is still a mystery to me in a sense that when I came from industry I had no experience of the then current curriculum. I had no experience of what was required except to know that I knew that learners had to write tests during the course of the year and in matric (Grade 12) they were all confronted with the matriculation final exam.

He adds that:

Teachers teaching in the old dispensation were not prepared to move away from their comfort zone; there was this whole resistance to change in education; many of them were not even interested in whatever training that was offered if any was offered. I still experience that teachers cannot accept the concept of outcomes-based education.

In response to the question of whether he applies OBE in his own practice, he made the following comments:

I think libraries for instance close very early, six seven o'clock in the Winter. It does not give learners a chance to go and do research there. Learners from township schools still have very limited resources. We (I) try to practice OBE as far as possible in a sense that, yes, you give learners projects and tasks and lucky for me in the school where I am I can allow and most of the learners have access to resources. I have experiences that there are a number of learners just did not have access. They were very honest and say, Sir, the library I go to in Elsies River and Belhar or close to us just didn't have the necessary books to help us. As an educator I in fact had to bring books, I had to bring resources. I pulled off materials from the internet and gave it to these learners ...

(iv) *Understanding of the NCS and Assessment*

When asked to respond to the question of understanding the technical jargon and terms used in the curriculum, he had the following to say: *honestly I don't*. He further expounded by saying that he understands the terms **assessment** and **assessment standards** very well, but terms such as **critical outcomes** and **developmental outcomes** make no sense to him. He also stressed the question: what is the importance of this (CO and DO) to you as a teacher? Colin echoes his concerns about having to know these terms with respect to the need for preparing learners for the examination. His entire argument is predicated on the assumption that examinations have proven over the years that (in his words) *you cannot say that a particular assessment standard dominates or gets predominance over the other assessment standards. So I would really question the real need for assessment standards in that sense.*

With regards to issue of how often he assesses his learners, his response was that *it puts a big workload on us*. He stated further that assessment has put what he calls *an entire bore* on them as teachers. Teaching Grades 10-12 requires 8 assessment tasks per grade, excluding 3 class tests per year and 3 examinations. However, as an educator he said:

You have to work because schools are under pressure to show the department that they assess the learners and that they do meet the number of assessment tasks that must be done.

According to Colin the matriculation examination has become *the mother of all assessments* for teachers in all schools. This can be related to the fact that schools get categorised on the basis of their matric results and are called *Learner Attained Schools* (LAS) if matric pass averages drop to less than sixty per cent. When a school is labelled/identified as an LAS school, the department takes control of the school, whereby principals are stripped of their autonomy and assigned a mentor who guides them in their decision making process. This situation is further exacerbated when the department sends a team of departmental officials once per week to evaluate teacher practices. This involves the setting up of lesson plans and unannounced classroom visits. For teachers this period takes place for a full year and can be a very unpleasant period. In the next section I focus on the use of textbooks and other resources in guiding Colin's practice.

(v) *Textbooks and learner support materials*

This section focuses on items 23 and 24. It describes Colin's responses to questions such as how he feels about the different textbooks written to guide his practice as a teacher. Colin mentioned there are a number of Physical Science textbooks (Grade 10-12) on the market from which to choose. When he was introduced to teach Physical Science to Grade 12s the school had already bought a number of textbooks that in his words were *useless*. He stated the following: *I said to my learners from day to day I don't see its usefulness ... it just did not have the information required for the learners to pass matric*. He further elaborates that he discovered that authors of textbooks were briefed by publishing companies as to what was required in the NCS document. However, since the time of completion of the textbooks and the actual implementation of the NCS, many changes were made to the curriculum. In other words, most textbooks on the market were not aligned with the need to provide details of what is required to pass Grade 12 Physical Science. Colin benchmarked his notion of a good textbook with the requirements to pass Grade 12. He felt that there is no single textbook on the market that has all the materials and depth to go into each topic: *textbooks do not meet the requirements of the NCS or examinations for that matter*. He currently uses the *Study and Master* textbook for Physical Science. This textbook (in my opinion as a former Physical Science teacher) does not provide insight and depth into the content, but is a summary of each topic followed by revision exercises in the form of questions with answers. It can be considered a revision workbook (for learners) and appears to be suitable for learner preparation for the examinations for every grade.

According to Colin, textbook writers do not consult external examiners and moderators with regards to what the needs are for learners to pass Grade 12. In his response to the question of what he thinks about the old popular Physical Science textbook **Brink and Jones**, he said: *now that was a good textbook, because those textbook writers knew exactly what universities wanted and what schools needed for teachers to help learners pass Grade 12.* He added: *there are still some chapters that are very, very useful in my teaching.*

(vi) *Learner performance*

This section makes reference to Colin's responses to items 30 and 31, focusing on his learners' Grade 12 results over the last three years and what he considers to be the underlying reasons why they obtained the results they did. In 2008, working under difficult conditions, Colin had a good pass rate and he ascribes this to good, hard-working learners. He forwarded additional reasons by saying *I have been teaching these learners for three years*, meaning he worked with the learners from Grade 10 to Grade 12. In 2009 his results (pass average) declined to a dismally low 36% and he regards this low pass rate as the result of departmental pressure exercised on schools not to hold learners back, even if they deserved to fail. He argues they (the learners who failed in 2009) were not able to cope in Grades 10 and 11. Hence these learners whom he describes as **weak** ones had a negative impact on his results and subsequently on him as an inadequate teacher. According to Colin, most of these learners should have been kept back in Grades 10 and 11, but because of the high failure rate in 2008, learners were routinely promoted without meeting the criteria. In this regard he had no control over the system. In 2010 his pass average decreased and he attributes that again to learners who were not ready for Grade 12 because they had failed in previous years. Colin said: *I told the principal in March 2010 already that 12 of the 36 Grade 12s will not make it at the end of the year.* This was because they had failed Physical Science in Grades 10 and 11 and met all other criteria to be promoted to Grade 12 Physical Science classroom.

5.4.4 Interpretive narrative

The last two decades have witnessed remarkable strides made in research regarding the NCS (OBE) and its implementation process in South African schools. Despite these strides, its findings revealed that the implementation of the NCS is best described as being still in its infancy (Kriek and Basson, 2008; Lelliott *et al.*, 2009; Brodie, *et al.*, 2009). Likewise, based

on his responses to the interview questions, Colin can also be considered as not being an active implementer of the NCS. Many quantitative and qualitative studies have examined classroom practice from various perspectives reflecting on the curriculum changes taking place and the challenges teachers are facing. This phenomenological attempt is a search for the truth about Colin's reality in the Physical Science classroom and how he perceives the curriculum from various perspectives. Sadala and Adorno (2003) aver that phenomenology is a search for subjective truth that can be described as floatable and precarious, based on an individual's view of the world. The following themes emanating from the data influenced Colin's actions or behaviour regarding the NCS: i) strong beliefs he holds about himself; ii) his beliefs about the curriculum; iii) scarce resources and related challenges; and iv) beliefs about the discipline of science and content. Each theme is discussed below.

(i) *Beliefs about himself - the self*

Underlying Colin's experience with the NCS, there appears to be a negative relationship between the knowledge he holds about himself (subconsciously/psychologically) and his perception of the NCS. Colin's **persona** or **identity** (as described in his biography) about how he best perceives teaching/learning was already formed in a system which he regarded as fragmented with lots and lots of shortcoming. There is compelling evidence in the literature linking teachers' thinking to beliefs they hold about themselves. Cohen (1990) contends that the *old self* (ideas) reaches out more strongly when confronted with new innovations. When confronted about how he feels about the NCS, he responded as follows:

I come from industry. I had no experience of the current curriculum (NCS) ... I had no experience of what was required except to know that learners have to write tests during the course of the year and in matric (Grade 12) they were all confronted with the matric final examination.

This expression describes Colin's deeply ingrained phenomenological attitude developed and established under apartheid, where the focus was on memory learning, tests and examinations. Instead of responding in favour of the NCS (because of his open rejection of the apartheid curriculum), he expresses his belief in favour of the old traditional curriculum. Most scholars argue that to be an effective teacher it is important to demonstrate the willingness to nurture change in small strides such as a positive outlook and being less preoccupied with the **self**.

Neisser's (1980) studies about (auto)biographical memory and change in the details of memories over time strongly suggest a uniquely personal and reconstructive process operates in people. Another study by Scott, Kelly and Tolbert (1995:5) on individual psychology suggests that human behaviour/development lies in a conceptualisation of reality and its influence on their destinies. Colin's conscious mind can be described (in Popper's terms) as a bucket that holds a copy of reality that was poured into it by the environment in which he lived and was educated (Scott *et al.*, 1995:5). Therefore, Colin finds it difficult to take ownership of the NCS and hence struggles to implement it. In Colin's world the image he sculpts (in his consciousness) about the NCS is directly tied to his experiences with schooling under apartheid and in industry. His reality became a cognitive model imprinted on his consciousness (see Sealley, 1996) of how he perceives the NCS, which was constructed through the *self*. Furthermore, the verbal representation in his transcript reveals that his past remains present in his consciousness and produces itself when he engages with the teaching of the subject.

Colin is in a state of consciousness that neither denounces nor accepts the NCS. Subconsciously he is experiencing an interior representation – laying out within him a lack of success, which was imposed on him by intellectual boundaries of thinking under apartheid. In other words, the present (NCS) is placed under threat by the past (history of the old system). So the question remains: why is he not following the NCS? One possible reason could be that he does not want to confuse himself with the new terminology which requires a new framework of thinking as opposed to the familiar traditional terminology and way of thinking. Therefore he states: *... learners have to write tests during the course of the year ... in matric (Grade 12) the final examination*. Next, I look into his beliefs about the NCS or his epistemic philosophy, as Derrida (1967:246) refers to the phenomenon.

(ii) *His beliefs about the curriculum (NCS)*

His belief about the curriculum is captured in his responses to the question asking how he feels about the NCS. The following are a few excerpts to substantiate his beliefs:

I, however, think that such a system (NCS) was not one that I looked forward to in a sense that ... my own personal experience is such that ... in the workplace one needs to be involved, if one wants to know something one need to be involved, and go and search for it ... I think OBE has its merits and it has its challenges. The reality is that most learners in the so called townships from previously disadvantaged

groups have not and still have very limited access to resources where they could access this information.

In response to the question of whether he implements OBE in the classroom and whether he has all the qualities of the teachers envisaged by the NCS document, he responded as follows.

Well I try to practise OBE as far as possible. I think the NCS document have given more meaning to terminology that were in the past simply hidden or not spelled out ...

Colin holds strong beliefs about the NCS and its place in the teaching and learning process. Muijs and Reynold's (2002) view beliefs as dynamic and permeable mental structures that are susceptible to change. Colin's conception, values and ideological perception about the NCS are embedded in the excerpts cited. His view about the NCS is not aligned with what he thinks works in practice, but he rather views the NCS a good curriculum in theory. When he states *I try to practise OBE as far as possible* in reality he sees it (OBE) as an immensely laborious intellectual exercise to deconstruct his thoughts of the old system to conform to the new logic and understanding of the NCS. His comment *I try* can be interpreted as an epiphenomenon of following and/or applying the NCS in his teaching. In his mind there is a mental conflict between following the traditional path of the NATED 550 curriculum under which he received training as a learner and teacher. He finds it very difficult to assimilate the NCS and to make it part of his cognitive structure. Therefore, his mind loosely accommodated or compartmentalised the NCS, to be used when the occasion demands it. Ogunniyi (1988) refers to this concept as *the bridge principle*.

Drawing from my observations and interactions with Colin, what further exacerbated his struggle to implement the NCS are the problems/challenges he faced with issues such as training and resources. The latter is substantiated by constantly referring to many teachers' refusal to take ownership of the curriculum and showing disregard and/or no interest in the training programmes offered by the National Education Department. Also, other issues emerging from Colin's response focus on problems relating to the interpretation and its implementation of the complex terminology to define the curriculum. The latter surfaced constantly during the interview (discussed in the next sections). Matoti's (2010: 569) study on the *unheard voices of teachers and the curriculum* corresponds with Colin's views and found similar evidence. He asserted that such problems may lead to fears and concerns for teachers implementing the curriculum.

Based on the language he uses, Colin appears to be trapped in the past. Events in Colin's life under apartheid imposed on him intellectual, psychological and cultural constraints in applying the NCS. Colin's responses show that history can have both intended and unintended consequences. For this reason Merleau-Ponty (cited in Taylor, 2001:653) contends that understanding people should be conceived not as a way of knowing, but as a mode of being. Put differently, in order to understand Colin one needs to know where he is coming from and view his behaviour through the exteriorisation of his consciousness.

(iii) *Scarce resources*

When asked what he considers to be his biggest challenge in implementing the NCS, Colin consistently (like a stuck record) mentioned how a lack of resources made it difficult to teach effectively. At one stage he stated:

OBE does not really benefit learners from disadvantaged groups because you as a teacher then basically still have to develop all the materials, even to help them with projects.

On another occasion he had the following to say:

In fact I had to bring books, I had to bring resource materials, one learner in particular I see her face where she simply said to me: Sir, where will I get such information, the textbooks, the books at the library has nothing ... I don't have access to the internet; I don't have money to go and sit at the internet café.

There is a corpus of literature illustrating the difficulty teachers in South Africa experience in implementing the NCS because of a lack of scarce resources (Jansen, 1999; Matoti, 2010: 569). Resources can be regarded as an external locus of control, over which teachers like Colin have no control. Many teachers like Colin continuously complain that classroom innovations constantly fail as a result of a lack of resources. This may lead to the use of instructional or pedagogical practices anchored in a teacher-centred approach rather than a learner-centred approach, as prescribed in the NCS. Sandt (2007: 347) argues that the greater the teachers' knowledge of different teaching resources, the greater *freedom* a teacher has in choosing his/her teaching approach. This is vital to the planning of a lesson and the way it is carried out in a situated context.

Fullan (1994) points out that one of the consequences of teaching in a resource-poor or deprived school is the impact this might have on teacher decision making. He argues further that teachers might make curricular decisions that would keep learners occupied with menial tasks and problems associated with recommended textbooks. Also, teachers might typically apply pedagogical practices that seek confirmation of content (laws, principles and theories in science) and revision exercises rather than practices that seek to falsify primitive theories and principles. To apply the latter requires textbooks, workbooks, practical manuals and laboratory equipment. Ogunniyi (1978: 52) maintains that accomplishment of the aims and objectives of a new curriculum depends on consistent and cumulative exposure to appropriate materials presented in an appropriate manner. The essence of the NCS is to teach learners what science is (LO 2 & 3) and how it works (LO 1 & 3). In order to accomplish these LOs, learners must be trained to carry out activities that scientists undertake when doing their work. In so doing, learners not only carry out the skills but also acquire the aims of the NCS. Therefore, Colin cannot apply his experience gained from industry to expose learners to the real world of science, because the lack of resources makes the quality of the content ineffective.

(iv) Beliefs about the discipline of science and the content

Colin's belief about the discipline of science is a consciously held aspect in his teaching, as it is strongly influenced by his drive to produce good matric results. This phenomenon is highlighted throughout the interview, as he continuously refers to science as a *problem-based activity* but is limited by pressures from sources external to him. To substantiate the pressure he experiences from external sources, his philosophy about how he views the discipline of science is captured in the following excerpt:

In the workplace where I worked one need to be involved; if you want to know something you need to go and search for that ... in the new system I believe has objectives of drawing learners into constructing knowledge on their own.

According to Sandt (2007: 345), many factors might affect his behaviour and/or action as a science teacher that might deviate from his preconceived views about the subject. Even though he does not view science as a fixed body of knowledge (but as a body of knowledge consisting of interconnected structures of the universe), the pressure placed on him by

examinations (especially the matric examination) negatively influences the way he teaches the subject. The pressure for good matric results placed not only on him but on all Physical Science teachers throughout the country and the lack of resources interfere with his beliefs about not only the discipline of science, but also the way the subject is being thought. It appears as if he constructed mental models of viewing the teaching of the subject as a structured, fragmented activity that requires memorisation learning. The latter is observed in what he considers to be a very bad choice for a textbook:

When I started teaching my Grade 10s, 11s and 12s and preparing them and particularly the Grade 11s for the first NCS examinations in 2008 ... I discovered there were so many textbooks on the market; the school by then have purchased a particular textbook ... I said to my learners right from day one I can see it's useless because it just did not have the information required for the learners to be able to pass matric examinations.

His concern about good matric results is the main reason why Colin prefers the **Study and Master** textbook as an appropriate teaching tool for Grade 12. This textbook in particular focuses only on revision exercises (questions and answers with total disregard for conceptual understanding of concepts) centred on preparing learners for examination with no in-depth explanations on the processes of science. It is far removed from the learner's personal construction of scientific knowledge. At the centre of such teaching is the formalisation of the idea that science is a rote-learning activity with the aim of passing the examination.

In a constructivist philosophy (such as the NCS) the teacher views the mind as an interactive system which mediates sensory input to represent models of reality, thereby enabling both teachers and learners to *sculpt their personal experiences within tangible boundaries of our individual scaffolding* (Scott *et al.*, 1995: 5). Colin's long history with the subject during school and in industry helped him to construct images and ideas of science that view the minds of learners as being incapable of output that is regulated and controlled by a system interested in the processes of science rather than the product of science. This system, influenced by good Grade 12 results, forms the basis of Colin's decision-making process with regards to what he considers to be good teaching tools and methods of science. Many studies have shown a strong relationship between examination results and the teacher's beliefs about

the discipline of science and the choice of content taught. These two variables seemed to have a negative correlation with an external locus of control with the potential of probabilistically producing learners who are not adequately prepared for preparing for careers in science at university.

Edwin's transcript analysis

Section 1 (items 1 – 7)

Table 5.3: An ideographic analysis of Edwin's statements

Item/s	Units of meaning of Edwin's language	First elucidations	Researcher's notes
1	I grew up in Bishop Lavis, and am 48 years old. I have 26 years of teaching experience (Physical Science). I studied at the University of the Western Cape, majoring in Plant Pathology and Plant Protection. I completed my degree in 1984. The political climate dictated me to go into teaching as the field I was in was reserved for whites only. I've done <i>some</i> Physical Science in my second year at university.	He never intended to become a science teacher. He did <i>some</i> Physical Science in his 2 nd year. He is better qualified as a Biology/Life Science teacher. He calls himself a political activist and was asked by leaders in the anti-apartheid struggle to teach PS. At that stage he had no teaching qualification.	Major part of his life is spent under the apartheid curriculum. He received both his schooling and university education under apartheid (1979-1984).
2/3	I was left with few options but it was a requirement dictated by the political situation to become a teacher. I was not trained to be an educator, there was a need at the school I was sent to for PS, and I enjoyed it. It was actually a subject where theory could be reinforced by practical work to show learners you are actually talking truth.	He wanted to become a researcher or work in the private sector, but was forced into teaching with no training, because his field was reserved for whites only.	His entry into the teaching profession (PS) was politically motivated.

4/5	<p>My early years I spent at John Ramsey but left to a neighbouring school who offered PS (Bishop Lavis High). Despite poverty and difficulties I still made a choice to do PS. We had a unqualified PS teacher who left. The Maths teacher took over. The entire class had to read through the textbook from one page to where the bell takes us. This was the method for 3 years. No practical work. The content had no link with the real world.</p>	<p>His early engagement with PS as a learner might result in a negative perception towards the subject. His scientific training at university did not prepare him for teaching PS. As a learner he had a poor understanding of how a scientist works. The <i>what</i> and <i>how</i> about PS were not spelled out to him due to lack of practical work. At school the PS was fragmented, dry and uninteresting, etc.</p>	<p>His understanding of science learning and thinking operated at a very low level early in his life. According to Forgas and Melamed, (1966:5), he exercised adaptive behaviour because of the situation This was a common phenomenon for people trained under the apartheid curriculum (Green and Naidoo, 1998; Oginni, 1978:52).</p>
6/7	<p>My passion was to teach PS in a meaningful way and that has been the hallmark of my teaching. This school has been instrumental in teaching Physical Science educators in this whole Northern district since 2003. I am the facilitator and more senior people do the teaching for ethical reasons. It is the passion I have for Physical Science on a practical level</p>	<p>He places a strong emphasis on teaching meaningfully. This might imply an integration of practical work and theory as an approach to teaching and learning. He came across as a very passionate science teacher and the laboratory in which he teaches is well equipped with technology.</p>	<p>It is his objective in life to make a difference in the lives of young people learning the subject. He does not want a repeat of what happened to him as a learner to his PS learners.</p>

5.4.5 Biographical descriptive narrative of Edwin (age 49)

This biography represents Edwin's life as a learner, university student and teacher of Physical Science. In addition, the biography expresses concern about whether or not his history remains present in his consciousness for future engagement with the subject. Derrida (1967: 246) points out that historical appearance constitute the truth about our philosophy. Our philosophy dictates how we perceive things subconsciously, which is the aim of phenomenological research. Phenomenology aims to find the truth about **why we do what we do**.

Edwin grew up in Bishop Lavis (classified as a coloured neighbourhood under the Group Areas Act of 1966 under apartheid) situated 15 kilometres from Cape Town. It was in this densely populated area characterised by low-income families, sub-economic housing (red-face brick schemes), high illiteracy rates, gangsterism and high drop-out rates among learners, where he attended high school (one of two high schools in the area). Bishop Lavis high school was the only school in the area that offered Physical Science as a school subject. Edwin explains this in the following excerpt:

My early high school years were spent at John Ramsey which at the time did not offer Physical Science. I had to go to the neighbouring school, Bishop Lavis High that offered Physical Science. So there you can already see that there was a huge interest in Physical Science on my side despite poverty and difficulties. I made a choice and the decision to move to another school that offered the subject.

According to Edwin, the Physical Science curriculum at Bishop Lavis High was delivered, in his words, by *a highly unqualified educator*. The following excerpt serves as evidence for Edwin as he described his Physical Science teacher:

I found myself in a school where the Physical Science teacher I had was highly unqualified. The Physical Science educator at the time had to leave for Namibia and the Mathematics teacher had to take the Physical Science class.

Edwin further explained that the spirit within which the subject was offered was ancient and somewhat ossified. The syllabus was also fragmented, dry, obsolete and uninteresting. Edwin points out that Physical Science did not make any sense to him as

he had to learn most of the work through self-study with no understanding of its application or usefulness in real life. This is captured in the following statement:

His teaching method was, the entire class need to read through the textbook from one page to wherever the bell takes us. That actually was the method for three years. So we had no Physical Science; we actually became very good readers to the advantage of our Afrikaans and English educators.

Concerning the practical nature of the subject he stated: *we had no practical work, no explanation, because this is a person who taught mathematics but who also struggled to get through Maths 1 at university.* When asked about his school experience with Physical Science and whether it resulted in him hating the subject, he asserted that it only encouraged him to read more books that led him to complete the matric/Grade 12 (known at that time as Standard 10) examinations successfully.

In 1981 Edwin enrolled for a Bachelor of Science (BSc) degree at the University of the Western Cape (UWC), majoring in Plant Protection and Plant Pathology, against stiff odds, as he lacked a solid foundation in Physical Science. He had high hopes of becoming a researcher to enter the private sector or becoming a scientist that he dreamed about all his life. This dream slowly died as the political disputation in the country shaped and influenced the direction of his life. He obtained his BSc degree in 1984 and recalled that teaching was never a career choice. The following excerpt explains:

It (teaching) actually was not a choice, it was the requirement for the situation which I found myself in because I was not trained to be an educator in the first place. I was trained to be either a researcher or go into the private sector but ... both avenues were closed because of detentions in the mid 1980's. I could not continue with research and number two I could not go into the private sector because of job reservations.

According to Edwin, he was approached by leaders of the anti-apartheid movement and asked to report for duty as a Physical Science teacher at a school in his old neighbourhood that did not offer Physical Science. At the time of his appointment as a Physical Science teacher, he had had no teacher training. This is evident in the following statement: *Well, I did some Physical Science during my second year at university.* To his amazement the same educator that taught him was still at the neighbouring school and he

soon realised that there were many others like his ex-teacher placed at different schools to teach the subject. The following excerpt explains Edwin's statement:

When I entered the profession (teaching) ... the educator was still teaching at the neighbouring school and I found there was quite a significant percentage of similar teachers placed at different schools. So ... when I was approached by the political seniority at the time to go to John Ramsey High school and apart from educating and teaching I had a political role to play, that is why I was detained in the very first year of teaching at a school – that is when I realised that I need to stay in teaching because our learners encountered problems after school getting into universities, because they are not well prepared and from here my passion to do Physical Science in a meaningful way. That has been my hallmark of my teaching up till now.

The spoken language or statements made by Edwin represent his story (his life), within which is located the inner self, through which one can transcribe or describe his attitude phenomenologically. It would be futile to even speak of consciousness while ignoring the grave realities of the apartheid period, as they are intrinsically tied to issues relating to how he perceives the teaching and learning process. In the next section I provide an interpretive description of Edwin's experiences by drawing on Heideggerian phenomenology.

5.4.6 Interpretive narrative

Edwin's responses to items 1 -7 elicited multiple emotions and psychological cries of anger, disappointment, hopelessness and powerlessness regarding the impact of apartheid rule on his future. These transformations took place through a process of reflection. According to Bengu (cited in Dalamba, 2000: 44):

It is important that the conceptualisation of the role of education takes cognisance of the forces that have shaped education, knowledge-production and cultural reproduction in Africa ... The need is to ... engage in and encourage a set of contending discourses to challenge these hegemonic discourses.

According to Merleau-Ponty (cited in Taylor, 2000:653), our history always influences our outlook on life. Apartheid to Edwin continues to be a burning experience. Having

survived the destructive policies of apartheid, Edwin chose teaching as a career through which he recovered and redefined his life. Therefore, it is not surprising that his ultimate career choice definitely influenced the way he looks at the world and those around him. As a result I find it necessary to look at the following themes that emerged from Edwin's transcript:

- The brutality of apartheid;
- Edwin's first engagement with Physical Science;
- Edwin's reasons for entering the profession.

(i) *The brutality of apartheid*

As a young boy with his innocent outlook on life, Edwin had dreams of becoming a scientist. These are his words: *...there was a huge interest in Physical Science on my side. Despite poverty and the difficulties I still made the choice and the decision to move to another school.* Later in the same text Edwin defines the brutality of apartheid and its subsequent impact on his life:

I was trained to be either a researcher or to go into the private sector but both avenues was closed because of detentions in the mid-eighties I could not continue with research and number two I could not go into the private sector because of job reservations.

In view of the above citation, these experiences subconsciously created a manifestation of a negative mindset in Edwin's consciousness about his life, as his dream of becoming a scientist had to be suppressed. Foucault (1966) would have argued that this new shift for Edwin resulted from a reconstruction of his life that is tied to the relations of power that existed during that time of his life. His choice of career as a teacher therefore needs to be understood through an ontology of the self that provided new impetus to define his life. At that stage of Edwin's life there was no moral or ethical law that could free him from the apartheid's web of power, so to speak. Evans (2000: 177) argues that such phenomena (the way Edwin ended up in teaching) might influence his behaviour or thinking, since one's perspective is strongly influenced by the professional perspective of the outlook one has on one's professional career. Evans (2000: 177) points out:

I have defined professionalism as: an ideologically, attitudinally, intellectually, epistemologically-based stance on the part of the individual, in relation to the practice of the profession to which s/he belongs, and which influences his/her professional practice.

The dispossession of Edwin's dream – or put differently, the dreams stolen by the thieving brutality of apartheid – gave birth to a new life in teaching, something which Derrida (1967: 293) argues requires a re-education. He argues that this rebirth is slight and yet decisive. In South Africa many individuals (especially teachers) were stripped of their dreams. Teaching was reserved for coloureds and careers in science (medicine, engineering, astronomy, etc.) were reserved for whites only. Edwin referred to this as *job reservation*. That is why *place/lived space*, according to Merleau-Ponty, is so vitally important because it shapes us, moulds us and eventually controls our future.

Today, after two decades after the dawn of democracy, apartheid and its brutality are still at work. As long as there are distances that separate us from **who we are from whom we want to be**, these are signs that the cruel force of apartheid still survives in our consciousness. Apartheid carried most white people with it, but not necessarily the dreams of all people. Throughout the world today there are so many people who bear witness to Edwin's experiences, who feel the way he feel or think the way he thinks. My own personal experience of living in South Africa is one such experience. In the most striking sense most teachers attribute their choice of teaching as being the consequence of an external locus of control shaped by the brutality of a system (apartheid) that dictated and shaped their lives, and stripped them of their dreams. Therefore the historical section about Edwin's life and how he ended up in the profession represents his consciousness of how Edwin might perceive the world of teaching. In the next section I will discuss Edwin's first engagement with the subject.

(ii) *Edwin's first engagement with Physical Science*

This section focuses on Edwin's first encounter with Physical Science as a school subject and the subsequent predispositions and intellectual curiosity stimulated during his days as a learner. It is at the school level where the foundation, skills and processes of an understanding of science are laid. Therefore, the descriptions and reflections of Edwin's

experiences provide a framework for how he perceives the subject. Husserl (1970) pointed out that a person's experiences and life world consist of their everyday context and any problematic situation can be traced to it. Edwin's first engagement with the subject is very important as it may illuminate and clarify certain issues most central in/to his teaching of the content.

Under apartheid most science teachers followed a prescriptive, authoritative and content-laden approach, resulting in many learners losing interest in the subject (Jansen, 1999; Ogunniyi, 1976, 1986, 1987). Drawing from my own experience, I can remember the prevalence of learner-bashing and a discourse of derision where learners had to do what pleased the teacher. Edwin's entire thinking and perceptions about science are encapsulated in the following excerpt:

The teacher's teaching method was the entire class need to read the text from the book from one page to where the bell takes us. This actually was the method for three years so we had no teaching of Physical Science. We actually became good readers to the advantage of our Afrikaans and English educators...

The crux of the above comment by Edwin represents his underlying ontological disposition towards reality that created frameworks in his mind that are influenced by how he perceived the subject (Scott *et al.*, 1995: 5). Scott *et al.* further point out that any new incoming sensory experiences Edwin might have are filtered through his perceptions of the knowledge he acquired as a learner of Physical Science. Edwin contended that the content he was exposed to had no social meaning. The following excerpt represents this claim: *the content you were trained in at that stage had no relation to the application of the knowledge of the real world.* The perception Edwin developed through his experience created what Forgas and Melamed (1966: 4) refer to as *adaptive behaviour*. His image of science – or put differently, his understanding of the nature of science – was warped in the sense that he believes that *science is about doing* and not about theory. The process or nature of science has structure. This framework of thinking is evident in his explanation of why he entered the profession:

...it is one of a very few subjects where one can practically reinforce the theory, so one can always relate back to the practical side and show learners that what you are talking about is truth which is very difficult with other subjects.

He used the words **relate**, **back**, **talking** and **truth** in the excerpt above. The picture he paints about how he perceives the subject is somewhat fragmented and obsolete in the way he used the word **truth**. In science the phenomena becomes the theory and not vice versa, provided learners discover how to arrange phenomena in a self-illuminating order or structure. Edwin's perception therefore is not aligned with the processes of science. Paraphrasing Husserl (1970), Edwin's perceptual life world of Physical Science can be extracted through his experience with the subject in order to unveil his epistemic thoughts embedded in his consciousness. O stergaard *et al.* (2007:96) describe the concept of *nascent logos*, which Heidegger and Merleau-Ponty defined as a meaning being born in our awareness as if by itself provided, *i.e. he is present to the things he perceives*. The place or context within which Edwin found himself (under apartheid) are, in Merleau-Ponty's terms, present to the perceived ideology of the subject.

(iii) *Edwin's reason for entering the teaching profession*

It was never Edwin's intention to become a teacher. The only truth about his reason for entering the profession is that teaching for him was never a choice. Edwin explains how he ended up in the profession:

It actually wasn't a choice, it was the requirement of the situation which I found myself in because I was not trained to be an educator in the first place. I was trained to be a researcher ... I could not go into the private sector because of job reservations.

When Edwin entered the teaching profession in the early 1980s, the career had many benefits. Unlike today, teaching was a highly credible and respected occupation. Parents and learners honoured teachers for their role, support, interest and meaningful contributions they made to the youth. I recall that as a child, if a teacher lived in the same road as us, we had to call him *Meneer* (Sir). My mother would always remind me *moenie vergeet om vir meneer te groet nie [do not forget to greet your teacher]*. Teachers also received a very good salary and other benefits such as holiday leave three times a year. This could be one of the reasons Edwin decided to stay in the profession and actually enjoyed it. He said *there was a need at the school. I was sent to for Physical Science and I actually enjoyed teaching the subject*. He also stated that his field of work (as a

researcher) was reserved for whites and that teaching opened the door to earning an income. Edwin further expanded on how he saw his role as a teacher to assist learners in gaining a better understanding and preparation for university. The following concerns regarding Edwin's ability as a Physical Science teacher and the subsequent consequences of his teaching need to be highlighted:

- He entered the profession with no teaching qualification;
- His content knowledge was a grave concern as he received training in Plant Pathology. It is fair to say he would have been a better Life Sciences teacher than a Physical Science teacher;
- His previous experience of Physical Science at school level and his training at the university did not prepare him adequately to be a Science teacher. When asked why he decided to teach Physical Science, he mentioned that he got *some training* during his second year at university. Adler (cited by Scott *et al.*, 1995: 8) argues that one's orientation of life is determined by our upbringing and becomes more well-established as one develops;
- The way that the latter impacted on the way in which he views the teaching and learning process will be discussed in the next section, which addresses his responses to items 8 -31.

Section 2 (Items 8 – 31)

The National Curriculum Statement and its implementation

Table 5.4: An ideographical analysis of Edwin’s statements

Item/s	Units of meaning of Edwin’s language	First elucidations	Researcher’s notes
8	I teach: Two: Grade 10 classes PS/35 learners/group Two Grade 11 classes PS/31 learners/group Two Grade 12 classes PS/30 learners/group One Afrikaans and one English class per grade	His teaching workload is within the DOE policy prescriptions. However, his assessment responsibilities might be too much apart from his administratively duties.	Workloads are uncontrollable by nature (Weiner, 1992). <i>Intensification</i> of teachers’ work might lead to <i>self-regulating tendencies</i> of teachers as coping mechanisms (Hargreaves, 1992). Admin burden might result in him having less time to reflect.
9/10	The shift to a new education system requires that every science facility in every school had to be brought up to a functional level. This means 95% of all schools required laboratories. In the previous system we were required to conduct 10 experiments on Grade 12 level. So the first thing that went out by the window was prescribed experiments. This was replaced by preferred investigations. Releasing government from providing science labs. In the last 5-6 years not a single piece of equipment has been sent to any school. No more expectation and no prescription of practical work. We are moving away	Government’s inability to deal with the new ideals of educational change caused instability in our schools. All highly resourced schools were left untouched. The serious concern for the lack of practical works in PS was slowly phased out of schools. Evidence of deficiencies and gaps in quality teachers delivering the curriculum. Expectation of	Fullan (1991) educational change depends on what teachers think. Edwin’s consciousness and morale are low. The primary concern for change in the curriculum was not met; instead it went from bad to worse (Van Driel, 2001). Lelliott <i>et al</i> (2009) argue that there is a disjunction between promulgation of policies and implementation.

11//13	<p>from practical work.</p> <p>No PS teacher should have a problem with content and that is where the emphasis was at that point. The workshop concentrated on content and that is not our problem. We got teachers that have a problem with content and that are utter nonsense. The emphasis should have been on how am I going to teach this? How am I going to assess the skills? Because in the past we followed the route that most of us at university had to do, that was to confirm the known in practical sessions.</p>	<p>teachers was not met as school environments did not met their needs.</p> <p>The emphasis in training was more on content reflecting the strong legacy of the previous regime. Some scholars refer to as the superficial cleansing of the old curriculum (Jansen, 1999; Le Grange and Beets, 2009). Edwin's current reality then was not addressed as he needed training in the delivery of the content. Therefore he did not value the training.</p>	<p>Jansen (2001) refers to the kind of experience that Edwin had as the policy-reality disjuncture. Edwin's needed more help on how to teach the new content in the curriculum.</p>
12/14/ 15/17	<p>OBE is a very good approach in theory. It can only work ... if every science facility is brought up to a certain level. Once every science facility is brought at a minimum level then it will work. OBE require that learners have a wide variety of resources. Our learners here are slightly fortunate compared to schools in our vicinity. Our learners have access to the internet. I practice OBE, I also make sure that learners are provided with all the resources.</p>	<p>Edwin's school has a state of the art science laboratory making science practical work easily accessible to his learners. He used the words 'slightly fortunate' and 'OBE is good in theory'</p>	<p>It is difficult for him to change his philosophy of how he understand learners learn. He is still trapped in his way of learning, as Cohen (1990) would make the point. When a new curriculum or methods are introduced, teachers reach out with their own professional selves. Especially their old</p>

20/21	<p>Also at this school we take the best out of the previous system so we still hammer on tests with strict memorandums. We still do practical work that confirms the most important part of the chapter. The practicals follow the same protocol as in the old regime; we record the details and the learner records all the detail in a report. How I cover the content is my decision.</p>	<p>He is still stuck in his old ways of doing things. He had 16 years of experience in the old system. He still uses memorandums. He did not mention rubrics. He evaluates learners on the basis of facts and not for showing an understanding of the process of science. Contradicting views towards practice and theory. Edwin displays two personalities i) academic man and ii) personal self or teacher.</p>	<p>ideas and practices, beliefs, etc. (Cohen, 1990; Jansen, 1999; Christie, 1999; Green and Naidoo, 1998; Kriek and Basson, 2008)). He speaks on behalf of others, but whether it includes himself is not evident.</p> <p>Constructivist reality dichotomy (Scott <i>et al.</i>, 1995)</p>
22/23 24	<p>Envisaged qualities of NCS are all noble, but one needs to really implement them at this school we</p>	<p>He regards himself as meeting the criteria outlined in the NCS.</p>	<p>He appear to have a misunderstanding about the</p>

	<p>implement them most of it. We have a science club and show interest in science beyond our school. Most of the intervals are spent in the laboratory with learners making appointments for me to look at their practical reports. You don't have to implement them but you can do it piece by piece because every bit counts.</p>	<p>According to Edwin, he implements all or most dimensions of his work content, practical work, assessment, science and society. He considers depth of content as very important.</p>	<p>theory and practical aspects about the NCS and how it views the teacher standing in the science classroom.</p>
25/26/27	<p>The old Brink & Jones, and Pienaar & Walters were the only two good textbooks that were on the market. What was important about those textbooks was that external examiners used those two textbooks to consult. Now every textbook have critical shortcomings being the result of the majority of failures in this country because none of the textbooks are at the level of examiners. These textbooks are of no use.</p>	<p>The textbooks did not meet the needs of the learners to pass Grade 12. There is a misalignment between textbooks and the NCS. Edwin uses the examination as a benchmark to rate a textbook, which is why he refers to the old textbooks (e.g. Brink and Jones) as good textbooks.</p>	<p>He ignores the most important criteria to evaluate textbooks such as of reader friendliness, writing style, language, depth and scope of content, and importantly its alignment with the NCS.</p>
28/29	<p>You don't expect to have a lab like this and a facility like this and equipment like this at the school and this is because of the passion that I have for teaching PS on a practical level. My learners work with high-tech equipment... Practical work is an ideal leveller in the PS classroom because learners start to appreciate each other. The top learner no longer looks down on the learner that does not achieve because he/she is</p>	<p>He has a passion for practical-based science teaching. Learners from poor socio-economic background are fortunate to have such science facilities. Learners are well prepared for practical work that goes to university. Learners are</p>	<p>Kaunda and Ball (1998) point out that South African schools are characterised by inadequacies such as under-preparedness of learners in various aspects of science, lack of practical work and so forth. Practical science is crucial in</p>

	<p>dependent on that learner that is the guy that does the practical. So you have the harmony and the interdependence that comes out in a practical session. We do a lot of practical work. As a matter of fact I've had some of my learners coming back to tell me that in their first year the equipment they have used at university is so archaic compared to what they have done particularly in the linear air tract...</p>	<p>exposed to scientific skills and process. He develops learners' understanding through practical work. Through such activities he develops a culture of scientific thinking and practice at school level.</p>	<p>promoting learning. Edwin's passion for PS drives his teaching – which Nyagura (1996) describes as an effective learning environment. Practical work reflects the application of practical skills, understanding of scientific concepts and process (Ogunniyi, 1978).</p>
30/31	<p>You cannot finish your syllabus (Grade 12) in one year teaching it properly during the allocated time. We use extra time like Saturdays and the school holidays to reinforce already taught content. We use extra time not to cover new content only to reinforce it. Using this model we get through the syllabus. Other schools spread the Grade 12 syllabus over three years.</p>	<p>Under very difficult conditions and excessive pressure he aims to finish the Grade 12 PS syllabus. He sacrifices his Saturday's and public holidays to assist and give learners extra support. He uses what he calls reinforcing or put different consolidation exercises to prepare learners adequately for the Grade 12 examinations</p>	<p>His entire focus is on completing the syllabus to prepare his learners adequately for the exam. He is less concerned with whether they understand the processes and science which is the focus of LO 1 and 3 for the NCS</p>
32/33	<p>In 2008-pass average -60% In 2009-pass average 60% In 2010-pass average 48%. We have over-taught our learners last year at school.</p>	<p>Compared to national average pass rate, his pass averages are aligned with national average. Edwin considers the poor pass</p>	<p>He is conscious of the importance and external pressures of getting a good pass average for his subject.</p>

	<p>He comes to school at eight o'clock and get taught until 14h45, he go home and come back at 17h00. That was Monday-Thurs. Saturdays they arrive at 08h00 until 12h00. You ask me when does the learner have free time to study himself?</p> <p>PS is dying in many schools and nobody notices that and the major reason is we are losing educators, especially in township schools. In ex-model C and private schools PS is compulsory.</p>	<p>average as his learners being overworked. It appears as if he is spoon-feeding his learners.</p> <p>Edwin alludes to high attrition rates among educators resulting in fewer learners doing PS</p>	<p>Grade 12 teachers are under pressure to perform and produce good matric results, especially PS (Ogunniyi, 1986, 2005).</p>
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5.4.7 Descriptive narrative

The findings emanating from Edwin's transcript (Table 5.3) will be discussed from an objective standpoint. I will first present a descriptive narrative using mostly Edwin's own representation of his experiences and reflections to distance myself from his viewpoint. To put it simply, I will try to find my ultimate ground by returning to *the things themselves* (Groenewald, 2004), as stated by Gordon. The phenomenologist must carry out a transcendental reduction to reach the level of experience that is purely given (Tan *et al.*, 2009; Taylor, 2000).

The following themes emerged from Edwin's transcript:

- His views, feelings and perceptions of Physical Science;
- His pedagogical practice as a Physical Science teacher (content/syllabus);
- Views he holds about the FET NCS (curriculum and assessment);
- Views he holds about resources and textbooks.

(i) *Edwin's views, feelings and perceptions of Physical Science*

Edwin teaches only Physical Science to Grades 10-12. He teaches the subject in both English and Afrikaans as the medium of instruction. Edwin points out that the demise of apartheid changed the educational landscape in South Africa drastically. He maintains that Physical Science was affected more negatively than any other school subject. He expresses concern about this:

This [referring to the demise of apartheid] had huge logistical as well as financial implications for the powers that are in government, because it means that virtually in 95% of all schools new laboratories had to be built. ... now bringing all science facilities in all schools up to a certain level requires a lot of money ok, so the first thing that went out by the window was the prescribed experiments. In its place came practical investigations that weren't limited to a laboratory set up. This immediately released government from providing equipment. We are moving completely away from practical work.

When he was asked to respond to the challenges associated with the shift from the old system (NATED 550) to the NCS, he had the following to say:

Yes, I still do practical work. .. they (learners) use the equipment here. I don't allow them to use coke bottles and those things, they all use the apparatus they need. As a matter of fact from Grade 11 onwards they work with high-tech equipment...

In the above comment Edwin expresses himself as an advocate of teaching Physical Science practically. The following quote further corroborates his view on the delivery of the curriculum content: *it is only when the learner is exposed to a variety of practicals done in the laboratory to confirm existing knowledge, from that basis he can proceed and investigate new phenomena.* As a learner of Physical Science, he (Edwin) was rarely introduced to science as being a very insightful, creative and practical activity. Instead, he experienced the culture of science as a learner as a highly rational activity based on the rote listing of facts. It is for this reason that he stated as a learner, in the science classroom: *the entire class had to read through the textbook ... No practical work and the content had no link with the physical world.* His strong belief in teaching practical science is rooted in his history as a learner who did not have the privilege of being taught the processes of science. He is drawing on his past to ensure that he does not do to his learners what his Physical Science teacher did to him. Therefore the following expression explains his interest in practical work: *if a teacher only does the bare minimum of two practical investigations prescribed per grade, you can consider that your education will be failing the learners.* He describes his learners as *logicians at work.*

(ii) *Edwin's views about the shift to the FET NCS*

Edwin considers the shift from the old traditional way of curriculum delivery to the FET NCS as *nothing new.* The following extract from his transcript explains his view:

I mean there is nothing new to us as Physical Science educators in that the whole approach our whole teaching and our field has to do with skills, graphing skills, documentation skills, thinking on different levels, applications. These skills that is written in the NCS has always been part of our teaching – we just never emphasised it so much.

In Edwin's view his teaching strategies under the NATED 550 curriculum were very closely linked to the expectation of the NCS. He points out that the curriculum theory was deemed unimportant and less emphasis was placed on it. Teachers in the old system were more

focused on, or pulled towards, the *doing* aspect of the curriculum as opposed to a need to understand the complexity of theoretical constructs associated with the NCS. For this reason Edwin states: *These skills that is written in the NCS has always been part of our teaching – we just never emphasised it so much.*

He described the training offered by the Department of Education to teachers from the old system to prepare for the implementation of the NCS as an *utter waste of time*. According to Edwin, the emphasis of the training leaned more towards consolidating the content knowledge that Physical Science teachers struggled to grasp/understand. He stated *no Physical Science teacher should struggle with understanding the content*. He pointed out that what was of importance and should have been taught was, in his own words: *How am I going to teach this (content)? How am I going to assess the skills that need to be developed?* In other words, his needs and expectation of the training were never met and he regarded the training as minimal (see Brodie, Jina and Modau, 2009: 21). Edwin comes from a system where he spent most of his teaching and learning on memorisation, where form and content were the most important elements. In science factual knowledge is regarded as a considerably important means through which transformed meaning is established in solving problems by using formalised mathematical manipulation. Apart from the practical work, most of the methods used were very primitive, archaic and of no interest to learners and the motivation for learning science was mostly extrinsic. Edwin reported that it was necessary to make the shift/transition from learners being **spoon-fed** to helping learners construct meaning. It was how to make an **entire paradigm shift** that he found difficult to implement.

When asked whether FET added more value to the teaching of the subject, Edwin responded that the quality of learners entering the FET band restricts him from implementing the curriculum effectively. The following excerpt corroborates this statement:

The emphasis is on the application and development of skills, so learners come here lacking, not even having basic skills for our subject but basic skill for their own survival they don't. We frequently take out learners that cannot functionally read or write ... you give them a page to read they can't...we are performing miracles in matric.

Placing this quotation in context of his previous views (expressed in previous comments), there appear to be a number of constraints impacting on his role as a Physical Science teacher and active implementer of the NCS. For example, the poor reading ability of learners entering his classes presents constraints for him to implement and comply with the demands

of the NCS. For example, the NCS aims to produce independent and critical thinkers, but with learners with poor reading abilities he states that he is expected to **perform miracles**. His views and reasoning resonate with the work of Stein, Grover and Henningsen (1996), who found that higher-order tasks become less important and are likely to decline at the implementation level as teachers have to focus on the (literacy and other) challenges they grapple with as well as finishing the syllabus

Assessment, which he considers to be his biggest challenge, is no longer a problem for him. He attempts to maintain a balance between developing the cognitive level of learners and the quality of curriculum delivery. He points out that the NCS continues to place a lot of emphasis on tests and examinations. The following excerpt serves as evidence for this claim:

At this school we take the best out of the previous system, so still hammer on tests with a strict memorandum to mark. We still do every practical that confirm the most important part of every chapter, we still do that and we do them in the same way. Number one we record the details and then the learner converts all the detail into a report.

He regards himself as a teacher who actively fulfils the prophecy of change by scripturally following the standards and demands spelled out in the NCS. When asked what his views regarding the expected demands of the NCS are and its impact on him, he stated:

They are all noble qualities but one really needs to implement them. At this school we implement most, we have a science club through which learners who shows a great interest in science is beyond our school works addressed. We never lose touch with them, so we allow them to come here in the afternoons on a regular basis to talk to our learners, or do work whatever. ... so that passion that I have for helping them brushes off on them, because they are even prepared to sacrifice their breaks to come in here so those are the noble qualities and you can make a success if you envisage that.

I give the above quote at length as it describes his limitations that ceaselessly elucidates his focus and what he values as important in the delivery of the curriculum. In essence Edwin does not give a lot of attention to the **depth** and **scope** of the content, neither in learner participation nor in group work. The focal point of curriculum delivery in his view is centred on completing his syllabus by following a teacher centred approach as opposed to the learner-centred approach prescribed by the NCS. There appears to be a disjuncture between the

expectation with respect to the delivery of the NCS and the reality within which Edwin finds himself. Even though Edwin does not practice OBE as described/emphasised by the NCS, he is making small strides to leave behind his old habits and thoughts structure under the old system in favour of the NCS. In this section of the analysis I attempt to identify Edwin's actual classroom practice as well as the disjuncture between the intended and enacted curriculum. Worthy of note is his perception of the NCS and how he constructs and negotiates his teaching activities and meaning on the basis of how he perceives the NCS.

(iii) Edwin's views about textbooks and resources

Items 22, 23 and 24 focus on the quality of the different Physical Science textbooks on the market in the FET phase. Edwin takes issue concerning the quality, relevance, appropriateness, scope and depth of the textbooks. The following excerpt describes Edwin's views and perceptions of the textbooks:

The problem with these authors is they all jumped the gun and they wrote these books interpreting the NCS document to the best of their ability prior to the implementation of it with the result that every one of them had critical shortcomings. Being the result of the majority of failures in this country because none of them are at the level of expectations of the examiners.

Edwin also affords the high failure rate in Physical Science as being directly related to the poor quality of the textbooks. He points out further that the vast majority of the Physical Science textbooks do not meet the needs of both teachers and learners to teach Physical Science effectively. When he was asked to share his views about the textbooks used under the apartheid curriculum, he had the following to say:

They were pretty good textbooks, but what was important about those textbooks was that examiners had only these two textbooks to consult. What are you going to consult when you get the contract to set up a question paper for matriculants? You are going to look at what textbooks are used in schools and if there are only two textbooks, you are only going to consult two textbooks. You only have two textbooks to look at to get an idea of what educators are teaching...now what do look at now in Grade 12? Twenty books.

Edwin's critique of the quality of the various textbooks is based on how well the learners perform in the matric final examination. Furthermore, he raises concern about these

textbooks because in his view most textbooks available for teachers to teach the FET NCS are misaligned with what examiners expect learners to know in the Grade 12 final examination. He argues that examiners have a wider variety of textbooks to choose from when setting examinations. He regards the old Brink & Jones and Pienaar & Walters textbooks as **pretty good textbooks** because examiners only consulted these two textbooks when they set examination question papers. Teachers could religiously follow and teach the content to prepare learners for the examinations. He did not mention anything about the learner/reader friendliness of the language, nor did he discuss/critique the quality, relevance and appropriateness of the activities, cognitive levels of difficulty, practical application or multi-step problem-solving procedures found in the textbook. Instead, in his view a good textbook is predicated on the notion of how well a textbook prepares learners for the Grade 12 final examination. Furthermore, he expresses no concern about whether the textbook meets the demands prescribed in the FET NCS such as integration between subjects including mathematics, life science, geography, and so forth as well as vitally important curriculum guidelines such as conceptual progression and conceptual coherence in the content between the respective Grades (10-12).

Edwin also pointed out that he was approached by the chief curriculum advisor of Physical Science in the Western Cape as one of three teachers handpicked to write a textbook for Physical Science that addresses all the shortcomings of the textbooks currently in circulation. On closer inspection of the materials he presented to me, I discovered the entire section of the book he was instructed to write is in the form of revision exercises that focus only on mathematical integration and problems related to the content. In his section of the work (Mechanics) he devoted very little time to developing the conceptual understanding that learners struggle with nor did he address LO 3 (Science, Technology and Society) and LO 1 (Scientific Investigations and Problem Solving) central to the FET NCS. It is disappointing to note that the materials which he considered to be addressing the needs and shortcomings of the other books took the form of question and answers.

The school where Edwin teaches is a well-resourced school with a state of the art laboratory. He said:

our learners here are slightly fortunate compared to other neighbouring schools in the vicinity, but if you just take the average school in the vicinity here, classes are 45 to 50 that's the sizes here. Our learners come from impoverished backgrounds here and the only access to the internet they have is probably at our school and at other schools it is non-existent.

He also brought to my attention that the school where he teaches is occasionally used by the Department of Education to provide teachers with training in practical work, where his role during these training sessions is that of a facilitator. This speaks of the proficiency and efficiency of the teaching environment within which Edwin teaches. I will now turn my focus to a interpretive narrative of Edwin's views.

5.4.8 Interpretive narrative

(i) Edwin's conception of Physical Science

Edwin's convictions, challenges, views, perceptions and feelings towards Physical Science as a subject generate the following question: What is his thinking behind these responses when he narrates his experiences as a learner and teacher of the subject? The following comment provides an insight into this question:

...virtually in 95% of all schools new laboratories had to built ... bringing all these facilities in all schools up to certain functional level requires a lot of money. So the first thing that went out by the window was prescribing certain experiments ... and as a matter of fact in the past 5-6 years not a single piece of equipment has been sent to any school, not even a test tube.

In the above quote he revisits the burning and deeply troubling recollections of his experience under apartheid. Two decades after the demise of apartheid he still witnesses its legacy and scars on the life of his learners. Furthermore, subconsciously he finds it difficult to break the glass ceiling that apartheid has placed on his thinking to free his learners from the same interminable unhappiness he experienced as a learner. To him apartheid was not only powerful but also effective in psychological, social and cultural ways. For this reason he stated: *... bringing all these facilities in all schools up to certain functional level ... and as a matter of fact in the past 5-6 years not a single piece of equipment has been sent to any school, not even a test tube.* In his view he witnessed how his learners are being deprived of a quality science curriculum and now sees history repeating itself.

As a teacher caring about the quality of the subject at a national level, he sees how the school science laboratories across the country lie in ruins when he says: *95% of all school science facilities need to be brought up to functional level.* In his mind's eye he sees the apartheid power web and how the bulk of the country's Physical Science teachers lack the basic requirements to teach Science practically and in so doing follow the prescribed NCS. In his view the process of transformation is too slow and is yet to uplift the thoughts of teachers beyond the limits and boundaries of apartheid thinking. In Roth's (1981) view, Edwin raises concerns that the bulk of science teachers (95%) in the country might operate in a paradigm that places firm limits on their teaching and prevents them (as a result of poor infrastructure and a lack of laboratory facilities) from presenting the knowledge of science in a structured and meaningful way. Derrida (1967:38) would describe Edwin, as someone crying out against the historical totality of apartheid's psychological and social order intended obstruct the future of Physical Science.

Edwin's framework of thinking (and that of many other teachers under apartheid) and his ideas of the present were developed in earlier years under apartheid through what Foucault (cited in Roth, 1981:36) refers as *historical a priori*. According to Edwin, the future of Physical Science looks bleak when he weighs the challenges he (and many other teachers in the system) face such as poor infrastructure and support in the form of training and resources against the expected demands of the FET NCS. At times he felt vulnerable and intolerant toward these influences as they informed and shaped the way he was taught.

When asked how he ended up in the teaching profession he responded:

... the only choice I had was to go teach with my qualification. I then started out in Physical Science because I've done some Physical Science in my second year and I did this at UWC during the difficult years of 1980-1984.

He saw (his life teaching) Physical Science as an opportunity to reconstruct his life and to add value to revolutionary struggles of young people and generations to come. He asserts: *it actually wasn't a choice – it was the requirement of the situation which I found myself in.* As a learner he experienced overwhelming fear, intimidation and effort to pass the subject, as he stated: *the entire class needed to read through the textbook from one page to the wherever the bell takes us ... the content made no link and whatever I knew about the subject was self-taught.* As a learner he was forced to break the constant cycle of problems and

barriers. For example, as a learner of Physical Science he was largely *self-taught* or did a lot of self-study and now he wants to use his experiences to support and inspire learners who come from similar backgrounds. His experiences can be described in Heidegger's terms as: *coming to a clearing of the winds* (Conroy, 2003:4). This is a way to re-connect with his past with an enlightened understanding of what is going on around him in the Physical Science classroom. Despite his past, he is still faced with the challenge of having to teach his learners with confidence and passion. His role as a Physical Science teacher is to uphold the value of the subject and at the same time influencing economically deprived learners from understanding what a real scientist's job entails work. In so doing he is encouraging his learners to excel in the subject. The following excerpt corroborates this point:

I had a political role to play ... at the school I then realised that I need to stay in education because our learners encountered problems after school getting into university because they are not well prepared and from there he passion to do Physical Science ...

Edwin saw his responsibility and role as a teacher of Physical Science to be related both to himself and to his community primarily to establish and promote Physical Science as a school subject. This does not come without a price as he has to think daily against the grain of how he was socialised intellectually under apartheid. In so doing, Edwin appears to (re)construct the image of teaching the subject as **a selfless service** and, according to Dewey (cited in Higgins, 2010: 435):

Any individual has missed his calling, farmer, physician, teacher, student, who does not find that the accomplishments of results of value to others are an accompaniment of a process of experience inherently worthwhile. Why then should it be taught that one must take his choice between sacrificing himself to doing useful things for others, or sacrificing them in pursuit of his own exclusive ends, whether the saving of his own soul or the building of an inner spiritual life and personality?

Throughout Edwin's responses with respect to how he views Physical Science, he keeps his eye constantly on the **political scene**. Almost every response relating to the subject is loaded with political phrases. Caloma (2011) avers that one's epistemic conceptualisation of reality is found in a one's life history navigated in one's experiences. I would argue that Edwin's experience of Physical Science under apartheid can be compared to what he witnessed happening in the schools where he taught. He still continued to experience the harsh realities of apartheid almost two decades into democracy. His responses reflect the need for debate

around the still prevalent existence of apartheid in what have been historically called *disadvantaged schools* and the hegemonic discourses which influence the way he looks at Physical Science. In the next section I will turn my attention to the shift and implementation of the NCS.

(ii) *The shift to/and the implementation of the NCS*

The constitutional goals of high knowledge and high skills prescribed in the NCS are not evident in Edwin's descriptions of his practice as a Physical Science teacher. As Jansen (2001) and Green and Naidoo (2010) put it: *policy is not always practice*. The following excerpt explains my assumption:

OBE in theory is a very good approach. It can only work ... if every science facility is brought up to a certain level. Once every science facility is brought at a minimum level, then it will work. OBE require that learners have a wide variety of resources.

Even though Edwin expresses concern about the lack of resources in most schools in South Africa, the school where he teaches is well resourced. In his school he and the learners have access to textbooks, computer technology such as an interactive whiteboard, internet facilities and a well-equipped laboratory. His classroom environment provides the platform to follow the constructivist approach prescribed in the NCS. Brodie *et al.* (2009: 20) point out that in a constructivist environment learning takes place when the prior knowledge of the learner is restructured and reorganised in a more powerful knowledge structure. The role of the teacher is to help the learner achieve the latter through the type of activities and tasks s/he sets. Environments conducive to learning (such as Edwin's workplace) promote and foster the development of such skills (see NCS, 2008). From his description of his experiences with the NCS, it appears that Edwin's focus is on preparing learners for examination. Therefore, it is fair to assume he is not applying the NCS daily in his classroom. The *ideal self* in Edwin denounces the old curriculum, but the phenomenological attitude thwarts the pathway to the new curriculum (NCS). For this reason he stated: *OBE is a very good approach in theory*. Precisely for this very reason his thoughts, oppositions and associations with the apartheid structures can be described as not only dominating his perceptions of Physical Science but actually justifying them. In his own words, he spends his weekends and school holidays *reinforcing the content to his learners*. Therefore, he stated that he still follows *the old*

system by hammering on tests and memoranda and that he also *uses the best of both systems (NATED 550 and the NCS)*. Instead of restructuring and rearranging his classroom activities, tasks and assessment instruments to promote higher-order thinking skills and independent learning, he places a lot of emphasis on the old ways of doing things.

Petrovi (2011) would describe Edwin's consciousness as that of someone whose thoughts and ideas are trapped in the past. It appears as if his mind is constantly oscillating between the present and the past and he ends up unconsciously recalling memories of his past under apartheid. The theories he draws from to teach are made explicit in his narration of his life as a learner in the following extract: *I strictly follow the memorandum and do practicals the old fashion way*. He operates in a web of social power relations that imprison his thinking and one can almost say that his unfamiliarity with the NCS causes him to act in a transparent (unaware) way of continuing the legacy of the apartheid curriculum.

This is further explained when he pointed out that OBE will only work if all schools have fully functional laboratories. The old system was an examination-driven one where tests and memoranda were the centre of teaching and learning. Kriek and Basson (2008: 70) investigated the implementation of the FET Physical Science curriculum and found similar evidence and pointed out that, in most cases, teachers teach old examination question papers and example question papers to coach learners for the examinations. Because of the heavy pressures to obtain good pass averages and high throughput figures, teachers lose sight of the LOs, ASs and pedagogical demands set out in the NCS documents and follow what Heidegger called the *hammering* principle. Heidegger argued that we change the way we hold a hammer at the point when we realize that the hammer is not doing what we intended to do. As a coping mechanism, a teacher such as Edwin follows the old way of teaching, where the focus is mainly didactical and uses approaches such as tests and memoranda in order to produce good results

His response to the question of how he experiences the NCS is captured in the following comments:

On Saturdays mornings we reinforce the content taught in the week. At the end of the term during the vacation we have one week of reinforcing the content done in the quarter. There are other school around here who do it in a different way. They start to cover Grade 12 content from 10 and onwards... That is what happens in ex-model C schools. They get away with it, but you just try to that at some of our schools then you will

find the education department by means of subject advisors clamping down on you.

He continues:

At this school we take the best out of the previous system, so we still hammer on tests with a strict memorandum to mark. We still do practical work that confirms the most important part of every chapter we still do that and we still do it in the same way...

It is extremely difficult for him to change his philosophy about teaching, although he professes to be an advocate of change. It is his perception or understanding of how learners learn that dominates his pedagogy of rote learning. Cohen (1990) would argue that he is still trapped in his ways of learning science under apartheid. When a new curriculum is introduced that demands a pedagogical shift teachers reach out with their own professional selves through which their old ideas and practices, beliefs, etc. are relived (Cohen, 1990; Jansen, 1999; Christie, 1999; Green and Naidoo, 1998; Kriek and Basson, 2008).

(iii) *Edwin's views about resources*

The setting is a representation of the world within which Edwin is employed as an agent to either implement or promote the NCS. Resources and the lack thereof might become the moral justification for his thoughts on why Edwin thinks that OBE (one of the principles of the NCS) is a very good thing in principle. For the most part, his thinking can be considered habitually authentic in the sense that his past under apartheid is almost always overshadowing his thinking; therefore, he is not always making conscious decisions when he teaches (Conroy, 2003: 8). Regarding the issue of instructional resources, it appears that being trained in a resource-poor environment may cause the teacher to follow an unconscious internal logic in stereotypical thinking (Moerer-Urdahl and Creswell, 2004). It seems as if the ripple effect of apartheid outwardly influenced the feelings and connectedness of a person to the space within which they find themselves. The fact that Edwin mentions that ever since the introduction of the NCS the DOE has not delivered *a single test tube* to any school is difficult to believe as investing in historically disadvantaged schools has been part of rupturing the legacy of apartheid. Aiding and providing for the needs of teachers has the potential of multiplying outwards in that teachers take ownership of the curriculum and identify a need to change their practices.

Green and Naidoo (2010: 10) argue that the school type has a direct impact on the quality of curriculum delivery. They argue that learners who attend ‘fortified’ schools are in a better position to meet the demands of a new curriculum than learners who attend ‘exposed’ schools. Fortified schools serve rich communities with high concentrations of materials and symbolic advantage (*Ibid.*). These schools are characteristic of learners coming from higher economic status and backgrounds, with well-trained teachers, particularly in Mathematics and Physics. Exposed schools in turn (such as Edwin’s school) are associated with various disadvantages such as fragmented families, poverty, low levels of parental education and a lack of facilities to meet the demands of the NCS.

Even though the school where he teaches is well resourced, the community which the learners come from does not create a supportive environment conducive to promoting scientific thinking. For the most part, the area is characterised by illiteracy amongst adults, high drop-out rates, teenage pregnancy and high levels of gangsterism, to name but a few problems. Therefore the level and depth at which each topic in the curriculum is taught raises concern because of the inadequately supportive environments. Outside of school the learners do not have access to the internet, electronic data sources or parents to support them when confronted with problematic issues relating to the content. This kind of practical work demands that learners have a good support structure as they must become designers of practical investigations.

Edwin feels constrained by the large amount of content that needs to be covered, which is captured in the following extract:

You cannot finish your syllabus (Grade 12) in one year teaching it properly during the allocated time. We use extra time like Saturdays and the school holidays to reinforce already taught content. We use extra time not to cover new content, only to reinforce it. Using this model we get through the syllabus. Other schools spread the Grade 12 syllabus over three years...

He emphasised the impact of the time constraints within which he has to operate. The pacing and sequencing of the topics in the syllabus have implications for practical work, though he did not elaborate. Edwin pointed out throughout his experiences how important practical work is, but doing practical work requires time and apparatus. Edwin also emphasised how often he has to spend most of his break time in the laboratory to assist learners with doing practical work. Even though he considers laboratory work as important, the pressure on him to finish the syllabus has an impact on him with regards to curriculum delivery. It is highly

likely that he reverts to the old way of teaching as a result of the pressures placed on him, which makes perfect sense as an explanation for why he stated that in this school *I use the best of both systems*.

Thabo's Transcript Analysis

Section 1 (items 1 – 7)

Table 5.5: An Ideographic Analysis of Thabo's Statements

Item/s	Units of meaning of Thabo's language	First elucidations	Researcher's notes
1	I grew up in the Western Cape in Khayelitsha and attended Lushlaza High. After school I went to <i>Pentech</i> in 1995 to study teaching and finished my degree in 1997. After graduating I taught at a high school in Wallacedene and is still currently at the same school.	Thabo, a Xhosa male, grew up for most part of his schooling under apartheid. It was in 1994 that our country witnessed the demise of apartheid and the start of the changing landscape of education in South Africa.	Mampane and Boucher (2011) point out that many learners living in townships face an abundance of social ills and poor support structures, causing their lives to become compromised.
2/3/	I became a teacher after I did not perform very well in my Maths and Science. I wanted to be an engineer but that year they were starting their Physics courses in teaching. I was approached by one of the lecturers to study teaching and that is how I ended up in teaching. It never crossed my mind that I will ever be a teacher. Honestly it was not even my second choice.	He never intended to become a teacher and he had dreams of becoming an engineer. His poor performance in Maths and Science prevented him from becoming an engineer.	His poor performance in Maths and Science was common among black learners under apartheid (Green and Naidoo, 2006)
4/5	Mr Fleischman yow ... very bright teacher, and very enthusiastic, He loved his subject. He took us on excursions. He was from	He describes his experience with PS in Grades 10-11 as interesting and for the first time in his life as a	Geelan, Wildy, Loudon and Wallace (2004) found that high-quality teaching leads to a

6/7	<p>England and it was the first time a teacher would teach and mixes his teaching with practicals ... It was not just a matter of standing in front and giving us knowledge – that is why I still remember his teaching.</p> <p>Mr Fleischman left us in Standard 9 (Grade 11) and we had a new teacher in Grade 12. I did not do very well because Mr Fleischman left us and I was supposed to go to engineering. That was the time I never understood his teaching. I think the Grade 12 syllabus we taught ourselves. We never got anything from the teacher.</p>	<p>learner he was exposed to the see the integration of theory and practicals in PS.</p> <p>Thabo describes his Grade 12 PS teacher as incompetent and lazy. He (Thabo) had to learn the entire Grade 12 syllabus on his own in preparation for the matric examination. He says this is the reason why he could not become an engineer, because of the knowledge gaps. He appears to lack basic skills and foundational knowledge for reasons beyond his control (Bansilal and Wallace, 2008:84)</p>	<p>high quality of understanding on the part of the learner.</p> <p>Thabo received no coherent structure in learning and understanding science, his teacher did not use analytics or negotiated diagnostic techniques to unveil his worldview of science</p>
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5.4 Biographical descriptive narrative of Thabo (age 37)

Thabo was born and raised in an informal settlement called Khayelitsha in the Western Cape. Khayelitsha can be considered unofficially as the third largest township in South Africa. It is estimated that Khayelitsha has more than 1.2 million people. Khayelitsha is situated approximately 20 kilometres from the Cape Town central business district (CBD). Its geographic location is positioned between Swartklip Road, which goes over the N2 highway south of the R300 (secondary road), and Baden Powell drive from the city centre to Somerset West. Despite the hostility, crime and unemployment in Khayelitsha, it is also considered a very vibrant society (Mampane and Bouwer, 2011:114). Although as you drive through the township you notice the dire poverty, Khayelitsha also has a high level of buying power and over the years has produced thousands of black graduates in South Africa.

Characteristic of township areas (also referred to as shanty towns under apartheid) is the poor quality of infrastructure, lack of running water, poor sanitation (no toilets) and a lack of electricity. Thabo describes the school he attended as a learner as a bare concrete building on a piece of open land. It was a resource-poor environment. One of the objectives of apartheid education was to deprive blacks of their rights to a decent and quality education. This was achieved by keeping the tools of knowledge away from blacks; Kallaway (2011) notes that the white government pressed for native education to train human tools for the economic and administrative machine and to make more efficient servants of the native.

Thabo describes his experience of Physical Science (as a learner) both as stimulating and challenging at the same time. He mentioned continuously how happy and impressed he was with his Physical Science teacher named Mr Fleischman (pseudonym). In describing his teacher (Mr Fleischman) he used words such as 'yow', 'brilliant', and 'great' teacher. This teacher gave him hope of becoming an engineer one day. Then suddenly disappointment dawned on him when Mr Fleischman left and was replaced in Thabo's words by a 'horrible Physical Science teacher'. When asked to recount his experiences as a learner of Physical Science, he had the following to say:

Mr Fleischman ... yow...very bright teacher, and very enthusiastic he loved, He loved his subject ... I still remember his name, Mr Fleischman. I really liked the subject ... The reason I did not perform very well I think I think Mr Fleischman he left us in grade 11. We had a new teacher in grade 12 and we never understand our teacher so there were many times we went to the office to complain that we don't understand his teaching method and work. I think the grade 12 syllabus we taught ourselves...

When Thabo was asked to elaborate on what he meant by *a great teacher* he said:

He (Mr Fleischman) was coming from England so it was the first time a teacher would teach mixing his teaching with practicals. Throughout my schooling in secondary school that was the first time when a teacher will and mixes teaching with practicals. It was not only about him standing in front giving us all the knowledge – that is why I still remember his method of teaching.

Thabo's Grade 11 Physical Science teacher (Mr Fleischman) was described as an excellent teacher but he resigned (he did not provide details why the teacher left). Thabo's description of his new Physical Science teacher (in Grade 12) bears no resemblance to that of Mr Fleischman. Thabo adds: *I can't even remember his (new teacher's) name*. The introduction of the new Grade 12 Physical Science teacher was the start of a major crisis with regards to the learning of Physical Science for him. Phenomenologically, the new situation can be described as the start of a new inner consciousness, where he was forced to reorient himself and to break from his orientation to the subject as taught by Mr Fleischman. He described the situation in the Physical Science classroom as if he was always absent when it came to the learning of the content. A notion of pedagogy might be helpful here. Pedagogy in the Greek means 'leading a child'. Thabo's narrative here implies that he did not experience the tactful guidance that knows and follows the pedagogic success of his Physical Science teacher. Instead he recounts an unhappy conscious awareness of the subject from that time. He became mindful that Physical Science at that stage was of no value to him with no practical consideration given to the subject (which was not the case with Mr Fleischman). Geelan *et al.* (2004:449) write that *a particular kind of teaching leads to a particular kind of understanding*. As a corollary to this statement, the implication seems to be that Thabo felt his new teacher had no passion for his subject and/or learners, low self-esteem and motivation, and the outcomes of his lessons only skimmed the surface. The following extract serves as evidence:

I'm suppose to have gone to the field of engineering. Mr Fleischman he left us in Grade 11, we had a new teacher in Grade 12. We never understood our teacher unfortunately, so there were many times we went to the office to complain that we don't understand his teaching method. So the Grade 12 syllabus we taught ourselves. We never got anything from the teacher – even the name of the teacher I can't recall.

As a learner Thabo had high hopes of becoming an engineer. But his hope slowly dissipated as the inevitable challenge of coping with Physical Science under a new teacher, whom he described as knowing less than he himself. In attempts to seek help, they (Thabo and other learners) would go to the principal's office to ask for a substitute, but to no avail. The following excerpt explains Thabo's response when asked whether the teacher was qualified to teach Physical Science: *I don't know ... we went to the office to find out if we can't get a substitute, but we never got a positive response.*

Thabo developed an unhappiness with his teacher and subsequently unconsciously about the subject. As a result of this he became disaffected by the subject and consequently he could not gain entrance into the engineering programme as his results in both Physical Science and Mathematics (in Grade 12) did not meet the minimum requirements. Thabo blamed his Grade 12 teacher for his dilemma, as the following extract indicates:

I did not do very well. The reason I didn't do very well – I'm suppose to have gone to the engineering field ... I did not perform very well because of this new teacher ...

When Thabo did not meet the criteria to study engineering, he exclaimed that it was never his intention to become a teacher. While visiting *Pentech* (the name of the university) on a specific day, he was approached by a lecturer who encouraged him to enter teaching as a career. Thabo explains how he ended up in the teaching profession:

I became a teacher after I did not perform well in Maths and Science. I wanted to be an engineer. When I came to Pentech you know they were starting their Physics course in teaching. I was approached by one of the Lecturers to register to be a Science teacher, that is how I got to be a Science teacher.

Thabo pointed out that it never crossed his mind that he would *ever* become a teacher. It was not even his second choice of study after being rejected by the Engineering Department. After entering the profession Thabo hoped to make a difference in the way Physical Science is taught and one of his goals is to achieve a 100% pass rate, which is something he is yet to achieve after 13 years in the profession.

In the next sections under interpretive narrative I will attempt to contextualise Thabo's responses. His text (transcript) is filled with an intentional vagueness and one needs to zoom in on the historical structure of his mind to interpret his thoughts. Foucault (1989) points out that we are all historical beings. Therefore, in order to understand Thabo's responses in the

context of how he perceived the subject (Physical Science) as a learner, I will now explore the latent language in Thabo's speech/transcript.

5.5 Interpretive narrative

After presenting Thabo's autobiography, I discuss the themes and paradigms embedded in his transcript. In searching for them, I found modalities and fluctuations which allowed me to reflect on his unsettled sense of existence in the Physical Science classroom. For example, Thabo first described his experiences in the Physical Science classroom (under Mr Fleischman) as both exciting and stimulating as highlighted in the following two excerpts:

I really liked the subject. Mr Fleischman ... very bright teacher, enthusiastic, he loved his subject. He use to take us on excursions, aai he was a great teacher. He taught me in secondary school ... He was coming from England, so he was mixing ... he will teach and mixes his teaching with practicals and mainly he did practicals in our classes and students had to do some report back in classes. It was not only about him standing in front giving us all the knowledge. That is why I still remember his method of teaching.

After Mr Fleischman left Thabo noted:

Mr Fleischman ... yow...very bright teacher, and very enthusiastic he loved, He loved his subject ... I still remember his name, Mr Fleischman. I really liked the subject ... The reason I did not perform very well I think I think Mr Fleischman he left us in grade 11. We had a new teacher in grade 12 and we never understand our teacher so there were many times we went to the office to complain that we don't understand his teaching method and work. I think the grade 12 syllabus we taught ourselves

Thabo's experiences inform us that contradictions are an integral part of our life. The formation of his phenomenological attitude towards Physical Science makes us aware of the idea that life is neither concrete nor static. Furthermore, we learn from Thabo that change is endemic and our existence is filled with elements of historicity. By historicity I mean our past, present and future *which shapes and informs our lives informs us to shape others* (Conroy, 2003; Foucault, 1989). This concept is important in order to comprehend Thabo's phenomenological attitude as it is consistent with Heidegger's thinking about *being and time*. Spanos (1976: 457) notes: *the meaning of being must already be available to us in some way ... An interpretation is never a presuppositionless apprehending of something.* Heidegger

often used the phrase *coming to a clearing of the woods* as a way of describing reality (Conroy, 2003: 4). As Heidegger (cited in Van Manen, 1990) argues, there are no bridges built between two states of consciousness; rather, there is only the *leap*. Lucidly, Thabo's reality of Physical Science epistemologically leaped into a phenomenological objectified state of thought (Devenish, 2002). The negative perception towards the subject which he described as bland and abstract is represented in the following extract:

I did not do very well. The reason I didn't do very well I'm suppose to have gone to the field of engineering ... I did not perform very well because of this new teacher.

Some concepts that are central in his transcript were his inherent difficulty in connecting with the ideas established by his ex-teacher (Mr Fleischman). Thabo writes:

I still have to achieve a 100% pass rate in Grade 12 for my learners ...because of the way I was taught science by Mr Fleischman I also wanted to establish a science club at my school. I still have to achieve that after 13 years of teaching.

In view of the above comment, Thabo regards it important to leave his mark on his learners as Mr Fleischman did in his world. Such experiences are unique occurrences and Thabo's aim is to have his footprint blend with that of his ex-teacher. It was Mr Fleischman's contributions and the kind of understanding he brought to Thabo in the Physical Science classroom that inspired Thabo to want to become an engineer. Thabo understands the significance of the presence (or absence) of a teacher from his own experiences in the Physical Science classroom. He knows that learners come to him (in the Physical Science classroom) to gain knowledge and to do well in the subject. As a result he experiences an internal urgency to produce a good Grade 12 result of 100% pass rate as he exclaimed. It is the indelible experience that Thabo wants to leave in the hearts and minds of the learners who enter into his classroom.

Thabo also informed us about the possible damage that a teacher can do to a learner. To Thabo his Physical Science teacher was part of the teaching itself. He describes Mr Fleischman's teaching as immeasurably valuable, but the behaviour and role of his new Grade 12 teacher are responsible for his failure to become the engineer he dreamed of becoming. Thabo said: *I did not do well because of my teacher*. This quote echoes a plea from Thabo to other teachers to open their minds to the unpredictable influence they might

have on their learners. We exist in a world where there is an interdependence between the self, others and objects (facilities). When things happen, we use everyday coping skills without mental representation, as he said: *there were many times we went to the office to complain that we don't understand his teaching method.* In an attempt to cope with the difficulty he was in, he reacted by consulting the principal, which only provoked further anger as the principal refused to help. One teacher changed Thabo's life destiny. As he said: *never in my wildest dream did I ever think I will become a teacher, it was not even my second choice, it was not even a choice.*

Section 2 (Items 8-31)

The National Curriculum Statement and its implementation

Table 5.6: An ideographical analysis of Thabo's statements

Item/s	Units of meaning of Thabo's language	First elucidation	Researcher's notes
8	Currently I am teaching PS Grade 12. I have 100 learners in Grade 12. Their timetable will be changed for the second term and I will have a third class of grade 12's. By end of this year in total I will have 160 Grade 12 learners.	He teaches PS to 3 Grade 12 classes and 2 Grade 11 classes. An average of 50 learners per class. This reflects a heavy workload with administrative responsibilities.	Under apartheid enrolment in PS in black schools was low. Also strict criteria for selection were imposed. Today, the enrolment numbers have increased, as in Thabo's case, and the changing population of learners intensified the need for curriculum change (Lewin and Naidoo, 1998).
9/10	I started during a time where there was a lot of confusion. When I started teaching it was the introduction of OBE. Many of us were confused but I was in a better position. I was fresh from school but we were always at loggerheads with teachers that started teaching some time ago because of the new teaching style I went through that would be curriculum 2005. My subject head (HOD) he was coming from the old school. Teaching the traditional way or the old way which was dominant in the apartheid era. We were always at loggerheads as to how we must not teach the learners.	Thabo refers to the older generation of PS teachers as being confused regarding the curriculum change. He was well prepared during his teacher training regarding OBE. His new methods of teaching were not well received and supported by older teachers. He described his new teaching methods as not well received, as a result he was at loggerheads with older teachers including his HOD.	Thabo experienced a challenging time when he started his teaching career to introduce his new method. He describes their old habits as their enactment of OBE and subsequent confusion about OBE. There appears to be a power and position struggle between Thabo and his HOD (Mellville, Hardy and Bartley, 2002).

11/12	<p>I think we are fine with the NCS because at least with the NCS it is more content based. The problem is when the department saw that there are many educators that were not familiar with the content they tend to chop and change. In my view they took out topics that could have helped the learners. Topics such as two-dimensional momentum, motion, etc. These topics are not examinable. I was never taught these topics at school or even at <i>Pentech</i>. Most of those things that I am teaching currently I had to read them on my own to understand. To say I am confident, that would be far-fetched.</p>	<p>Thabo does not experience problems with the enactment of the expected pedagogy of the NCS in his classrooms. He expresses disappointment with some topics being removed from the curriculum. He had to do a lot of self-study to understand the new topics. His teacher training course w.r.t the content did not prepare him to understand and teach the new content.</p>	<p>Challenges such as lack of support and training to understand the curriculum is a formidable task. (Mellville <i>et al.</i>, 2011). Most teachers are still at a very early stage of curriculum implementation (Matoti, 2010)</p>
13/14	<p>The workshops conducted by the WCED they were not helpful. I would say if I rate them they would be 20% helpful. You know why I am saying that, is because they (WCED) took some of us (teachers) and made us curriculum advisors. Those were the teachers that were also confused as to the standards. Those were the guys that came back to us to conduct the workshops. One could see they were not confident. The content was done by Professors. I still remember Mr Frans those were the guys that helped us</p>	<p>According to Thabo the training he received by the DOE was inadequate. Furthermore he describes the training officials as incompetent. He sees the training officials as part of the problem as they create more confusion amongst the teachers (Matoti, 2010; Kriek and Basson (2008).</p>	<p>Teachers complained about poor training w.r.t. the content. There is a lack of understanding of the content and conceptual difficulties leads to <i>a field of struggle</i> to teach the syllabus (Setati <i>et al.</i>, 2009).</p>
15/16/ /18	<p>The content was on the new topics and it helped to some degree because the time spent was very short. I remember we stayed after school when one is tired for 2-3 hours or Saturdays 2-4 hours. That was the maximum time spent.</p>	<p>The content training offered by external people was very helpful, but the only problem is the short time frame offered. Thabo further point out that the short and</p>	<p>Thabo avers that he teaches according to the principles of the NCS. He uses a variety of teaching strategies aligned with</p>

20	One has no choice but implement OBE. It goes along with lots of things. One needs to assess the seating of learners. They must sit in groups and one have to group them. I am confident with teaching in context, I have always done that.	<p>inappropriate times frames did not do justice to the training he received.</p> <p>Thabo has a good understanding of the complex terminology associated with the NCS. He uses the NCS as a guide when he prepares his lessons. He also assesses his learners according to the assessment standards and related LOs. He teaches using insightful questioning techniques and group activities</p>	<p>the NCS. His dilemma is that the expectation and outcomes of science as an inquiry does not mirror the NCS (see Rogan and Grayson, 2003; Lelliott <i>et al.</i>, 2009).</p> <p>Thabo wants to give his learners a fair break in the teaching and learning in Science. It is an opportunity of receiving instruction in PS that is consistent with good, quality education (Mellville, 2011).</p>
17/21	Now we have grasped them. They were a problem when the curriculum was introduced. After about 5-13 years of teaching I have grasped them. I also prepare my lessons according to the assessment standards and critical outcomes	His most challenging aspects related to curriculum implementation is understanding and applying the CO and DO.	The demands associated with the implementation of the NCS engulfed his whole life so much that he could not finish his undergraduate degree.
22/23	I assess every day. Giving them exercises, giving questions, and asking a lot of questions. First of all I did not know how to prepare a lesson with the critical outcomes and developmental outcomes in mind.	He views the introduction of the new topics as very helpful to his learners as it adequately prepares learners for tertiary education. It makes the gaps between school (what a learner ought to know) and university smaller.	This statement stands in direct contrast with the aims and objectives of the NCS. This is an example of rote-learning as he only focuses on the facts of science instead of the processes and nature of science (DOE, 2003; 2006; Stoffels, 2006).

25/26/ 27	I am very happy. The NCS, unlike the old syllabus that I went through in high school, there are lots of new topics that are challenging even to the educators. So those topics even though challenging are also helping learners for tertiary education. My learners are all over the Western Cape, some at UCT, UWC and Stellenbosch University. So the new NCS is helping them a lot.	He feels he live up to the standards of what the NCS expects him to do. He is of the opinion that the NCS engulfed his whole life to an extent that he did not have time for his own personal development. He has to learn the new content while at the same time having to cope with the associated challenges such as having to teach the content he himself finds challenging to second language users.	
28/29/30 31	<p>I could not finish my degree because of the demands of the NCS. I was one of the educators that would stay until very late after school. The NCS has stripped me of my livelihood. One has to go and read a lot and try to study the subject matter the content. Some of my colleagues they did not bother, they just continue studying.</p> <p>My main source when I prepare is exemplars, old exam question papers, different textbooks, examination guidelines, etc.</p>	<p>His focus is to prepare his learners adequately for examination purposes. He uses old question papers, matric exemplars (draft exam papers) and textbooks to prepare his learners. He finds the books as not very helpful in preparing and bringing the content across to the learners. In his view the focus of the textbooks is more on context and content learners need to know for the examination.</p> <p>As a result of the extensive nature of the curriculum, he has to offer afternoon classes and sacrifice his weekends and school holidays to complete the syllabus.</p>	<p>He takes issue with the poor quality of textbooks. Most teachers in South Africa are dependent on a quality textbook to ensure delivery of the curriculum.</p> <p>Time available for completion of the syllabus is not sufficient. The result is that essential activities do not do justice to the content.</p>

	<p>Most of the textbooks are jokes and a waste of time. They dwell on this context and that context but when it comes to the content there is little information for the learners. I found out one has to use the exemplars and old question papers to teach.</p> <p>There is simply no time for practical work. Not even during the week. Our school which are ex-DET school one's that are in townships there are a lack of resources. There is a lot that needs to be done to equip those schools to have all the chemicals and to have all the necessary chemicals.</p> <p>I provide a lot of extra support and teach during holidays and weekends. I also offer afternoon classes. The time is just not enough to complete the syllabus.</p>	<p>The teachers point out that they have to sacrifice their weekends and holidays to prepare learners adequately for the final examination.</p>	<p>Most teachers in South Africa are under tremendous pressure to produce good Grade 12 results. This has the potential to impact negatively on the implementation of the NCS (Lelliott <i>et al.</i>, 2009; Setati <i>et al.</i>, 2009).</p>
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After reading Thabo's interview transcript (of items 8 – 31) several times to capture the essences of his experience (with the FET NCS), I did not quote his descriptions at face value. I grouped the items reflecting similar responses together and derived the following themes:

- Thabo's views on the shift from C2005 to the NCS;
- Thabo's classroom experience and understanding (interpretation) of the NCS;
- Thabo's responses to the training offered by the WCED in preparation to the NCS;
- His views on the use of practical work and the value of textbooks in applying the NCS.

In the next sections I will present a descriptive narrative of Thabo's experiences as described in his transcript.

5.6 Descriptive narrative

i) Thabo's views on the shift from C2005 to the NCS

Thabo entered the teaching profession in 1998. This period witnessed a radical paradigm shift (first C2005 and later NCS) in the history of education in South Africa (Lelliott, Mwakapenda, Doidge, du Plesis, Mhlolo, Msimanga, Mundalamo, Nakedi and Bowie, 2009:47). One noticeable demand of this shift is that of putting emphasis on the incorporation of learner-centeredness (in the FET phase) within the classroom setting (Kriek and Basson, 2008). This outcomes-based approach curriculum was new to some FET teachers in Thabo's school. I do not intend to provide details of this shift in this section, but it is worth repeating the learning outcomes the FET teachers at Thabo's school were required to address for Physical Science (DOE, 2003, 2008):

1. Scientific inquiry and problem solving skills;
2. Constructing and applying scientific knowledge;
3. The nature of science and its relationship to technology, society and the environment.

According to Thabo, there was at the same time an internal struggle with the older teachers at the school where he teaches to accept the new policy changes and to adopt teaching styles as prescribed in the NCS. Thabo pointed out that when he started his teaching career, it was a very confusing time in his life. In Thabo's words:

I started during a time where there was a lot of confusion. When I started teaching, it was the introduction of OBE. Many of us were confused but I was in a better position, because I was coming out of school ... I was fresh, but we were always at loggerheads with teachers that started teaching some time ago. Because of the new teaching styles I went through that – would be the curriculum 2005 – there were lots of confusion.

Thabo mentions the words **confused** and **confusion** several times in his transcript to describe the teachers' state of mind. Thabo's response is in line with the findings of Kriek and Basson (2008: 68), who found that teachers struggled to shift their traditional methods of teaching to OBE in the FET phase. They argue that this period was very challenging and confusing. Thabo, on the other hand, pointed out that he welcomed and embraced the demands by the DOE (today Department of Basic Education and Training (DBET) to teach according to the principles of the NCS. To quote Thabo: *...we were fine with teaching the NCS* On another occasion he stated: *What frustrated me was the resistance and lack of support by older teachers including my HOD to practice an outcomes-based approach.* He was constantly reminded by his older peers and colleagues what to teach and how to teach. According to Thabo, they did not support his teaching style [of applying the NCS] and he was admonished by his HOD every time he used an outcomes-based approach. The following excerpt describes Thabo's frustration in more detail:

You see the people that were my HOD he's coming from the old way of teaching. The traditional the old way, which was in the apartheid era. So we were always at loggerheads as to how much we must teach how much mustn't we teach the learners.

Haney, Czerniak and Lumpe (1996) alert one to the importance of attitude (Thabo's HOD's attitude) on change. They argue that curriculum change will not succeed if the teachers' attitude is not taken into consideration. Therefore the older teachers' disposition [especially that of his HOD] at his school is a significant factor that enables and inspires new teachers to respond positively to any new policy changes in education. Koehler and Gouws (1992) note that a

teacher's attitude towards a curriculum is influenced by his/her understanding of the content and knowledge of how learners might learn. This includes knowledge of how he/she might think that learners think and learn. This expresses how Thabo experienced working with the NCS, which I will discuss next.

ii) *Thabo's classroom experience and understanding (interpretation) of the NCS*

Items 12, 13 and 14 focus on questions related to how Thabo understands and interprets the NCS. When asked how he feels about the NCS and if he applies it in his classroom, he had the following to say:

One has no choice but to apply the NCS, because you see OBE goes along with lots of things. There are many things that one needs to consider, even the seating of the learners, you can't allow learners to be sitting alone or on their own ... This curriculum is fine. The problem is you see the department [DOE] when they saw that there were many educators that were not familiar with the content they tend to chop and change. There are sections that where they changed them for my own view I think those subjects those topics that were changed, we could have had them so that they can help the learners to understand science.

When asked whether he understands the complex terms and definitions (Learning outcomes, assessment standards, critical and developmental outcomes) associated with the shift to OBE (in 1998) when he entered the profession, he asserted that after 13 years of teaching he must by now know and understand the curriculum. The following excerpt serves as evidence for his response the technical terminology associated with the NCS alluded to in the previous sentence:

No, those concepts we have grasp, them we are confident with them now. They were a problem when the new syllabus was being introduced, like the C2005 when they were being introduced, we had to implement them, but now after about 13 years of teaching I think I understand and how to prepare my lessons according to the assessment and critical outcomes in mind.

Thabo pointed out that he assesses his learners all the time by using activities such as giving them exercises, questions, allowing learners to work in groups, tests and examinations. Thabo further stated: *all those tools I'm using them, but when it comes to assessment I assess every*

day. Thabo repeatedly said that he did not experience any problems in working with the NCS or applying the philosophy that underpins the NCS. When asked how he feels about the curriculum, he stated:

You know most of the time when I teach I'm teaching with confidence because [when] this new subject were being introduced I spent a lot of time on my own studying to understand them. Even the topics I made sure I understand. You know what helped me would be the exemplars that were provided by the WCED. Those exemplars they helped me a lot to understand those topics ...

When the FET NCS for Physical Science was introduced in 2006, the WCED rolled out draft examination question papers with their memoranda to teachers to prepare learners for the final examinations. Thabo realised that he lacked the necessary content knowledge to teach the Physical Science syllabus satisfactorily. His self-awareness or *magister internus* (Devenish, 2002:15) forced him to empower himself by using it (the fact that he was not familiar with the new content) as a learning opportunity to develop himself. This situation gave birth to a higher level of understanding and way of looking at the Physical Science content. Thabo exclaimed: *even the topics I made sure I understand*. Thabo acknowledged his weaknesses and saw it as his goal to solve the problems himself. The following extract explains how Thabo solved the problem:

I was never taught those topics at school not even at *Pentech*. I was never taught, but most of the things that I am teaching currently I had to read them on my own to understand.

Here Thabo reminds one of the philosophy presented by Husserl (1970). Husserl continuously pointed out that he considered himself an eternal beginner, and that real learning is in the doing aspect. Thabo found that, having to overcome his fears, frustration and anxiety of teaching the new material he was not trained for, is a process which he had to deal with personally. The way Thabo responded to the call for change reveals the essential features of his consciousness and the phenomena being researched as elements within his consciousness. A teacher's attitude towards science is a representation of beliefs and concerns he holds. Attitude, in turn, influences his response, especially with regards to his teaching strategies, which are an important contributor to how any teacher perceives any curriculum change associated with the subject.

Items 15 and 18 focus on what he regarded as most challenging and what he found most useful in working with the NCS. According to Thabo, his most challenging experience was when he had to link the critical and developmental outcomes with the learning outcomes when he was planning his lessons. The following comment explains Thabo's response:

My biggest challenge was first of all I did not know how to prepare my lessons with the critical and developmental outcomes in mind. During that time I only went to class not knowing while teaching whether I was meeting the demand of those critical and developmental outcomes but after some time I learned what was expected of me and did so.

When asked what he considers as most useful with regards to the NCS and how it improves science instruction in the schools, he said:

You know the NCS, unlike the old syllabus that I went through in high school, there are lots of new topics that are challenging even to educators. Even so, this is very good thing because teachers have to learn new things and at the same time learners are being better prepared for their tertiary education. In fact I am preparing these learners.

Thabo believes the new curriculum not only stretches the intellectual potential and abilities of the learners, but also makes him *very happy* when he sees his learners progressing and doing very well at university. Thabo feels he lives up to the standards and expected qualities of the NCS. Furthermore, he also feels he meets the demands of the type of teacher envisaged by the NCS. His experiences with the NCS forced him into becoming a lifelong learner, which is one of the qualities a teacher must have when implementing the NCS. The following excerpt describes Thabo's view about whether he lives up to the required standards of the NCS:

I started teaching at a very young age. When I started teaching I only had a Diploma and my colleagues will be asking me why am I not completing my degree. The reason is because of the demands of the NCS basically. I am one of the educators that would stay until very late after school, the first one to come and the last one to go out. When it comes to the NCS that is what stripped me of my livelihood. There were much confusion when it came to the NCS and one had to read a lot to and try to study to understand the content so my education suffered. Therefore I can say that I lived up to the standards. I am a lifelong learner and are slowly becoming a specialist.

Thabo took responsibility for his own development of the required knowledge and high skills needed to become an active practitioner of the NCS. He notes that this development came at the expense of his own personal professional development, which prevented him from finishing his degree. Shalem (2003), who investigated the issue of meaningful opportunities for teachers to learn, pointed out that it is the responsibility of the government to extend or build the teachers' professional knowledge, skills and attitude through meaningful support. Jansen (1999) critiqued the NCS vehemently for not providing enough support to teachers to prepare them more adequately. Furthermore, Fleisch and Potenza (1999) state that teacher professional development policies must be enforced and appropriate materials must be provided to ensure effective curriculum implementation.

iii) Thabo's responses to the training offered by the WCED in preparation to the NCS

Item 11 on the interview schedule focused on the training offered by the WCED to prepare the teachers for the introduction of the NCS. In this item I specifically delved into i) the quality of the training, ii) the duration, iii) the helpfulness of the training in implementing the curriculum, and iv) who offered the training. Thabo repeatedly asserted that the training created more confusion rather than demystifying the complexity and confusion of the curriculum. The following quote describes Thabo's view on the training he received:

You know the workshops conducted by the WCED, they were not helpful at all. I would say if I can rate them they would be 20% helpful. The other 80% was more confusing. You know why I am saying so, it's because the WCED they took some of us and made us curriculum advisors. Those curriculum advisors were the ones that were also confused. Those guys they were given the opportunity to come back to us. One could sense they were not confident, they did not know what they were saying in those workshops. At least when it came to the content. At least now there were Professors. I can still remember Mr Frans, he's working for the WCED Metropole North, ya, those guys helped us with the content, their workshops at least made sense.

When asked how he felt about duration and when the training he received was offered, Thabo said:

I still remember we'll stay after school when one is tired. We'll stay for two to four hours or on Saturdays two to four hours. That is the maximum time we spent on those workshops. Some of the workshops were also offered during the June holidays for a period of one week.

Thabo's view here indicates that he was *tired* when the training was offered. There appears to be concerns from Thabo's viewpoint about two aspects: i) who offered the training, and ii) the inadequate time frames for teachers to go for training. He pointed out in an earlier excerpt that the workshops were too short to fit in all the materials to be learned and in the above quote he highlights that the training was offered during school holidays, weekends and after school. Although efforts were made to provide training to teachers, serious thought should be given to who delivers the training as well as the duration and timing of the training provided. Thabo expected professionals and experts to offer the training.

iv) *Thabo's views on the usefulness of practical work and the value of textbooks*

This section refers to items 22 and 23 where the focus is on the use of the various textbooks and how Thabo feels about the quality and usefulness of the textbooks when he prepares his lessons. Items 24, 25, 26 and 27 relate to practical work and what his perception is about practical work in promoting the teaching and learning of science. When asked to give his view about the quality and nature of the content of the textbooks, Thabo states: *most textbooks are jokes*. When asked to explain the statement, he asserted:

Textbooks have this in mind, this context and that context. They dwell on the context of a certain topic and if you want to deliver this to the learners, there is little information about certain topics that one can impart to the learners. So basically in order for one to have a lot of content and knowledge of the subject matter, one actually has to use the exemplars.

Thabo uses exemplar question papers (an assessment tool) as a tool that provides some structure and a clear focus in preparing his learners. According to him, the textbooks are too focused on learning in context as an application of scientific concepts and phenomena that are not linked to any technical and cognitive activities. With respect to the activities and variation in the textbooks, Thabo said:

The activities in those textbooks they are totally not relevant. They contain information the learners will not be tested on. It is really just a waste of my time.

Thabo considers practical work as essential to assist in the learning of Physical Science. According to Thabo, most textbooks have little information about practical activities. When asked how often he conducts practical work, Thabo said:

There is no time to do practical work every day; you cannot even weekly do practical work. It is out of the question because there is simply no time.

He believes that practical work will help his learners understand the work better, but because of the lack of time and equipment, he cannot conduct the practical work. He stated:

Definitely practical work will help learners to understand the work better, but with our schools which are ex-DET one's that are in the township, there's a lot of lack of resources so ... there's a lot that needs to be done in equipping those science labs to have all the necessary chemicals in order to conduct a practical.

In his explanation Thabo did not draw any attention to the link between practical work and how scientists operate or mention that practical work is important in understanding science. When asked what kind of extra support he provides his learners, Thabo stated that he teaches most afternoons, weekends and sometimes in the public holidays to complete his syllabus. Therefore, very little consideration is given to practical work. The situation around practical work is further exacerbated by a lack of resources and facilities that make it almost impossible for him to expose his learners to practical work.

In the next sections under interpretive narrative I will focus on the above elements in the raw data to foreground the phenomenological horizon to which Thabo intends to attract our attention. Phenomenology, according Churchill (1990:47), *is a way of seeing, rather than as something seen*. One needs to view Thabo's responses from three angles: i) his lack of support from older or experienced peers and his HOD to enact the NCS, ii) his perceptions and interpretation of the

NCS, and iii) his eidetic residuum (Derrida, 1967) around textbooks and practical work in applying the NCS.

5.7 Interpretive narrative

Internationally there are a plethora of books and articles investigating the implementation of new curricula (e.g. Fullan, 1994; Fullan and Hargreaves, 1992), but there are relatively limited publications on how it has been undertaken in South Africa (Kriek and Basson; 2008; Rogan and Grayson, 2003). Those authors who touch on the topic do not provide a model for analysis or a framework based on South African science teachers. Therefore, to analyse and interpret Thabo's transcript I followed Heideggerian phenomenology. Heideggerian phenomenology, as explained by Van Manen (1990) and Conroy (2003), fosters a synergy between interpretive intentions and practical interpretation. Using his interpretive intentions, I delve into Thabo's primary philosophy that axiomatised his epistemology and ontological representations of his experiences. In the next sections I analyse and explicate Thabo's experiences to describe how he implements the FET NCS. I want to start this section by looking at the environment in which Thabo teaches his peers and his HOD's influence on his teaching strategies.

i) Thabo's lack of support and his discouragement by older peers and his HOD to apply the NCS

The day Thabo entered the profession as a Science teacher in the senior phase (grades 8 and 9) (he repeatedly mentions in his transcript) those around him (some colleagues including his HOD) were very confused. Conversely, he considered himself well prepared to teach the subject according to the principles and objectives (LOs, AS, etc.) of the NCS. He asserts:

I started during a time where there was a lot of confusion. When I started teaching, it was the introduction of OBE. Many of us were confused but I was in a better position, because I was coming out of school ... I was fresh, but we were always at loggerheads with teachers that started teaching some time ago. Because of the new teaching styles I went through that – would be the curriculum 2005 – there were lots of confusion

If we are to understand Thabo's experience as a new Physical Science teacher, then it is important to acknowledge how his colleagues (including his HOD) influenced his teaching. Thabo points out that his freshness from school and university paved the way for him to develop and adopt an outcomes-based approach in his teaching. In Thabo's career as a learner he was unhappy with the way he was taught Physical Science. The following quote serves as evidence of this:

The reason I did not do very well I think Mr Fleischman he left us in Grade 11. We had a new teacher in Grade 12, we never understood our teacher. Unfortunately there were many times we went to the office to complain that we don't understand his teaching method ...

Furthermore, Thabo stated:

... our teacher would take us on excursions those excursions we really enjoyed them, but honestly relating to our culture it was totally different science, but we used to enjoy it ... as to whether it was meaningful in terms of taking it back to our way of doing things never make sense in that regard.

The fact that Thabo [as a learner] was exposed to the teaching of Science in traditional ways, which he describes as meaningless and inappropriate (as indicated in the above quote) to his cultural beliefs, resulted in his questioning why he should continue to teach in the same way he was taught. He pointed out that he started out teaching Physical Science following an outcomes-based approach. His attempts as a teacher to implement the NCS were discouraged by his older peers and HOD. Lelliott *et al.* (2009:53) identify four factors that play a role in implementing the NCS, namely: i) teachers' uncertainties regarding the curriculum, ii) their inability to work with the philosophy of the NCS, iii) how they approach the new topics and its outcomes, and iv) teacher identity. I do not intend to discuss each of the four factors here, but want to zoom in on the teachers' uncertainties regarding the curriculum, especially as this relates to Thabo's experience. Thabo constantly points out how his older peers and HOD impacted on his teaching strategies and hindered him from teaching according to the principles of the FET NCS. Sithole's (2004) study on curriculum implementation in South Africa found that teachers like Thabo's peers and HOD find it difficult to interpret the NCS correctly. Factors such as qualifications and experience play an essential role in the teachers' ability to implement innovative new ideas and

teaching strategies. Despite being challenged, Thabo continued to apply outcomes-based strategies as he wanted to give his learners a ‘fair break’ at learning Science which he was denied as a learner. For this reason he said: *we were always at loggerheads with older teachers.*

Mellville, Hardy and Bartley (2011: 2276) argue that the majority of Science teachers struggle to venture into new pedagogies associated with curricular change as they are faced with overwhelming challenges. Some of these challenges are: i) most have a limited conception of the nature of science, which consequently restricts their teaching repertoires; ii) others, they argue, might lack sufficient substantive and syntactic content knowledge; and iii) they may have limited experience with the new curriculum. Thabo points out that the older teachers who were already in the system long before him were *confused*. Sethole’s (2001) empirical work on curriculum implementation contends that the older teachers at Thabo’s school may not have experience with the implementation of outcomes-based education, or they may have a limited or inadequate understanding of the curriculum, which is why Thabo constantly referred to them as being confused. According to Sethole (2001), such teachers are still at a very early stage in working with the NCS (as it was at the introduction of OBE). They used their perceptions and experiences with the learners and knowledge about teaching and learning to guide Thabo as a novice teacher to incorporate what they think works in their school. Mellville (2011: 2276) asserts that formidable challenges await teachers who are looking to challenge the hegemony of traditional teaching strategies without sustained support to overcome such challengers (or teachers).

There is evidence to suggest that there were differences in the ideas (or beliefs) Thabo and his older peers hold regarding how he must teach and which teaching approaches he should follow. Thabo’s ambition is to teach according to the principles of the NCS. In his view, applying the NCS is something he had to do as an inner activity and it might be the reason why Thabo stated: *we were at logger heads with the teachers that started long ago.* Thabo expresses himself as refusing to be ridiculed (to apply the NCS) by his older peers which led him into ways of thinking that did not agree with his colleagues.

Bourdieu (cited by Mellville *et al.*, 2011) argues that social worlds such as departments (in this case the Science department) are comprised of different social spaces or fields within which individuals contest for and accumulate symbolic and material products. These contests occur

between individuals whose dispositions or ‘habitus’ make them more likely or able to engage in the stakes of particular fields. These social spaces are represented subconsciously to orient a person’s actions. For this reason, individuals perceive the same opportunity differently because of different dispositions. Therefore, Thabo’s colleagues adopted a ‘habitus’ which they define as the relationship between learners, the learning culture and its associated change. The net result as in Thabo’s case is the development of a space of conflict and competition. The older teachers are dominant and the new ones are dominated as they seek to develop influence within the department.

To understand this phenomenon, the concept of the perceptual life world is of importance here (Ostergaard *et al.*, 2008: 96). This provides insight into why he responded the way he did. Perception, according to Merleau-Ponty (1968), is a *nascent logos*. It is inborn consciousness or an awareness of things and how we present ourselves to the thing perceived. Thabo’s critical consciousness towards their view is best described by Adler (cited in Scott *et al.*, 1995):

The mind is not merely appropriative, it is also assimilative and constructive ... it creates its organs of its own accord ... but only when stimulated from without ... such organs are, for example, forms of perception and thought, and certain concepts and other logical constructs.

According to Thabo’s HOD, there is only one best way of teaching for critical reasons. The first reason is the academic orientation, which is the perception of the teacher’s role as intellectual leader. This orientation produces a conservative teacher with one goal in mind – to deliver the curriculum. Second is the departmental culture, which creates resistance to change. This is a value that cannot be easily replaced. The third reason is the expectation his peers had with regards to Science teaching and the anticipation Thabo had about how learners learn. According to Sergiovanni (1992), power comes in many forms. He propounds that there are five forms in which power can be rolled out, namely: bureaucratic, psychological, technical–rational, professional and moral. Of these, he argues, moral authority is the most highly prized. Classifying Thabo’s HOD’s disposition of power, it is clear that he used bureaucratic and psychological ways of attempting to denigrate Thabo. What frustrated Thabo was his HOD’s teacherly axis of salience that failed to educate, convince and stimulate him. Dewey (1997: 37) describes the axis of salience as follows:

If a person decides to become a teacher ... he thereby necessarily determines to some extent the environment in which he will act in the future. He has rendered himself more sensitive and responsive to certain conditions and relatively immune to those conditions about him that would have been stimuli if he had another choice.

Thabo's HOD attempted to immobilise Thabo's intentions to implement the NCS. Koehler and Gouws (2007) would argue that his HOD's knowledge of curricula and the different ways of presenting the content was not suitable for his learners. His HOD held strong beliefs about the learning process, which involves the behaviours and mental activities of his learners as well as the appropriate teaching styles associated with such beliefs. Scott *et al.* (1995) explain that the deep mental structures and perceptions (in this case his HOD's views about NCS) are based on the expectation of how Thabo must teach. His HOD's reality based on experiences with the learners generated *self-knowledge* about how he thinks his learners learn. Scott *et al.* (1995) argues further that his self-knowledge creates deep mental structures that result in 'guiding self ideals'. Ansbacher and Ansbacher (1956: 93) point out that the guiding 'self ideal' motivates individuals to think in certain directions about teaching. Therefore Thabo's mention of the term *confused* and of *being at loggerheads* echoes a lamentation of his drive to implement the NCS that is contrary to the views and perceptions of his more experienced peers and HOD. Based on how his older peers and HOD responded to his struggle to teach the new curriculum, the evidence suggests that sometimes teachers are very willing to implement the NCS, but are being hindered in their tasks to do so.

As we saw through Thabo's experience, he had to work in a space of crucial and fragile negotiation between him, his peers and his HOD. He was caught in a battle between tradition and innovation. Thabo contended: *the people that were subject head my HOD he's coming from the old way of teaching which was in the apartheid era.* This comment corroborates the view that Thabo works with peers whose intentions were to maintain the status quo and to preserve the traditional ways of teaching, whereas Thabo's new innovations were being challenged and suppressed. Thabo represents a new generation of Physical Science teachers being produced with the aim of bringing new innovations in a way that undermines the prevailing tradition of practitioners. As in Thabo's case, when they are given a chance to teach and fail to work in tune

with the prevailing tradition, they become ridiculed by older peers and silenced until they eventually conform to the dynamics of the system in place.

ii) *Thabo's understanding and interpretation of the NCS for Physical Science*

A number of salient points with respect to his understanding and interpretation of the NCS are raised in Thabo's transcript. The following excerpt describes how he feels about teaching within the NCS model:

... I'm teaching with confidence because [when] this new subject were being introduced I spent a lot of time on my own studying to understand them Even the topics I made sure I understand...

This comment clearly indicates the role a teacher plays in implementing a new curriculum. As the core agents in curriculum implementation, teachers must possess specialised knowledge that is normally acquired through years of teaching and professional development experiences (Lee and Luft, 2008). This statement indicates that Thabo is adamant to implement the NCS. His words represent that he thinks he is teaching according to the principles of the NCS. He states that he had to undergo a lot of self development through self-study and familiarising himself with the new content on his own. Thabo's representation of how he feels about the NCS is that the content knowledge of Science sets the goal for his teaching. The following statement serves as evidence of this premise; when he was asked what he considers as his main source in the planning and delivery of his lessons, he replied: *My main source is many sources as possible, exemplars, previous question papers and even the examination guidelines.*

In view of the above comments, it is evident that Thabo's implementation of the NCS is mainly guided by the use of assessment tools provided by the department (exemplars, previous question papers and examination guidelines) to support the planning and delivery of the Physical Science curriculum. Research in South Africa has supported the premise that assessment instruments exert direct control over curriculum and teaching practices in almost all grades in the schooling system (Mholo and Venkat, 2009). Furthermore, other studies found that teachers put a lot of emphasis on what is assessed (in examinations) in their preparation and teaching of subjects (Mhlolo and Venkat, 2009: 36). As a result, teachers teach old question papers and exemplar

questions to learners. Thabo’s teaching style is not much different from those reported by other researchers. He considers these instruments (old question papers and exemplar papers) as the driving force and firm bases of his teaching. He did not mention the processes and nature of science or needs of the learner as prescribed by the NCS. Figure 5.3 illustrates how he plans and teaches science based on his descriptions in his transcript. The materials he uses to plan and conduct his lessons determine ‘what his class is aiming at’ (LOs), ‘what to teach’ (curriculum organisation), and ‘where to look for activities and information’ (resources). Thabo feels his knowledge of teaching is linked to his knowledge of assessment and what he considers important for the Grade 12 final examinations. Hence, he relied on old question papers and exemplars supplied by the DOE. His teaching does not cover the goals and objectives stipulated in the NCS and he shows disregard for the learner’s prior knowledge with regards to the topics in the syllabus. Figure 5.3 describes Thabo’s conceptualisation about teaching Physical Science according to the NCS:

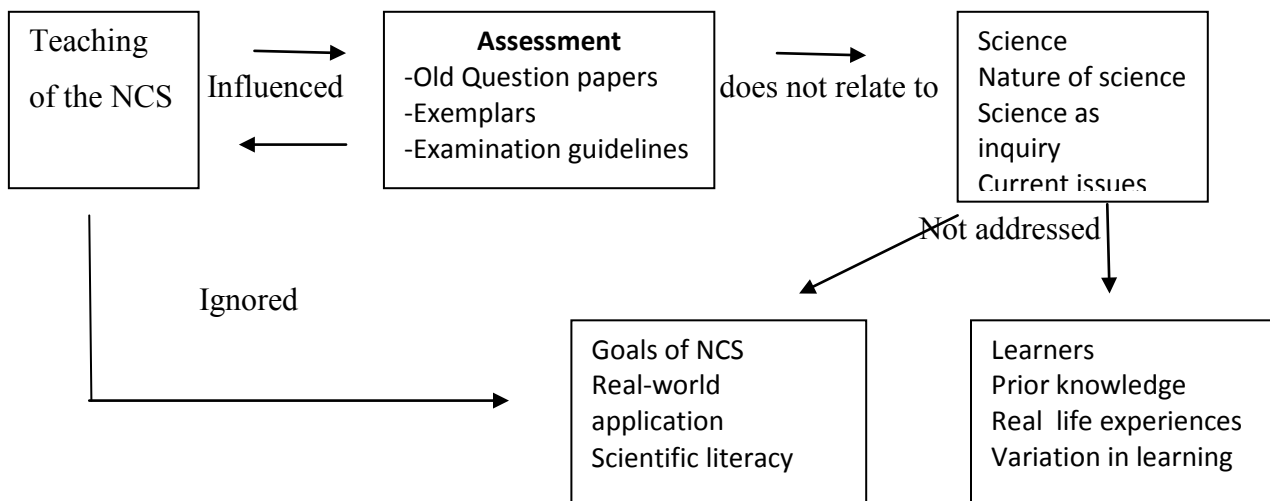


Fig 5.1: Thabo’s conceptualisation of the NCS

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The following extract serves as evidence for how he views OBE:

One has no choice but to apply the NCS, because you see OBE goes along with lots of things. There are many things that one needs to consider, even the seating of the learners, you can't allow learners to be sitting alone or on their own ... T his curriculum is fine. The problem is you see the department [DOE] when they saw that there were many educators that were not familiar with the content they tend to chop and change. There are sections that where they changed them for my own view I think those subjects those topics that were changed, we could have had them so that they can help the learners to understand science.

With respect to the complex terminology associated with OBE such as learning outcomes, assessment standards, critical outcomes and so forth, Thabo stated:

No, those concepts I have grasped them; we are confident of them now; they were a problem when the new syllabus was being introduced like the curriculum 2005, we had to implement them but now after 5 to 13 years of teaching I think I understand them and how to prepare my lessons according to the assessment standards...

In the above quote Thabo contends that he has a good understanding of OBE and the complex technical jargon associated with OBE. He continues to list the different components associated with OBE, namely classroom arrangements, teaching in context and the technical terms used in OBE. Furthermore, he reiterates that he is very confident in applying these aspects in his teaching. However, he fails to make connections among these components listed in the quotation to show how they interrelate with his teaching. When designing his lessons he disregards the principles of the NCS and allows assessment tools to guide him in his teaching. The following quote in response to the question asking how he assesses his learners corroborates this statement:

Uhm, exercises, giving exercises, giving questions, grouping learners, even tests, exams – all those tools I'm using them but when it comes to assessment I'm assessing every day.

Thabo's description of assessment is congruent with that of the traditional Science classroom as described by Schwartz and Sadler (2007), who point out that a traditional classroom represents solutions to curricular goals which learners do not understand or recognise. Thabo's description of how he assesses is empty of context and therefore his learners could fail to understand it and

be unable to apply the knowledge in a new context. When asked about whether he thinks he lives up to the standard of the teacher envisaged by the new NCS, he responded:

... I am one of the educators that would stay until very late after school, the first one to come and the last one to go out. When it comes to the NCS that is what stripped me of my livelihood. ...

A closer examination of the above quote by Thabo shows that he revisits how much he had to sacrifice. Instead of the cognitive demands of the NCS, namely that of specialised knowledge and skills, the teacher as curriculum designer, lifelong learning and learning programme designers. He does not interact with the question at the upper limits of his ability or at his optimal skills level in applying the NCS. The development of high knowledge and skills is one of the most important goals of the NCS. However, Thabo does not mention any of the qualities envisaged by the NCS. For example, he did not mention how he supported his learners in developing a critical voice or assisting learners to find personal relevance in the content. Schwartz and Sadler (2007) point out that teachers who view knowledge as something objective favour didactic teaching methods to maintain control of the curriculum.

In the next section I turn my focus to Thabo's view about the use of practical work and the usefulness of the textbooks in preparing his lessons.

ii) *Thabo's sentiments regarding textbooks and practical work*

Thabo's phenomenological representation and sentiments regarding the quality, relevance and effectiveness of FET Physical Science textbooks are similar to the views and concerns raised by Colin and Edwin (discussed in previous sections). One of the common concerns Thabo raises is the interplay between context (personal) and content (scientific facts). Thabo holds the view that there is a disjuncture between the content covered in the books and the content needed to prepare learners effectively to understand the processes of science and subsequently to pass the Grade 12 examinations. He points out that most textbooks focus more on general issues related to science rather than on the content specifications listed in the NCS. In Thabo's words: *most of the textbooks for FET Physical Science that are in circulation are jokes and a waste of time*. The following excerpt further elaborates on his assessment of textbook quality:

No they (textbooks) have this in mind, this context they will dwell on context of a certain topic and then if you have to deliver and then if you have to deliver this to the learners there's little information about the topic ... so basically in order for one to have a lot of content knowledge of a subject this is how I found out is that one has to use the exemplars.

As I probed further into Thabo's consciousness to get clarity and more detail about the usefulness and appropriateness of the textbooks, he explained:

Not really ignore them but even the activities in those textbooks they are totally not relevant they are that something that won't even be tested. Those activities are a waste of time.

Thabo draws attention to the fact that most textbooks do not provide teachers with creative expressions and innovations to cover the content. He points out that most textbooks lack depth and practical application of the content. For the most part, the concepts in the textbooks remain abstract and ideas and theories are presented that do not relate to the learners' need to pass the examination. The following comment confirms his belief: *those textbooks they are totally not relevant, they are that something that won't even be tested...*

For the most part textbooks guide and influence the teaching strategies and level of depth teachers follows (Bahta, 2003). Previous studies by Kriek and Basson (2008: 70) found that FET Physical Science teachers in South Africa indicated that the textbooks were of a poor quality. According to Kriek and Basson's (2008) study, Physical Science teachers find it difficult to select an appropriate textbook and argue that there should be a standard textbook to guide teachers at which level and depth to teach each topic. Other international studies by Christidou (2011: 147) reveal that most textbooks fail to address the issue of how to overcome barriers to learning in an environment that is resource poor, resulting in teachers being deprived of laboratories and equipment. Underlying all his viewpoints regarding the poor quality of textbooks is his complaint that this problem directly affects the delivery of the curriculum.

A lack of quality textbooks could result in pitfalls, by which, teachers such as Thabo resort to firm limits and control of the content. Furthermore they might adopt teaching approaches that are boring and implement routine activities that cover the content. This concern could be one of the reasons why Thabo stated: *so basically in order for one to have a lot of content knowledge of*

a subject this is how I found out is that one has to use the exemplars. As an alternative to the lack of quality textbooks, Thabo followed traditional teaching strategies such as coaching learners by teaching exemplar question papers as a form of curriculum delivery. Flanders (1994) reports that if textbooks are of a poor quality then teachers might teach more old items and content than new content. Such approaches add little value and allow minor contributions to meaningful learning, learner motivation, achievement and independence. The problem with Thabo's response to follow draft question papers is not his surreptitious intent, but rather it is the way in which such a response was invited. One important aspect of implementing a curriculum effectively is the development of quality notes and textbooks. In the next section I will shift my attention to Thabo's perceptions of practical work.

5.7.4 *Thabo's view and perceptions of practical work*

The importance of practical work is often seen by teachers as central to the appeal of Science as a subject. There is also the common perception held by Science teachers that practical work motivates and helps learners to understand the content better (Abrahams, 2009; Kriek and Basson, 2008; Rogan and Grayson, 2003). The descriptive narrative showed how Thabo regulated the teaching and learning environment. Thabo is quite unambiguous about how he feels about the appropriateness, relevance and importance of practical work in the teaching and learning process. Thabo's eidetic forms bring to light a structural prioris, which is a space of description, a schema of motive and conflict between what works and what he thinks can work in the context within which he teaches. For example, when he was asked how often he does practical work, he had the following to say:

Erh, only the times when they (learners) have to do their case work. There is no time at all, there's no time to do practicals every day. You cannot even do it weekly. It is totally out of the question.

Beneath the sincere response in this comment is found the answer to what Thabo considers as important in the teaching of science. Consciously, in the above comment Thabo displays an ontology of habit that can be traced back to his life as a learner sitting in the Physical Science classroom. His response reflects his consciousness of thought and how it was established as an imprint of memory that practical work is not a priority in the teaching of science. This state of

consciousness becomes the complex through which he personifies the practical importance of Science. Studies in South Africa have shown that teacher attitudes towards practical work become progressively more negative over time (Kriek and Basson, 2008: 69; Stoffels, 2006). Husserl (1970) would ascribe Thabo's response to practical work as the 'fixing of attention on the formal' aspects of Science. Put differently, it is a coping strategy whereby he ignores the practical aspects and resorts to making Science a formal instructional process because consciously (he is aware) he lacks confidence and skill in performing experiments. This concern results in his adopting or returning to a spontaneous activity in which the content is presented as the collocation of facts in what he considers good Science teaching.

Despite the potential effective value of practical work, Thabo's negative attitude can be strongly influenced by a variety of factors. The following excerpt describes why Thabo finds it difficult to conduct practical work:

Definitely practical work will help learners to understand the work better, but with our schools which are ex-DET one's that are in the townships, there's a lot of lack of resources, so ya, there's lots that needs to be done in equipping those science labs to have all the necessary chemicals in order to conduct practical work.

The comment clearly indicates that resources are both a problem and a limiting factor for Thabo to complete practical work. His views are not different from what other researchers found regarding how teachers complained about a lack of equipment, overcrowded classrooms and textbooks (Smith, 2005; Rogan and Grayson, 2003). Thabo's statement in the above comment alludes to a psychological structure of consciousness whereby he rebels against doing practical work (even though he considers it important) and draws attention to the (common) root of the problem, which is an ill-equipped science classroom. He does not confront psychological constraints (such as feeling incompetent, lack of confidence or inspiration) and instead resorts to historical explanation (which is the legacy of apartheid education). His response can be described as 'being on the safe side' or playing it safe (Felder and Silverman, 1988) as his main aim is to cover the syllabus. The fact that Thabo repeatedly complained that *there is no time* to do practical work serves as evidence. Thabo's views on why he does not do practical work foreground a phenomenological space that explains why he does not do practical work. The fact that most schools do not have adequate laboratory equipment is always primary amongst most

studies, because it alone can answer and elucidate meaning to the context in which teachers like Thabo teach.

In the next sections I take the explication process of all the participants one step further by making sense of their experiences by linking their narrative text to the form of logic in their narratives within the communicative collusion of the South African context. I want to blend their subjective experiences with the conditions that exist in South African schools where Physical Science is taught.

5.8 Discussion of the findings

According to Groenewald (2004: 1), phenomenology is a *distillation process*, whereby data that are unrelated to the research question/s are removed from the research and statements central to the research question/s are increasingly brought to view (Devenish, 2002: 14). In line with this approach, I excluded the unrelated data in the explication process and used those statements of essence iteratively to unveil revelatory structures that exist in the consciousness of each participant. The consciousness of represent the *eidetic residuums* (Devenish, 2002: 14) or extracted ideas of each research participant once I followed the principles of the *epoché* and reductions (Derrida, 1967). I used the research participants' transcriptions to *clear the woods* as Heidegger (cited in Laverty, 2004) puts it, to describe clearly and succinctly what goes on in their minds. Having completed this process, the essential experiences of the teachers will now be discussed.

As I delved into the thoughts and feelings of each participant (through their experiences and stories), my aim was to construct an epistemological framework of the knowledge they hold about Physical Science and Physical Science teaching. Each teacher's experience is unique and personal, and embedded within each teacher are **truths** about how they construct their knowledge of Physical Science. These truths subsequently influence the way they perceive and teach the subject. As Science learners, the research participants were left on the periphery and were unaware that issues such as race, identity, socio-economic status, social and psychological experiences within their cultural representation indirectly intersect with the education they received. The findings in this study indicate that the teachers carry some form of psychological baggage (as a result of apartheid education practices) which they drag with them into the present.

As a result they develop psychological defence mechanisms against the subjective realities of change in the Science classroom. It is as if they are surrounded by layers of various voices, some loud and shrill (apartheid curriculum), others soft and squat (NCS) that indirectly silence their own inner voices, so that they may not awaken to the truer sense of teaching that likely stirs within them. It is not clear (based on the findings) to what extent this psychological aspect becomes part of their personality as Physical Science teachers.

What is it that the interpretive narrative of each teacher speaks about? Surely it is more than just the remembrance of the past or the historical events in their lives. How can we relate to the voices of Colin, Edwin and Thabo? We can see a glimpse in every descriptive and interpretive narrative of each participant of the persons they were as learners who understand what it feels like to grow in the absence of a quality Physical Science teacher. Therefore, this study not only provides insight into the shift from the present to past (NATED 550 to FET NCS), but also inwards and outwards (emotions), as well as upwards and downwards (psychological dimensions). Why is this important and why should anyone care? Each teacher's story creates a new understanding that gives higher public profiles to human qualities that highlight the social and political circumstances in which teachers live and work in contemporary South Africa.

i) What do the findings mean for South African Physical Science teachers?

Apartheid instituted divisive marginalised policies within South African schools. All participants recounted stories of how they were deprived of a decent education and instruction in Physical Science as both learners and pre-service teachers. The following excerpt from Colin serves as evidence in support of this construct:

While I was in matric I realised the need for knowing more about Physics and Chemistry, and on my own I studied through a correspondence school...The sadness of the apartheid system was the so-called coloured people, if they took the six basic subjects you could not write another subject, so I never got so far as to write Physical Science in matric.

Edwin, on the other hand, explained his experiences of Physical Science as follows:

I find myself in a school where the Physical Science teacher was unqualified ...We had no teaching of Physical Science, so we only became

very good readers to the advantage of our Afrikaans and English teachers. We never had a problem with our reading, never knowing that we read every day for one full period each one of us one paragraph out of the textbook.

Thabo describes his experience in the Physical Science classroom as follows:

He would take us on excursions those excursions we really enjoyed, but honestly relating them to our culture; it was totally different Science, we use to enjoy them. As he was trying to make us understand what he was teaching us as to whether it was meaningful in terms of taking us back to our way of doing things never made sense in this regard.

This complex background and narration of each participant teachers' experience with Physical Science as a school subject provide insight into issues of identity construction, race, voicelessness, powerlessness and injustice. Costandi (2010: 88) avers that colonial powers spread their influence through culture, education and literature. No participant described his experience with Physical Science as promoting fun, excitement, the use of their imagination, individual interest, or a high level of learner involvement. On the contrary, they described their experiences as bland, morbid, dark and unsatisfying. The following excerpt from Colin further supports this claim:

I did not do PS as a school subject. I studied in the 1960s and did General Science till Grade 8. My passion for science I develop from my father who fixed broken radios and electronic equipment. PS was not compulsory to enter for a science degree. The General Science we did was very traditional or teacher talk, transmission knowledge and examination driven. My parents could not send me to a school that offered PS because of our poverty situation. Coloured people were not allowed to study science under apartheid.

Edwin also explains his view as follows:

The entire class had to read through the textbook from one page to where the bell takes us. This was the method for 3 years. No practical work. The content had no link with the real world.

The following statement represents Thabo's view:

I really liked the subject, now the reason I did not do very well I think Mr Fleischman he left us in Grade 11, we had a new teacher in Grade 12. We never understood our teacher unfortunately, so there were many times we went to the office to complain that we don't understand his teaching method ... so the Grade 12 syllabus we taught ourselves, we never got anything from the teacher – even the name of the teacher I can't recall.

These statements suggest that they (participant teachers) are missing *something* (excitement, interest and so forth) from their engagement with Physical Science as learners. The sum total of these experiences potentially developed a counterproductive mindset towards Physical Science, including no well-defined understanding of the processes of science. Their minds were colonised by an education system that changed their consciousness from viewing science as a way of thinking or understanding the world to a depressing memorisation of facts. They were not offered opportunities to discuss scientific processes regularly. Rather, they were struggling with understanding Physical Science and experienced a subconscious battle not to drop the subject. Many South African Physical Science teachers (currently implementing the NCS) experienced similar conditions as described by the participants in this study. Therefore it is a fair assumption that the voices of the participants might resonate with the majority of Physical Science teachers. Most teachers today simply have to submit to the demands of the DBE to implement the NCS and therefore have their own perceptions of the NCS. The result is that they might view the NCS and the teaching thereof in a negative way. As Thabo stated: *we simply had to learn what we were given*. Can this be the reason why our country is not producing the number of science graduates we need annually? This question warrants further investigation. In the next section I will discuss the dialectical relationship between the participants' experiences as learners of Physical Science, the teaching of the subject and the implementation of the NCS.

ii) *Implementation of the NCS*

The findings suggest that four basic assumptions could influence the way the participants might perceive and implement the NCS. First is the issue of the *self*. The self refers to the knowledge they hold about themselves with respect to the subject. Here it is important to acknowledge the indelible mark their schooling left on their consciousness, which found its way into the classrooms in which they teach. Each research participant pointed out that **facts** are more

important than the **processes of science**. Constandi (2010:88) notes that *we teach who we are*. On the basis of their statements and descriptions of their experiences, it is fair to say that their past (as learners and students) has never really gone away. It only had a facelift (Said cited in Constandi, 2010: 89), but it still exists within their lived spaces and is spread over the huge expanse of their teaching lives.

Second is the issue related to beliefs about learning and how teachers think learning occurs. The evidence implies that when they view the curriculum, they are caught between two distinct lived worlds: i) one that represents their past (with which they are well familiar), and ii) the NCS (a world that requires a complete paradigm shift in their thinking). The NCS requires more than simply the teaching of content and the learning of information by learners, but rather an understanding of the processes of science and the meaning derived from the content.

Third, their thinking is highly influenced by the drive and pressure from both internal and external sources to produce good Grade 12 results. This issue played a critical role in the delivery of the curriculum which (in the case of Colin, Edwin and Thabo) compromised the quality and effectiveness of the teaching and learning process. As extensively discussed in earlier sections, all participants point out that the Grade 12 results are central point of reference in their teaching.

The fourth aspect that possibly influenced the way they view and implement the NCS is the lack of resources to support the effective implementation of the NCS. Each participant pointed out that resources are the key challenge they face when teaching a topic. Based on these assumptions, I attempt to illustrate in Fig 5.2 what it is they think about when they are introduced to a new curriculum.

Fig 5.2: A diagram for the rationale of teachers' mental conflict when introduced to a new curriculum

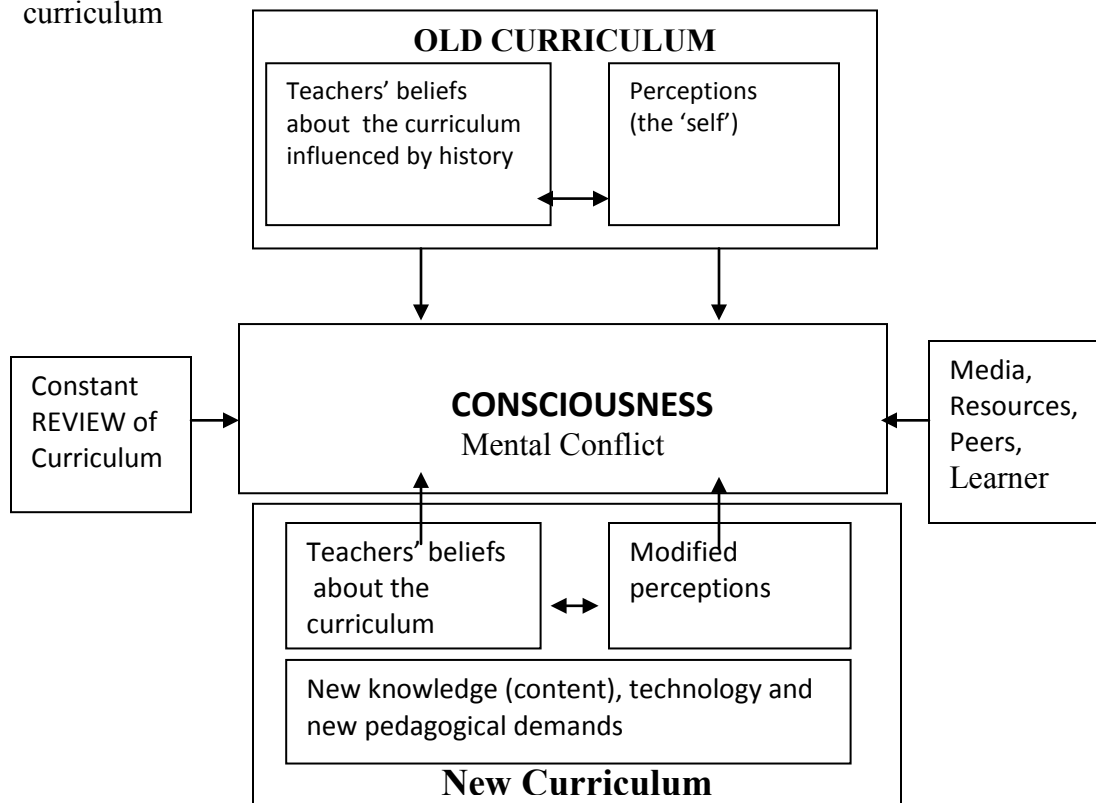


Fig 5.2 presents a diagram of what is possibly going on inside the minds (consciousness) of the teachers as they struggle to take ownership of the NCS. The question that this thesis attempts to answer is: What goes on in the mind of Physical Science FET teachers as they implement the NCS? Figure 5.2 suggests that the teachers' pedagogical content knowledge is underpinned by core beliefs or personal philosophies they hold about themselves. It is established in the literature that teachers teach who they are (Constandi, 2010; Thomas and Pedersen, 2003). In their work setting they develop psychological defence mechanisms as coping strategies, if they experience difficulty with understanding a new curriculum. As a result, they construct a curriculum representing a mixture of the old and new to suit their needs. The evidence in this study suggests that they constantly feel the need to apply the NCS and to break with the legacy of apartheid education, but grapple with both internal (psychological stranglehold) of apartheid education) and external (resources, poor preparation of learners, negative publicity and reports in the media, and constant review of the curriculum) pressures. Their psychological childhood experiences under apartheid act as a space of conflict between what they think will work in practice versus the prescribed principles outlined in the NCS. The literature points out that one

might assume that any curriculum that goes against a teacher's belief might result in cognitive conflict (Rogan and Grayson, 2003; Kriek and Basson, 2009; Mellville, 2011; Cross, 2007).

Each curriculum comes with its own associated challenges. Some teachers might accept change, while others simply reject change from the onset, because it means they will have to unlearn the old ways of teaching and replace them with new ways of teaching. Mellville, Hardy and Bartley (2011) observe that, without sustained support, it is difficult for teachers to overcome the day-to-day challenges they face. Some teachers tend to isolate themselves from agents of change, while others object to attempts to challenge the hegemony of traditional teaching. For example, Thabo's experience is a case in point, where his peers from the outset rejected his teaching style associated with the NCS. To challenge the deeply entrenched tradition of the apartheid curriculum is to invite conflict over values. The central section of the diagram illustrates the conflict that exists in the consciousness of the teachers. All three teachers expressed the following concerns that subsequently lead to conflicts within their sub-consciousness: i) time, ii) training, and iii) the pressure to change. The teachers' capacity to deal with the issue of pressure enforced upon them by the DOE can be viewed as a system analogous to apartheid education. Again, they were left on the periphery with no say in what they think is needed to learn Physical Science effectively. As a result, they (teachers) find it difficult to see any validity in changing from their old ways of knowing to the new demand stipulated in the NCS. It appears as if they are re-experiencing the (psychological) powerlessness and marginalisation under apartheid. Their unwillingness to adopt the NCS becomes a projection of power from the teachers' side (Mellville *et al.*, 2011). This means they refuse to challenge the deeply engrained historical values of how they perceived the subject expected by the new curriculum. Thabo attempted to challenge the toxic practice of traditional teaching and had the potential of possibly transforming the entire department to implement the NCS had it not been for a few (including the HOD) who stopped him. Being a novice teacher, Thabo did not have enough embodied power to challenge the deeply entrenched views of his older peers.

Based on the consideration of the latter argument, I propose another diagram (Fig 5.3) as a frame of reference for how teachers might possibly view teaching a new curriculum. Both curricula include two central aspects interacting with each other. In each world the teacher sees the curriculum differently, especially with the demands it brings. Some teachers might ask the following questions:

- How do I view myself (strengths, weaknesses) teaching the curriculum?
- How do I view my learners in this new curriculum?
- What is the reason for introducing the new curriculum?
- How will the new curriculum impact on my Grade 12 results?
- What are the demands placed on teachers with respect to pedagogy and content?

The findings emanating from the data reveal that the questions listed above could affect teachers' perception of the NCS as they actively evaluate the situation and its associated demands. It is worth repeating that teachers in South Africa are under pressure to produce good Grade 12 results. Such pressure creates a more examination-oriented disposition whereby a teacher stresses rote-learning instead of developing confidence in learners to work independently. All three teachers in this study raise strong views and opinions regarding the importance of the NCS, but fail to comply as they have to sacrifice their school weekends and holidays to prepare learners for the examination. The latter is another finding of a complex interplay of factors that has the potential of hindering the effective implementation of the NCS.

The general aim of this thesis is to understand teachers' lived experiences in the Physical Science classroom and report on what shows up in a teacher's mind when he/she teach. In the next section I propose a model to explain why the conflict exists in the mind of the teachers.

iii) How Physical Science Teachers Interpret the Curriculum (FET NCS)

Phenomenography, Selley (1996: 838) writes: *is the study of the qualitatively different ways in which people experience and conceptualise the world around them.* According to Selley (1996), people construct cognitive models as firm bases from which they derive meaning from the world around them. Whenever humans interact with the world, every experience encountered is converted automatically into a cognitive model that humans revisit when confronted with a similar situation. Therefore, it is fair to say that teachers reconstruct their experiences through modelling (see Fig 5.3).

Fig 5.3: An interpretation (NCS) of teacher knowledge based on experience

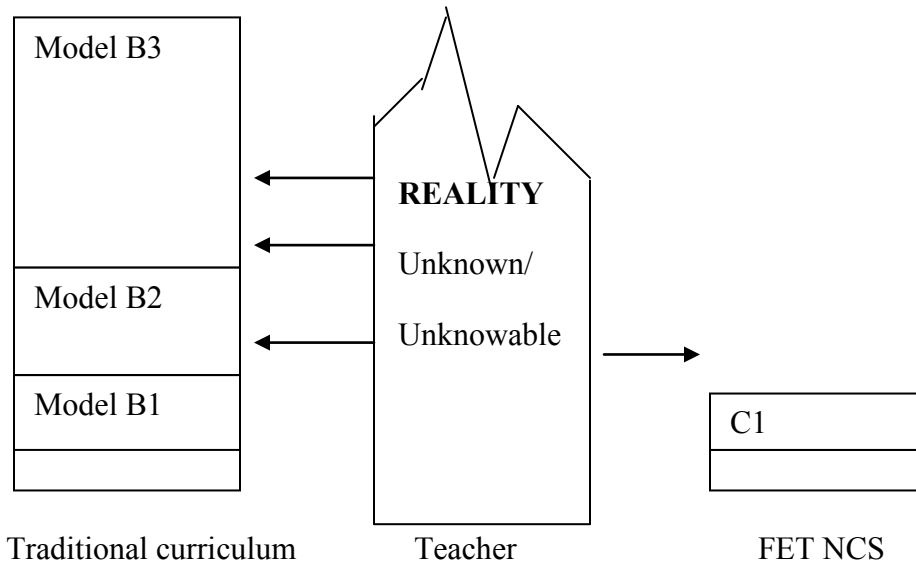


Figure 5.3 shows a cognitive map used by the teachers in this study to construct their consciousness based on their realities when they engaged with the NCS. Reality in this diagram refers to the teachers' experiences in the Physical Science classroom and everywhere else in the teaching setting. The bases on both sides of the centre column represent the old curriculum (labelled B_1) and the new curriculum (labelled C_1). In the diagram the traditional curriculum (models B_1 to B_3) grows by enlargement and amplification, shown as rising from the base. The diagram represents how teachers become comfortable as they experience/work with a curriculum (old) for many years and construct new mental models (B_2 - B_3) and structures to become more familiar with the technical operationalisation of the curriculum. Hence, they expand their knowledge and use insightful innovations to become active practitioners of the curriculum. As Petrovi (2010) points out, the teacher develops set ways in his/her cognitive structures that create habits within which he/she operates daily. These habits become psychological complexes that crystallise and become very difficult to unlearn, especially when teachers are introduced to new ways of teaching that require them to unlearn their old teaching strategies.

Whenever a new curriculum is introduced, represented by model C_1 , the only knowledge teachers have to create a cognitive model/map to guide its implementation is provided by policy documents and training. If teachers have no stored memory or exposure to the implementation process, they might not know how to respond to any new situation in the classroom. This dilemma might result in their searching for consistencies between the old model (traditional curriculum – NATED 550) and the new curriculum (NCS). At some point in their consciousness, the teachers will notice some or no consistencies. If no consistencies are spotted, there is no amplification or growth of the model. The implication of this situation is that the teacher might reject its implementation not because he/she does not agree with the philosophy of the curriculum, but because of the pressure and demands associated with it. For example, the NCS stipulates that teachers change their pedagogical practices from teacher-centeredness to learner-centeredness. Another stipulation is that teachers shift from the use of norm-referenced assessments to criterion-referenced assessments. In such instances either the teacher rejects the new phenomenon and starts complaining that he/she is confused or that the new phenomenon (curriculum) will not work in his/her classrooms. In actuality the problem lies with the teacher having no mental model to make sense of the new phenomenon. Teachers who desire to change their practice might make a fresh start and build or construct new cognitive models based on some fundamentals of the old curriculum (B_1 - B_3). The challenge teachers might face in order to extend the model from C_1 to C_n is to make a cognitive commitment, whereby they will have to think with the new, although partially developed, model and resist the temptation to revert to the old familiar model (B_1 - B_3) with which they were once comfortable. The question of how to address this goes beyond the scope of this study.

5.9 Summary

In this chapter I focused on the data explication process. I used descriptive and interpretive phenomenology to analyse each teacher's transcript. Descriptive phenomenology provided a narrative of each teacher's experiences using, for most part, the direct words of each participating teacher. Through this process I could present the experiences of the teacher as lived from a de-contextualised perspective. It is through descriptive phenomenology that I could provide a biography and a representation of how each individual experienced the implementation

process. In this part of the analysis I followed Husserl's philosophy of applying the *epoché*, i.e. refraining from [trying to ascertain] the pure essences of the experiences. I also followed Husserl's notion of eidetic *residuums* i.e. extracting their own personal ideas as presented in each transcript.

In the second part of the explication process I followed Heidegger's and Merleau-Ponty's notion of placing the teacher in the context or environment in which he teaches. This is where I used interpretive phenomenology to explicate each teacher's experiences. I went beyond phenomenology and interpreted each teacher's experiences in the context of their lives as children as well as the context within which they teach. This process revealed possible psychological influences that had the potential of influencing the implementation of the NCS either negatively or positively. I concluded the chapter by placing the findings in context to allow generalisation. I provided a diagram to illustrate what is going on inside the minds of teachers as they grapple with the implementation process. Also, I used a diagram to explain how teachers interpret the curriculum. In Chapter 6 I will provide a brief overview of the major findings, implications and recommendations for further research. I also reflect on the methodological underpinnings of the study.

CHAPTER SIX

CONCLUSIONS AND IMPLICATIONS

6.1 Introduction

This study investigated the lived experiences of three black South African (FET) Physical Science teachers as they strived to implement the FET NCS. More specifically, the study examined their inner consciousness to gain deeper insight and understanding of their lived worlds and what it means to be a Physical Science teacher in South Africa. My aim was to figure out **what it is they think about, what they think they are doing when they teach**. The emphasis leaned more specifically towards **when they teach, what they teach and how they teach**. This study confronted and revealed the epistemological basis of their core beliefs, emotions, convictions, and perceptions of their teaching strategies in implementing the NCS.

In Chapter 5 I presented the findings on each individual teachers' experiences in two sections, The first presented a descriptive narrative, where I placed more emphasis on using the participant's direct words to describe their experiences with the phenomena as expressed in his transcript. Also, in the descriptive narrative I followed Husserl's (1970) conundrum of focussing on *the essences of the things (teaching) themselves* – in other words how the teacher's mind is oriented towards the curriculum. The second section presented an interpretive narrative, where the focus is more on the context (or understanding the situation) in which the individuals teach. In this section I use Heidegger's notion of the teachers as coping beings (Conroy, 2003). In other words, how do they cope with challenges when implementing the curriculum (NCS). Heidegger (cited in Conroy, 2003:4) explains that interpretation is a way of getting in touch with the inner world of the individual.

Insight into the **inner consciousness** of individuals falls within the ambit of phenomenological research. As Husserl (1970; 2000) maintains, human consciousness is the centre of phenomenological inquiry. Merleau-Ponty (1962:353), on the other hand, captures Husserl's thinking about inner consciousness in the following way:

I experience my own body as the power of adopting certain forms of behaviour and a certain world, and I am given to myself merely as a certain hold upon the world: now, it is precisely my body which perceives the body of another person and discovers in that body a miraculous prolongation of my own intentions...

In view of the above citation, Merleau-Ponty explains the uniqueness of consciousness and, in the context of this study, the idea that each individual experiences a sense of separateness that represents their own thoughts, realities and philosophies. This study involved three participants who were selected purposively, from whose interview transcripts the data were constructed. Each interview was approximately one hour long and focused on issues relating to their experiences with the FET NCS. I gained a richer understanding of their perceptions and insights relating to the NCS by exploring their inner consciousness. The interview data formed the basis of my analysis in Chapter 5. The purpose of this chapter is, firstly, to reflect on the research process and, secondly, to provide a succinct overview of the major findings and the conclusions drawn from it, while bearing in mind the uniqueness of each teacher's experiences. Finally, I shall discuss the implications of the major findings of the study.

6.2 Reflections on the research process

Chapter 5 focuses on the data analysis and explication of each research participant's experience. The main source of data was one-on-one semi-structured interviews. The interviews provided access into the inner consciousness of the respective teachers to gather data orally in the form of rich content-based descriptions. These rich descriptions were aimed at drawing information about the challenges, convictions and perceptions of the teachers about Physical Science.

In a phenomenological inquiry the aim is to search for subjective truth about how people respond to their sense of existence in the world or the teacher as a coping being, which is consistent with Heidegger's thinking about *being and time* (Conroy, 2003: 3). This refers fundamentally to intelligibility or how, in this case, the teachers made sense of the curriculum, or their place in it, and how they became aware of the lived space within which they teach. Therefore a phenomenological methodology is specific, because it illuminates the teacher's contextualized

experiences of Physical Science. The ontological and epistemological aspects derived from the data provided the basis for the essences of their consciousness. The essential interest in the focus on their consciousness is to generate new meaning and understanding revealed through their stories, adding extant knowledge and raising new questions about Physical Science teachers' experiences, both complex and familiar. Husserl (1970) stressed the importance of discovering the truth as derived from understanding the human lived experience, by exploring it systematically in the form of a rigorous inquiry or research. In this regard Van Manen (1984:38) writes:

As we research the possible meaning structures of our lived experiences, we come to a fuller grasp of what it means to be in the world as a man, a woman, a child, taking into account the sociocultural and the historical traditions which have given meaning to our ways of being in the world. (Brown, 1992:51)

In this study, firstly, Husserl's (1970) two principles were followed, namely, (i) the *epoché* – the notion that the natural standpoint of the researcher must be bracketed out of the enquiry (refer Chapter 3.2); and (ii) *the essences of the things themselves* – that is focusing on and discovering the essence of every intentional act. Secondly, the study moved beyond Husserlian phenomenology and followed Heideggerian phenomenology to articulate the views of the teachers and how they made sense of the teaching world (pedagogy and curriculum). Their everyday practices are aspects or signs of ways of coping with the world. The signs and ways of coping with the world (which is a form of Heideggerian phenomenology) enabled the construction of an interpretive narrative for each research participant. Although conducting research in the tradition of phenomenology was not as straightforward as I had anticipated, each narrative allowed me to present my findings in a concise and contextualised form. This was a learning experience coupled with many challenges and new discoveries which were highly informative. The study was concerned with investigating inner consciousness in search of meaning and truth was a new discovery and I found the search for each participant's inner consciousness to be very challenging. Another new discovery is that phenomenology does not offer an effective theory with which one can explain and/or control the world, but rather it offers the possibility of attaining plausible insights which brings us into more direct contact with the world. Also its methodology is very elitist (Van Manen, 1990), its language is very challenging and confusing, and shields it from the concrete processes in which the researcher is engaged.

Therefore in the next section I will reflect on the strengths, weaknesses and lessons learned from conducting research under the flag of phenomenology.

6.2.1 Phenomenologist as workers of experience

The phenomenological school in educational research is divided into two groups: those whose works are grounded in reference to Husserl and those who reference Heidegger. Both groups of scholars concentrate their research activities on the idea of lived experience. Although both groups are located within the phenomenological tradition of researching lived experience, the differences between them are clearly marked. Husserl's (1970) pursuit of truth about humans focuses on the theoretical and philosophical aspects of their experiences, with the emphasis on *bracketing* and *essences* (Palay, 1998:817). On the other hand, Heidegger focuses on the ontological and the contextualisation of experience (Vandermause and Fleming 2011: 368). Both traditions use lived experience to elucidate and validate the way in which people experience particular phenomena through observation and interaction that leads them to indubitable meanings of truth about humans. Therefore phenomenology can be described as a pure science of experience. Its emphasis is on the world as lived by a person, not the world or reality separate from the person. Before I explain my role as a worker of experience in this study, I first want to discuss the value of researching lived experiences.

According to Husserl (1970), experience is the legitimising source of cognition and Merleau-Ponty (cited in Addyman, 2009) maintains that experience is the most immediate source and the last measuring stick of all experiences. Both scholars (Husserl and Merleau-Ponty) agree that lived experiences can be described as a reasonable measure of truth. The question is: What makes research on lived experiences different from other types (quantitative or qualitative) of studies? Firstly, lived experiences are concerned with those areas of human existence (in this case of teachers) that provide insight into the silent voices of consciousness, purposiveness and meaning. Furthermore, lived experiences allows us to understand the everyday lives of teachers more carefully and attentively without any preconceived notions and ideas. This requires us to be open to our own experiences and to the experiences of others, and in so doing one puts aside any dogmatic arguments and opinions we might have about others. The experiences of the

teachers in this study were not only a passageway to construct data, but they became a lens that awakened me to a deeper level of understanding my own experiences of how we live authentically with ourselves and others, i.e. colleagues, learners – and in this study, *the curriculum*. In the words of Kierkegaard (cited by Carson, 1992), lived experience became a kind of *remembering forward*. In this sense the implementation of the NCS becomes not a description of how the teachers *attempt to implement the NCS*, but how the process of implementation unfolds in their practice as teachers. In other types of research frameworks and methodologies (ethnography, case studies, surveys, etc.) the research can become impersonal. Researchers often fragment and abstract teachers' experiences in such a way that we no longer understand it. In this regard Van Manen (1988:439) asks: *Is it ever possible to observe a child's (teacher's) experiences in a pure way*. In most studies on the curriculum and pedagogy, researchers illuminate some aspects of teaching, but at the cost of removing its true meaning in the lives of teachers and learners. Therefore, it makes no sense to *sever experiences* from their highly complex and interwoven context as found in other studies (Brown, 1992:54).

In this study the focus was on the teachers' lived experiences, with the emphasis on the essences of their existence in the Physical Science classroom and on how they implement the NCS. Given the views regarding lived experiences, I want to raise two critical points. First, the depth of the interview questions allowed the teachers to reflect on, and describe, their lived experiences. In so doing, they thought critically about the nature and origin of their experiences with regards to implementing the NCS. This allowed the teachers to take a step back from their practice to conceptualise their everyday concerns that typically influence the implementation of the NCS. Second, their experiences as Physical Science teachers as described in these narratives represent their subjective truth and embody being-in-the-truth as they experience the curriculum. Here the interpretive narratives connected the domain of their experiences with the domain of *dasein* (to be) (Groenewald, 2003). The application of *dasein* allowed their experience to speak for itself by making explicit the contextual complexities embedded in the descriptions of their experiences. It is worth noting that each teacher's experiences were unique in their own way. In other words, each research participant came from a distinctively different background, they teach in a different context (including unique infrastructure of the school, resources, support structures and learners) and each participant has his own understanding or perception of the curriculum.

Next I will reflect on the data-collection process.

6.2.2 *Data-collection process*

Interviews are a common source of gathering data for phenomenological research. In this study the goal of the interview was to seek or uncover what it means *to be* in the Physical Science classroom and implementing the NCS as revealed through the stories of the participants. This phenomenological inquiry shifts away from positivist thinking, as I remained open to unexpected or unfamiliar responses; in so doing I provided space for an interactive exchange to manifest between me and the participants, as suggested by Vandermause and Fleming (2011). This allowed me to understand their concealed meanings in order to make sense of their experience. The language used by the participants in the interview became a narrative text that were transcribed and co-created in the explication process under the interpretive narrative.

This study used two sources of data, namely interviews and field notes. I compiled my data on the lived experiences of how they experience the curriculum through the teachers' descriptions in semi-structured oral interviews. Each interview was consistent with the research question and aligned with the phenomenological method of inquiry. I allowed each teacher to share his experiences by focusing on the essential essences of their experiences with the NCS in the Physical Science classroom. The essential essences questions delved into the complexities and heart of the teachers' lived experiences as they strove to implement the NCS. Most of the questions related to their daily feelings, perceptions, convictions and the challenges they faced on a daily basis. Here it is worth stating that the views of Dinkins (2005) guided me. She argues that consideration should be given to the way researchers draw out responses without leading their participants into a set answer. Furthermore, I allowed them enough time between responses to think about their experiences very deeply to obtain quality data. Their responses were derived from their individual transcriptions. Although there are many other data sources that fall within the ambit of phenomenology – such as rich descriptive essays or observations – I felt that their lived experiences were best captured through interviews and understood through language. Because the strikes taking place in schools at the time, the problems with gaining access through gatekeepers such as WCED and school principals, as well as the busy schedules of the teachers

themselves, made it difficult to do follow-up interviews (discussed in the next section). These are the realities researchers are faced with when doing this kind of research.

The single semi-structured one-on-one interview produced enough rich data for the study. The instrument generated a lot of information and I feel that there is still room for me to produce more research beyond this thesis on the lived experiences of teachers. Heidegger (cited in McConnell-Henry, Chapman and Francis, 2011: 29) points out that to live is to listen and understand. He contends that all humans are self-interpreting beings, and that truth is how a person sees it and experiences it.

6.2.3 *Field work*

The data-collection process as discussed in Chapter 4 was not an easy task, because it depended on the teachers' disposition, mood and work pressures. The process relied on the teachers' availability and was structured in such way as not to interrupt their busy schedule and the school timetable. Interviews can be time consuming and difficult to arrange and they involve a significant amount of travel. Some participants agreed to the interviews and later changed their minds. As a result of this, I negotiated with the teachers to find a time appropriate for them to conduct the interview. This resulted in my having to change the number of participants of the study as my sample size was reduced from 5 to 3 respondents as 2 withdraw from the study (see Chapter 4, subsection 4.2 for full details). The brief of phenomenological research is to develop an understanding of what it is like to live an experience. My aim was to understand their experiences. Therefore careful consideration was given to the philosophy of phenomenology so that the methodological aspects were trustworthy.

The data-collection period was another learning experience for me, filled with new discoveries and problem solving. One of the new discoveries was establishing the criteria for the selection of the participants. I selected them because of their particular life experiences, age and the schools in which they teach. The collective criteria for selecting the participants pertained to the types of schools and communities within which I taught the subject.

Another new discovery is that teachers are often ready to tell their stories. It was important for me to structure questions that recalled events related to the implementation of the NCS without an overlay of conscious explanation but rather, an ontological expression. In this regard I discovered that the phenomenological interview is different than other forms of interviews, where the representation of events in a journalistic fashion is sought. During the interviews I had to control the tone of my voice, my facial expression in response to replies, and master the ladder technique (see Chapter 3) of questioning. I had to be very careful not to ask invasive questions about personal philosophies and beliefs too early in the interviews. Another new discovery that required problem solving was to strategise and reflect on how best to coordinate the data-collection process so as to prevent any chance of losing data. Here I took into consideration all possible questions related to the participating teachers' experiences until most dimensions of their experience were covered. Omitting the most essential questions to gain an insight into their consciousness would imply a loss of data. Overall, I feel the teachers were very co-operative, considering the fact this study took time away from their busy schedules.

6.2.4 *Interview strategies*

The aim of a phenomenological interview is to generate meaning and understanding of the lived experiences of teachers. In such an interview, according to Husserl (1970), the researcher brackets out his own preconceived understanding and allow the narrative text to speak for itself. The phenomenological interview is a distinctive form of interviewing (or questioning) and requires fidelity to the phenomenological circle. Fidelity refers to assumptions that are consistent with either Husserl's or Heidegger's thinking. To Husserl, bracketing and essences form the basis of the interview from which evolve the descriptive narrative of the individual. Departure from Husserlian phenomenology to the realm of Heideggerian phenomenology means that the researcher becomes an involved agent in the interpretive process and cannot bracket out his/her understanding as data are gathered via interview from which the interpretive narrative of the experience flows. McConnell-Henry *et al.* (2011: 33) note that *a successful interview constitutes asking questions and illuminating the participant's experiences until both parties feel satisfied that a shared understanding has resulted.* I followed the Husserlian line of thought

when I conducted the interviews as my aim throughout the interview was to convey the teachers' individual experiences without interpreting what it was I thought they said. Each time I was unclear about a response I invited them to elaborate on their response. I used each teacher's descriptions of his experience to construct a descriptive narrative where my focus was on the epistemological and philosophical dimensions of their thoughts. This narrative allowed me to provide a biographical account of each teacher's experiences with Physical Science both as learners and teacher. Furthermore, I used the same interview data and followed Hiedeggerian phenomenology to provide an interpretive narrative as most of the time the participant was likely not unaware of the meaning embedded in the descriptions he provided. Vanderhause and Fleming (2011) point out that interpretation of experience has meaning within itself that elicits understanding by its very nature as a description of significance. Van Manen (1990) propounds that phenomenological interviewing is about borrowing the stories of individuals as a way to acquire understanding. The bulk of my interview questions focussed on *who, what and when* questions as opposed to the *why* question, because these probes allowed my respondents to elaborate and clarify issues raised.

Phenomenological research focuses on understanding individuals and the logical flow of their thoughts about phenomena. Its methodology has a moral presence fashioned in a way to capture the lived world of individuals. The desire of a phenomenologist is to understand experiences so that the subjective truth about participants can be revealed. Brown (1992:49) sums up this point as follows:

We want to understand man [sic] from his world, that is, from the meaningful ground structure of that totality of situations, events, cultural values, to which he orients himself, about which he has consciousness, and to which his actions, thoughts and feelings are related ...

The above quotation expresses the main aim of this study. Therefore this study sampled only three participants, allowing me to delve deep into their inner consciousness by producing rich descriptive data to capture their thoughts. The methodology allowed me to capture the consciousness and the setting and allowing me to bring their lives closer to that of other Physical Science teachers to gain insight and understanding into their lived worlds. It is worth noting that any other qualitative or quantitative methodology would not have provided similar results. In the next section I shift my attention to the writing process.

6.2.5 *The writing of the thesis*

This subsection is a discussion of how my thoughts and ideas in this thesis were expressed in writing. My thoughts and ideas embody my thinking processes. Husserl (1970) believed that we are all eternal beginners as far as writing is concerned and the learning is in the writing itself (Devenish, 2002). Writing this thesis was both a learning and enriching experience. During the writing phase I found it extremely challenging to determine how to present my ideas in a clear, concise and succinct manner, while at the same time being scholarly.

At first my positivist background dominated the writing of my ideas in a style that represented absoluteness and definiteness. Husserl's positivist philosophy influenced my thinking even more and subsequently my writing became more positivist as his philosophy leaned more towards proving an idea. Husserl's approach to writing (as a mathematician) is similar to the way he would write a mathematical text. In mathematics it is possible that a solution to a problem is the solution or a theorem in mathematics is the theorem of proof. Husserl's phenomenological reduction of absoluteness and the irreplaceability of experience clouded my writing style and presentation of the thesis. Similarly, Van Manen (1990) points out that the difficulty with phenomenological research is understanding i) its elitist methodology and ii) the philosophical representation of the ideas of phenomenological scholars. As I engaged with the writing of the thesis I struggled to represent the ideas of others such as Husserl, Heidegger, Merleau-Ponty, Derrida and many others in an easily understandable manner. What was even more challenging was how to structure and represent the data explication process. Here Husserl and Heidegger did not provide a structural framework on how to go about doing the analysis.

As I engaged with the literature, I soon realised that writing the explication process should be structured around my ideas and intimacy with the participants. I prefer to use the term *explication* and not *analytical framework* as phenomenology is not concerned with analysing the thoughts and consciousness of others, but the explaining of it as communicated to them by the participants. The explication process represents my thoughts and ideas in an attempt to answer the single research question. Therefore the writing is an ongoing process and not an end product itself. The way that phenomenologists go about their data explication process is personal. The structural frameworks provided by other phenomenologists are only guides that require constant

reflection and adaptation that depends on the research question. As a result I structured my own explication framework but also used the frameworks of other phenomenologists.

This structuring led to me shift my writing style from the Husserlian tradition of absoluteness and definiteness as I presented my thoughts and ideas of the lived experiences of the research participants in language. Throughout the thesis I tried to remain open to my research question and kept it permanently in the back of my mind. I realised that this thesis is an attempt to bring fresh approaches with new possibilities for how we think of what it means to be a Physical Science teacher when confronted with and implementing a new curriculum (the NCS). The writing of this thesis represents my view and reveals and generates my understanding of what it means to be a Physical Science teacher in a South African classroom.

Weiman (2008) points out that language is an attempt to communicate and express our ideas and thinking. He argues further that language is less a means of knowing and comprehending the other than encountering the unacquainted other insofar language has both revelatory and concealment aspects. Therefore through language we converse with others in an interval where one can only approximate the other. Understanding this is crucial as one often writes with close attention to the resonances of compromise, where one rearranges the views of others. The writing in this thesis is closely tied to (answering) the research question, and signifies my thoughts and interpretation of the lived worlds of three Physical Science teachers. The dormant content of the teachers' consciousness is made manifest in this thesis through the unity of language with a partial understanding of what it is like to teach according to the principles of the NCS (see Chapter 2).

6.3 Overview of the findings

Chapter 5 is a representation of the narratives (descriptive and interpretive) of each individual teacher's experiences with the NCS. In so doing, I revealed their conscious awareness with regards to the delivery of the NCS. Just as a painter is limited and stimulated by his/her choice of colour and canvas, my representation of their narratives were also limited and stimulated by their transcriptions. In this metaphor the painter refers to the researcher, the canvas represents the teacher and the choice of colour refers to different descriptions of their experiences. I used

both their past (historicality) and their backgrounds to elucidate the complexities of their lived worlds. I draw from Husserl's, Heidegger's and Merleau-Ponty's philosophical philosophies that a person must be understood from his position within a specific time and place to represent the findings.

The major finding in this study showed that the teachers' consciousness, with respect to Physical Science teaching was negatively influenced by the legacy of apartheid education. This negative consciousness through which they framed their thoughts and filtered their ideas became the collective mindset through which they personified their teaching. The study revealed that the delivery of the NCS (by the teachers) was mostly axiomatised by old habits and images in their thoughts engrained in their memory under apartheid education. In Conroy's (2003:8) terms, they can be described as *an agent's agent* or, put differently, as agents of a system (apartheid) through which they navigated their thoughts. Their thoughts are directly tied to the fundamental structures of their experiences (social, political and scientific) under apartheid. In other words, they acted habitually in ways over which they had little control, but they were not always politically conscious of their impact on their learners.

The findings in the study also showed that their awareness of the NCS unconsciously oscillated between the present and the past, and that they continuously and unconsciously bring the past into the present. They constantly have to struggle against the phenomenological self or attitude and ceaselessly suppose and follow thoughts of pre-comprehension or preconception (Derrida, 1967:177). Their thoughts constantly placed them in their past, causing them to go against the grain and philosophy of the NCS. The philosophy of the NCS refers to the development of a critical voice for both teachers and learners, constructing their own meaning from text, independent learning and their struggle to deconstruct text to generate multiple meanings. In other words, they continue to think through their old and historical mindsets. Their responses to the NCS reflect the old curriculum where scientific knowledge is thought of as absolute and incorrigible as opposed to knowledge being in a constant cycle of change. As a result of the old framework of thinking, they avidly followed the twists and turns of the old curriculum when they worked with the NCS, even though they openly denounced the old system. For example, Colin could not break with the past, although he was trained as a Physical Science teacher 10 years

after the demise of apartheid. When he was asked how he felt about OBE seeing that he received training (as a pre-service teacher) in the new curriculum, he said:

OBE is still a mystery to me. All I know is that learners have to write tests during the year and in matric (Grade 12) it's all about the matriculation exams to me. The system (OBE) is not one I looked forward to.

Edwin, on the other hand, said:

OBE in theory is a very good approach but at this school we take the best out of the previous system so we still hammer on tests with strict memoranda. We still do practical work that confirms the most important parts of the chapter. The practicals follow the same protocol as in the old regime...

Thabo shared similar sentiments to Colin and Edwin about implementing the NCS. The following comment from Thabo serves as evidence: *There is simply no time for practical work. Not even during the week.* According to the NCS, learners should extend and build their knowledge around practical investigations and scientific problem solving. Yet Thabo argues he simply cannot find the time to do practical work. The absence of practical work implies that he openly rejects the call to change his practice as a Physical Science teacher. Furthermore, it appears as if all three teachers in this study find it difficult to clear away the dust that has accumulated in their consciousness during their training as learners of Physical Science under apartheid education, as the findings show how apartheid education clouds their perceptions about the NCS. Under apartheid education they were compelled to become slaves and prisoners of their own thoughts and ideas. They were strictly controlled as to **what to teach** and **how to teach** by inspectors who were employed and instructed to monitor and ensure that teachers follow state aims and objectives. All three teachers in this study indicated that the state's motto under apartheid was that science was not meant for black people. For example, when Edwin and Colin wanted to follow careers in science, they were asked: *What does a black man want to do with Physical Science?*

The teachers in this study moved through a personal emotional journey recounting who they were trained to be as opposed to who they wanted to become. Their experiences as framed in their descriptions represent a struggle to overcome the psychological and multilayered social complexities of apartheid. Their descriptions suggest that conditions under apartheid made them

agents of a system that blinded them from seeing the beauty of science in the cosmos. In other words, due to factors beyond their control they are compelled to skim over the laws and principles of science with little intellectual effort and interest in how they apply in the learner's world. The following excerpt by Thabo serves as evidence for the latter claim: *We simply give them (departmental officials) what they want.* Although they wanted to implement new teaching strategies as described in the NCS, they still held strong subconscious feelings of resisting the shift to teach according to the philosophy of the NCS. In the next section I focus on the tensions that flow from the self – the issues embedded in their consciousness as revealed in the findings.

6.3.1 *The fractured self*

Petrovi (2010) describes the self as a subject in which events and thoughts occur. He refers to the self as an individual who is an active thinking subject. In this study the **fractured self** refers to a person who does not articulate and signify his own thoughts and ideas, but is perceived as a **being** in a state of consciousness whose originality, creativity and thoughts have been put to sleep. Apartheid became the medium and paradigm through which the self (being and consciousness) was fractured with respect to the knowledge about teaching and learning they hold about the discipline of science. The evidence based on their own personal descriptions suggests that apartheid influenced their perception of science and as a result they view the teaching of the subject in an obscured way. They use the same obscured lens or false perception to view themselves, which influences the way they implement the NCS. The conceptions and convictions they maintain were developed in them as children. The schools and homes in which they were raised produced a discourse that was controlled, selected and organised, and whose aim was to reproduce their powers. The dominating discourse under apartheid became the cornerstone of social control as it not only repressed their actions but created and defined *who they are* as Physical Science teachers.

Foucault (1972) describes social control due to historicity such as apartheid as a way of getting inside the minds of people in this case teachers to create on their behalf *regimes of truth*.

Foucault (1972) describes regimes of truth in the following way:

Each society has its regime of truth, its *general politics* of truth: that is, the types of discourse which it accepts and makes function as true; the mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true.

Through his notion of regimes of truth Foucault (1972) unmask the epistemological dangers of a political system such as apartheid education. He alludes to how a society's general politics can regulate the intellectual borders of peoples' minds. It is as if the political system becomes imprinted on the individual's mind and eventually becomes a form of life that they regard as normal. In line with Foucault (1972), the findings showed that apartheid is deeply engrained in the teachers' thoughts and became their respective consciousness. Apartheid placed boundaries in their consciousness with limited intellectual abilities to view themselves in a particular way. For example, instead of showing their learners the beauty of the equations and formulas of science – i.e. what they can do with the equations and formulas – teachers focused instead on the abstract nature of the formulas. In so doing, they transferred the same cognitive images in their own minds to their learners, who in turn might reproduce these cognitive images in the minds of future science learners in generations to come. The following comment by Thabo corroborates this claim:

Under apartheid we hardly did any practical work ... and the Grade 12 syllabus we had to teach ourselves, we never got anything from the teacher ... one has no choice but to implement the NCS ...

Thabo indicated that he could not find the time for practical work and yet the above comment corroborates that he was not exposed to practical work as a learner. When he was a learner his teacher/s did not do practical work or regard practical work as an important part of Physical Science. His learners are now experiencing what he went through in the Physical Science classroom. It might become a cycle that continues to repeat itself in the next generation of Physical Science teachers.

According to Apple (cited by Cross, 1997), schools are consciously set up and founded in the belief that they support and maintain state aims and ideologies. Put differently, schools support what governments define as **regimes of truth**. These regimes of truth inform, shape and control the minds of teachers and possibly their learners to adopt particular norms, values and behaviour. There appears to be a considerable overlap in the way Thabo was trained as a learner and pre-service teacher of Physical Science and the way he teaches the subject. The overlap is evident in the above comment that Thabo considers practical work as less important than knowing and teaching the content. There is compelling evidence in the literature that one teaches who one is (Constandi, 2000). Therefore Thabo's mindset as well as Colin's and Edwin's regarding practical work in Physical Science was shaped and formed by his teachers. I now want to shift the discussion to the images of their thoughts and why they think the way they do.

6.3.2 *The images of their thoughts*

The findings in this study revealed that the participating teachers' biggest challenge is not the lack of resources or training they received to implement the NCS), but the struggle in their thoughts to overcome the forms and stranglehold of apartheid in order to transform their thinking. Apartheid influenced almost every dimension of their careers as Science teachers with regard to their views, conceptions, thoughts and consciousness, including their knowledge and their conscious awareness of what they consider to be true based on the apartheid government's definition of truth. It is reasonable to assume that the teachers' life histories as revealed in their descriptive narratives direct their consciousness. Their intellectual frameworks, interpretive lenses and philosophical viewpoints all rooted in their thoughts were engrained in them under apartheid, which is consistent with Heidegger's notion (in Conroy, 2003) of *hammering*. As a carpenter uses his hammer to hammer nails into the wood, similarly their minds were indoctrinated with the intellectual frameworks, interpretive lenses and viewpoints of a system in which they as teachers were considered subjects of the state through control and manipulation. In other words, they find it difficult to overcome these forces of being manipulated and controlled by an apartheid mentality.

Underlying the images of their thoughts such as their inability to transform, the stranglehold of apartheid education, their knowledge, etc. there is a struggle to transform their practices, that is, to become the teacher envisaged by the NCS. According to Freud and Foucault (cited in Beihl and Lock, 2010) a person's thoughts can be defined from two angles: i) past traumas and unconscious complexities, and ii) entangled regimes of power and knowledge. In this regard each individual teacher's biography mapped out the unconscious complexities of his past experiences and realities in South Africa. Their biographies capture the interplay between the political, social and psychological dimensions of their thoughts. Furthermore, their biographies shed light on the afflictions and injustice they experienced at the time they were learners and also how they ended up in the teaching profession. As learners they were exposed to teaching strategies where issues of inquiry in science were viewed as matters of method and protocol. The problem with viewing the teaching and/or learning of science as method and protocol is not that it is an indigenous evil or surreptitious intent, but rather the way in which these discourses have pervaded their consciousness. Also, it is not the methods, procedures and concepts they use as teachers that are at issue, but rather their struggle to develop a deep desire to overcome the discourses they learned under apartheid and to view the teaching and learning of science as a creative and critical practice.

In the teachers' thoughts there appears to be a deeply rooted struggle to revert to the kinds of activities prescribed by the NCS that will aid learners to understand their environments, allowing them to break through the boundaries and limits that apartheid education had placed on their thoughts. It is this stranglehold that imprisons their thoughts and makes it a struggle to transform their practices. This perhaps explains the confusion about the complaints the teachers raised about textbooks, resources and training. They want one single textbook to use religiously as in the past, which examiners can use to set examinations. For example, Thabo followed exemplar question papers to prepare lessons, whereas both Colin and Edwin preferred in their classes to use the old Brink and Jones and *Study and Master* textbooks which were prescribed under apartheid education. It is not that they make unreasonable demands for one textbook or that these textbooks are necessarily bad teaching tools. The concealed meaning behind such claims explains indirectly that they find it very difficult to stop their old ways of doing things. In so doing, they lay claim in their thinking space on their territory of the familiar, which makes it

difficult for them to transform their thinking. Edwin corroborates this in the following comment: *I take the better of the two systems and still do the old and mixing it with the new ... we still hammer on tests with strict memoranda...* Even though he complained about the poverty of the apartheid curriculum, he does not view the shift to the NCS as a new beam of light entering his imprisoned thoughts, nor does he perceive it as the dawn of a new era. Instead he sees the past (old system) in the present (NCS).

6.4 Implications of the findings

This study scrutinised the lived experiences and consequently the consciousness of Physical Science teachers as they strive to implement the NCS. My interrogation of their consciousness in search of truth intended to reveal who they really are as Science teachers as well as the impact of their lived experiences as Physical Science teachers. This study suggests that a form of psychological power suppresses their identities of how they subconsciously feel about themselves and their self-knowledge with regards to Physical Science teaching. This study investigates how they view their own practices as Physical Science teachers. This phenomenological study took an unintended path and ended up at an unexpected truth about what kind of knowledge and consciousness the teachers hold. At this point the question arises (i) What Physical Science teachers, curriculum planners and policy-makers might learn from this study, and (ii) How we might use the lessons learnt in this study to take Physical Science teaching forward in South Africa.

6.4.1 *The impact of the apartheid education system on teacher practice*

The voices of black teachers in South Africa with regards to the implementation of a new curriculum (NCS) are seldom heard. This study afforded the opportunity for three black South African Physical Science teachers to express their views, challenges, convictions, perceptions and feelings about the implementation of the NCS. In order for us to understand **why they do what they do when they teach**, this study investigates their past to capture the core, defining

truths of a teacher's being as encapsulated in their childhood. Furthermore, this study revealed the way in which apartheid (race and racism) influenced the subconscious structure of their thoughts. This phenomenological study is an attempt to provide a framework through which the lived experiences and daily realities of Physical Science teachers can be understood.

It is important to understand the lived experiences of teachers, seeing that Physical Science is such a high-priority subject in South Africa given the fact that large amounts of funding by the DBE is provided for teacher training, infrastructure, computer software programs, laboratory equipment and so forth. The findings revealed that two critical components compromised the teachers' understanding of Physical Science. Firstly, the ideological, political and social context in which they lived shaped their development and understanding of the subject negatively. Therefore it is critical to examine how they experience the teaching of Physical Science in the current curriculum (NCS) and how the past curriculum ideas and aims affected the implementation process. Secondly, it is important to look into the factors that informed their practices and responses to the NCS in order to prevent the past from repeating itself in the future.

These experiences of Physical Science teachers might resonate with the majority of other Physical Science teachers in South Africa. For this reason it is important to look at these issues. If the teachers who participated in this study were affected by apartheid, others might also be affected, because many teachers currently in the system also received training as learners and pre-service teacher training under apartheid. Therefore this study could offer new insight on how curriculum policy makers and curriculum advisors might provide training to teachers. Furthermore, the study might also reveal that Physical Science teaching is a highly complex phenomenon, especially with regards to what it means to be a Physical Science teacher in contemporary South Africa. This is because of the demands the DBE, society and the pressure of the Grade 12 results place on teachers. The study showed the respective challenges teachers might be faced with on a daily basis as well as the perceptions they hold with regards to the subject. As a result, the study might open up new insights to curriculum policy makers and training officials on how to structure their planning to position them in such a way that the individual needs of the teachers are met. This study might also inform curriculum advisors on how to orientate themselves in the field to the pedagogic good of teachers, bearing in mind the

uniqueness of each teacher's experiences. The findings showed that teaching is much more than the dutiful delivery of the curriculum, but also entails the necessity of being sensitive to the teachers needs in order to ensure that they do the right thing for the learners.

This study paints a picture of the lived world of the three teachers under apartheid as learners, pre-service teachers and teachers during apartheid as well as teaching in the post-apartheid era – with its distinctive social, political, symbolic and material dimensions – infused with the intensities and apartheid's effects on their own subjectivity. In this study the decisions the teachers made to enter the teaching profession were attempts to find a space in life so that they could breathe above the political constraints that apartheid placed on them. Their choice of teaching not only collided with their own personal subjectivity (construction of the phenomenological attitude), but also with those (learners) who journeyed with them through the curriculum. From the participants we learn that teaching was not their first career choice. Edwin describes his entry into the profession as part of an agenda to be *a political activist*, Colin describes it as *fate* and Thabo pointed out that he was persuaded by a lecturer to study teaching and that to him teaching was not even a choice at all. It is argued that individuals who are forced into a profession for reasons beyond their control might experience reactionary undercurrents of anger, irritation, impatience and complaints that sometimes lead to them acting inconsiderately (Evans, 2003). The fact that they did not want to become Physical Science teachers does not necessarily make them bad teachers. What this study wants to open up for discussion is the notion that we need to look at these teachers with insight and understanding. They need to be understood in a different temporality as they try to endure and at the same time escape the constraints in their thinking as they strive to articulate new ways of becoming (perceptions and beliefs). From this study we learn that being a Physical Science teacher in South Africa is not always easy, as shattered dreams of the past can lead one to become reactionary. The twisted instruments of power and injustice under apartheid culminated inside of them to become political beings through which they view the world.

This study calls for a conscious awareness of how political powers are constructed, broken down and re-constructed so that teachers, who are always moral agents of politics, are not caught up in such messiness. If such messiness entangles their lives it is important for teachers to be trained

on how to adjust their consciousness depending on the realities they are exposed to. In each of these teachers' lives we can see the reflections of the political powers that shaped and informed their thinking and also at the same time their helplessness to transform their thoughts into a domain of liberated thinking.

6.4.2 *Training of the teachers*

In this study the findings showed that all three teachers took issue with the poor quality of the training they received in preparation for the implementation (of the NCS) process. For example, Edwin pointed out that training officials focused more on **what to teach** than **how to teach**. In so doing, he lost interest in the training sessions because he struggled more with the how to teach (OBE) section of the training. Thabo, on the other hand, described the training as *a complete waste of his time and energy*. Underlying these comments there is a consciousness of being lost and their struggle within their minds to find direction. Furthermore, their descriptions of the training are packed with ambiguities, confusion and paradoxes as their expectations and needs were not met. As Thabo puts it: *we were left more confused ... those who offered the training were some of us (ex-teachers) that they made curriculum advisors who was even more confused than us about OBE*. Colin commented that even today OBE is still a mystery to him. The findings showed that the training officials failed in their task to lead teachers to a higher understanding the curriculum (both content and method) leaving them uncertain on how to orientate themselves positively towards the curriculum.

The knowledge this study reveals about the concrete lives of the teachers' lived worlds exemplifies the complexity of the teachers' minds and of teaching itself. The tensions between being and feeling lost, and finding direction during the training created a dichotomous consciousness that might have increased their anxiety, which could in turn have stifled their willingness to transform their practices. This study maps out what happens inside the mind of a teacher. It unveils the kinds of consciousness that might prevail when teachers are exposed to training programmes when it comes to the implementation of a new curriculum. To curriculum planners and training officials, the study might allow them to see the *layout of the complex structure of a teacher's thoughts*. If training officials know and understand what goes on inside

the mind of teachers, they can see where these teachers are coming from. This will allow training officials to plot with a high degree of precision how to get teachers where they want to take them. This will make training officials better prepared to handle those individuals who choose different paths in implementing a new curriculum. If training officials approach teachers with insight and understanding, training becomes a process of communication instead of a process of imparting information. In so doing, they might in some way help to break down those layers and complexes that stir up emotions which cause teachers to block out mindsets that reject new ideas presented to them during the training. The study also attempted to explain how training officials might break down these complex layers that possibly hinder teachers from changing their practices.

6.4.3 Breaking down the complex layers in the teachers' consciousness that hinder change

The findings showed that the teachers' experiences under apartheid became the collective consciousness through which they interpreted the training and subsequently their implementation of the new curriculum. Their thoughts continuously oscillate between the present and the past, which stifled their willingness to change their practice. Therefore a first phase of training might be aimed at rupturing the cycle or cutting the cord that oscillates between their old habits driven by the memories they hold about how they were trained and/or thought as learners and pre-service-teachers. Cutting the cord between their habits and their memory destabilise the thoughts that could result in synthesising events and new experiences differently during the training sessions. Deleuze (1994) draws on the work of Bergson and uses the concept of duration. Deleuze argues that we don't remember our past in the sense that our memories of the past are stored in our brains. He argues that we only remember the past when some event in the present is aligned with the past. The present event therefore triggers the memories of the past which is like a flash back that we virtually recreate. Deleuze refers to this as our *virtual becoming*. Our virtual becoming eventually intervenes into our present. Training officials should use Deleuze's concept of virtual becoming as the starting point of any curriculum training programme in an attempt to open the minds of the teachers and make them more tolerant of and receptive to the new information. It is only when the cord that controls the mind of the teacher that iteratively

oscillates between the present and past is ruptured that his/her mind is reduced to the present. The teacher is then left in a functional state where he/she looks at the curriculum differently with a deeper and more insightful understanding.

Next I discuss the value of phenomenological research in South Africa.

6.4.4 *The value of a phenomenological study*

Phenomenology is a *human science* that is concerned with the lived experiences of humans. Today in South Africa very few phenomenological studies are conducted as a result of the strong legacy of positivism. Before I embarked on this study I had my doubts about the value and quality of small-scale phenomenological research compared to that of large surveys and statistical studies situated within the positivistic tradition. I soon learned that for most part quantitative researchers are preoccupied and concerned with subject-object relationships with the focus on statistical significance that neglects the totality of the human spirit. Also the generaliseability, rigour and precision employed in such research can be misleading as no two humans are alike. Therefore even though the findings in such studies might be statistically significant, their practical significance becomes questionable.

Phenomenology, on the other side, focuses on the human being in his or her entirety and is concerned with human existence that involves consciousness, purposiveness and meaning (Pinar and Reynolds, 1992; Van Manen, 1990). This study in particular viewed the teachers in their humanness and place in the world of teaching in which they dwell. For me, this study opened up a new perspective on the way I look at a Physical Science teacher as well as Physical Science teaching itself. My relationship with each teacher was unique and I view each teacher's lived world differently from the way researchers from other research paradigms might look at them. Researchers coming from other research traditions such as positivism might see the teacher in a non-personal way, *but I saw the person*. By the *person* I mean the past (childhood experiences), their present, their needs and ontologically their seriousness with regards to their thinking without any preconceived idea from the researchers perspective. This study provided me with new insights and understanding on how to aid teachers in their course to be effective

implementers of a new curriculum. Curriculum planners, policy makers and subject advisors could now take informed action/reaction based on a greater understanding of what it means to be a Physical Science teacher in this day and age in South Africa.

This study also informs the research community of what is most needed in educational research. What is most needed is a commitment to understand the teacher by valuing both the intellect and emotion, informed and shaped by both the present and the past. In research one can easily look past the person and the uniqueness of each individual and focus on the grouping and respond with preconceived ideas and intentions. In so doing, one can look past what a particular experience means to an individual. This study is a representation of the voice of the teacher to be heard in research and gives us an opportunity to look at them differently in response to their voices.

6.5 Limitations of the study

This study was constrained by several limitations. First was the fact that the study was conducted only in the Northern District of Cape Town. Second is that only three teachers were involved. This section serves to point out the limitations pertaining to the study as a whole.

6.5.1 Not more than three teachers were involved in the study

It was not possible to involve more than three teachers in the study, because my focus was on understanding the lived ontological and philosophical aspects of the teachers' world and how they impacted on their teaching. Investigating the ontological and philosophical aspects of a teacher's thoughts, with the aim of understanding them, requires the researchers to delve very deeply into the different essences that make up a teacher's everyday life. Each aspect of the teacher's existence needs to be considered and requires radical questioning that allows the teacher to elaborate on such issues. Therefore the data-construction process (interviews) provided me with access into most of these essences about their existence in the teaching world. Overall the three participants generated approximately 90 pages of transcriptions that needed explication and this prevented me from expanding the study beyond three participants.

Furthermore, my interest was on participants who taught in what were historically called **disadvantaged schools**. I choose these participants because I taught in similar schools and their experiences allowed me insight and understanding of what it means to be a teacher in such schools. This implies that possible potential teachers were left out of the study, since their schools were not selected to take part in the study.

6.5.2 *Time constraints*

Time was a major constraint. Most teachers work under tremendous pressure from the DBE to complete their syllabi. Most of the time they are forced to sacrifice their weekends, public holidays and schools holidays to squeeze in lost time during normal schools hours due to circumstances beyond their control. Furthermore, they also use the time to do consolidation exercises and tutorials to work with weaker learners.

Apart from their responsibilities at work, they also have a family life to consider, of which they were very mindful. As such, 2 of my original 5 participants withdrew and indicated that they simply could not afford the time for the purposes of this study. Those participants who did decide to take part in the study only made themselves available on their terms as far as time was concerned.

6.5.3 *Generalisability of the findings*

The point of doing phenomenological studies such as this is to present in-depth insights into the lives of teachers from which we can learn what their experiences are like teaching learners that come from poverty-stricken communities. This study reveals the pedagogical situation and challenges teachers might face and sheds some light on the question of what it means to be a Physical Science teacher in this day and age in South Africa. This study provides knowledge and answers to research question that studies such as large-scale surveys and other quantitative studies cannot provide. This study intended not to provide results that are generalisable but to show that no two humans are alike and to understand that truth is subjective, floatable and precarious.

6.6 Recommendations for further studies

There are several issues that emerged from this study that warrant further research. Some of the recommendations emanate directly from the design of the study, some as a direct extension of the findings of this study as issues which emerged in the data.

6.6.1 *Investigations into the impact of apartheid on teacher practice in South Africa:*

This study has shown that apartheid played a major role in the teachers' understanding and teaching of Physical Science. This study revealed the impact of apartheid on the way the teachers were trained as learners, pre-service teachers and in-service teachers in Physical Science. The question arises whether apartheid does affect teacher practice in general and, if the answer is yes, an investigation into why this is so should be undertaken.

If apartheid had such a negative impact on the pedagogical practice of the teachers in this study, it is possible that this finding might resonate with many other Physical Science teachers. Many active teachers currently teaching Physical Science were learners and pre-service teachers under apartheid. Therefore the study could be extended to other Physical Science teachers and to other teachers in general.

6.6.2 *Research on the lived experiences of learners in the Physical Science classroom*

This study investigated the lived experiences of three Physical Science teachers. It represents the voices of only three teachers. A further study is recommended where the lived experiences of the learner in the Physical Science classroom is explored. Investigating the lived world of the learner might provide insight and understanding into the uniqueness of how learners experience the subject. Most studies in Science overlook the uniqueness of how learners experience the learning of Physical Science. Such knowledge is vital, because it might provide teachers with deeper insight into how to approach the individual needs and learning styles of the learners. By investigating the lived experience of the learner we would understand not only how the learner experiences the teaching and learning of the subject, but also discover the essence of a learner's

existence in Physical Science. In other words, we can unveil what goes on in the minds of learners during the teaching and learning process.

6.6.3 *There is a growing need for phenomenological research in education*

Most research methodologies fail to some degree to capture the uniqueness of their research subjects – for example, how they (learners and/or teachers) conceptualise, perceive and respond to the world around them. The reason their methods fail is because their focus is on the epistemological and not the ontological. Phenomenological research not only informs us of the uniqueness of individual teacher and learner needs, but also how to position ourselves to address their needs. It helps us to build knowledge about teachers and learners based on their experiences in the world in all its dynamic variation. Its method is reflective, descriptive and interpretive but not manipulative, keeping in mind that teaching or learning as an event comes before theory.

6.7 **Conclusion**

This study intended to investigate a single research question centred on the lived experiences of three Physical Science teachers, and how they implement the FET NCS. Husserl, Heidegger, Merleau-Ponty and various other phenomenologists provided the philosophical routes to enter the teachers' consciousness to confront the silent voices of *who they are* and to mine their epistemic beliefs, challenges, perceptions and convictions about the NCS.

In this study phenomenology provided the means through which I located the teachers' essences or essentialities in their existence. These essences can be considered a language of psychology, which are their own personal monologue giving reasons for their responses to the NCS. It was my intention to locate and foreground these silences. This silent language of their inner consciousness elucidated their metaphysical anticipation or decisions they took with respect to the curriculum. These silent thoughts represent their own unique meaning through which they express and negotiate their realities. In order to unveil these obstacles and challenges that possibly hinder curriculum reform, it is critical to listen to the voices of the teachers.

The findings showed that their realities as Physical Science teachers are very complex and coupled with many challenges. Delving into the complexities of their consciousness revealed

that apartheid affected their understanding of Physical Science negatively and subsequently hindered the way they implemented the NCS. The findings revealed that their thoughts, ideas and memories of apartheid as both learners and teachers are their biggest psychological deterrent to a positive perception of the NCS. Their past memories of apartheid education are always operative and intertwined in the delivery of the NCS. Several sections of the data corroborated this point and confirmed that their thoughts and ideas about Physical Science are reduced to a prearranged system that directs their responses, measures and functions.

Recommendations were made on the basis of these implications. The implications showed that there is a need to gain more insight into the consciousness of other Physical Science teachers to reveal whether the impact/legacy of apartheid also resonates in their practices, since many of them were also exposed to apartheid education as learners and pre-service teachers. Another recommendation is to shift the focus to the lived experiences of learners in the Physical Science classroom. Their voices are critical to gain more insight into how they perceive the subject and why this is so. This will provide teachers with knowledge about how to position themselves in the classroom when they teach so that they can plan according to the needs of the learner. Also within the research community, it is hoped that more phenomenological research will be undertaken, as it affords explanations of the world of our research subjects. Furthermore, phenomenological research focuses on and expresses the essences of people by articulating their voices. In so doing we can learn to develop and extend our understanding of both teachers and learners. This study showed that teachers operate in an ever-changing environment in which there are constant new technological developments, social changes and/or political evils that necessitate changes to the curriculum and subsequently changes to their teaching strategies.

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Appendix A



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
jou kennisvennoot • your knowledge partner

20 April 2010

Dr RS Cornelissen/A Wyngaard
WKOD
Privaatsak X9114
KAAPSTAD
8000

Geagte Dr Wyngaard/Cornelissen

VERLOF AAN PhD-KANDIDAAT OSCAR KOOPMAN OM NAVORSING AAN GESELEKTEERDE HOËR SKOLE IN DIE WES-KAAP PROVINSIE IN 2010 TE DOEN

Mnr Oscar Koopman (Studentenommer 14310961), 'n Doktorale student van ondergetekende, is tans besig met navorsing oor die volgende goedgekeurde onderwerp: *Science Teachers Experiences of the Implementation of the FET Curriculum for Physical Sciences*.

As deel van sy empiriese navorsing beplan hy om onderhoude met enkele onderwysers aan genoemde skole te voer. Die onderhoude met onderwysers sal na-uurs afgeneem word en sal dus nie die skoolprogram ontwig nie. Hy beplan ook om klaskamer aktiwiteite van geselekteerde onderwysers waar te neem. Reëlins vir laasgenoemde sal met die betrokke skoolhoofde gedoen word en sal nie die normale skoolprogram ontwig nie.

U word dus hiermee vriendelik versoek om toestemming te verleen dat hy wel onderwysers by die betrokke skole in sy navorsing kan gebruik. As promotor sal ek uiteraard sorg dat die vereistes wat u gewoonlik stel, streng nagekom word. Kontak my asseblief by 021-8082280 (of llg@sun.ac.za) indien u enige navrae het.

Sou u egter meer inligting van die student verlang, kan u hom kontak by: 0833524298 (of koopmano@cput.ac.za).

Baie dankie by voorbaat vir u gunstige oorweging van die versoek.

Vriendelik die uwe

Prof L.L.L. Le Grange
(Promotor)

Appendix B

Inquiries: Dr R.S Cornelissen
Tel: (021) 467 2286
Fax: (021) 425 7445
Ref no: 20100507-0034



Mr Oscar Koopman
Department of Education
University of Stellenbosch
Private Bag X1
MATIELAND
7602

Dear Mr O. Koopman

RESEARCH PROPOSAL: SCIENCE TEACHERS' EXPERIENCES OF THE IMPLEMENTATION OF THE FET CURRICULUM FOR PHYSICAL SCIENCE.

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. The programmes of Educators are not to be interrupted.
5. The Study is to be conducted from **16th August 2010 to 15th September 2010.**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr R. Cornelissen at the contact numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as submitted to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:
**The Director: Research Services
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000**

We wish you success in your research.

Kind regards.

Signed: Ronald S. Cornelissen
for: **HEAD: EDUCATION**
DATE: 21st May 2010

Appendix C



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**STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH**

Title

Teachers' experiences at implementing the National Curriculum Statement for FET Physical Science

You are asked to participate in a research study conducted by [*Oscar Koopman, BSc, HDE, Bed Hons., MEd*], from the [*Education*] at Stellenbosch University. [The results will contribute to finalizing my PhD studies. You were selected as a possible participant in this study.

1. PURPOSE OF THE STUDY

To investigate the lived experiences of FET Physical Science teachers. This study will report on activities taking place in the science classroom amongst others, pedagogical activities, assessment, policy implementation (NCS) and teacher-learner relationships. Through this research the issue of inequality in the science classroom can be addressed as schools with different social backgrounds were selected.

2. PROCEDURES

Data Collection

The investigator would like to conduct an interview with the teacher of approximately one-hour long.

3. POTENTIAL RISKS AND DISCOMFORTS

The teachers normal teaching time and school timetable will not be disrupted for the purpose of data collection. The interviews will take place after normal classroom school hours.

4. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

This study will report on the activities taking place in the science classroom ranging from pedagogical activities, assessment, policy implementation (NCS) to teacher-learner relationships. Through this research the challenges teachers are facing with respect to their understanding of the NCS of Physical Science and the nature of science (NOS) can be addressed if it is found to be inconsistent Furthermore the research will help and encourage the teachers in this study as the literature points out that teachers suffer from low morale due

to being overworked. Teaching science in some disadvantaged schools require more input than any other subject, insight might be provided in this regard as what kind of support mechanisms can be put in place to increase teacher output in the science classroom.

5. PAYMENT FOR PARTICIPATION

N/A

CONFIDENTIALITY

Any findings that emerge from this study will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of the data being kept by the researcher. It will not be shared with any other person except the teacher and the supervisor in charge of the study.

6 PARTICIPATION AND WITHDRAWAL

You can choose whether to participate in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

7 IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Prof Lesley Le Grange at 021 808 2883 or via email llg@sun.ac.za

8 RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

Appendix D

Interview questions

1. Please tell me more about yourself:

- i) Age and where you grew up;
- ii) Institution you studied at? Explain why you studied there;
- iii) Major subjects for your qualification;
- iv) Years of teaching experience and subjects taught;
- v) Specifically - teaching experience in Physical Science

2) Why did you decide to become a Physical Science teacher?

3) Is/are there any other close family member/s (mother, father, brother, etc) who are also teachers (specifically maths and science)?

4) Tell me more about your Physical Science teacher at the school you attended as a learner.

i) The method he used when he taught

ii) Whether or not you liked his teaching style

iii) Looking back as a learner of Physical Science, did you enjoy the subject? Explain why.

5) If you reflect on your childhood experiences as a learner of Physical Science was the content socially and practically meaningful? In other words could you relate the work that you did in the class to the real world and make sense of it.

6) When you started your career as a Physical Science teacher what did you aim to achieve?

7) Did you reach your objectives?

8) What grades do you teach and how many learners are there in each grade?

- 9) How do you feel about the changes that took place in the country regarding education after the death of apartheid?
- 10) What are your views and how do you feel about the changes in the curriculum concerning grades 10 to 12 that was introduced as the FET NCS for Physical Science in 2006?
- 11) How would you describe the training you received in preparation for the implementation of the NCS? How long were the training sessions? Was the training adequate or not? Were the people who offered the training competent enough? Did you learn new things? Did the training help with implementing the new material and methodology?
- 12) The FET NCS requires an outcomes-based approach, how do you feel about OBE? Do you apply an outcomes-based approach in your teaching?
- 13) The curriculum as described in the NCS uses complex terms such as learning outcomes, critical outcomes, developmental outcomes, and assessment standards, do these terms have any meaning to you when you plan your lessons?
- 14) Do think along the lines of these outcomes as stipulated in the FET NCS when you prepare your lessons?
- 15) What are the challenges you faced with implementing the NCS? What did you do to overcome those challenges?
- 16) What are the perceptions of your peers about the FET NCS for Physical Science?
- 17) How do you prepare your lessons, and what resources do you use when you plan your lessons? What teaching strategies do you use to implement OBE in the Physical Science classroom?

- 18) What did you find most useful in the FET NCS in improving the understanding of the learners regarding Physical Science?
- 19) What kind of discourse creates the best environment for implementing the NCS in the Physical Science classroom
- 20) The NCS envisages a specific type of Physical Science teacher. For example some of these qualities this teacher must have is that he/she must be dedicated, committed, subject specialist, researcher, designer of learning programs, life-long learner, scholar, etc. What is your perception of these qualities?
- 21) Do you think you live up to those standards or qualities set by the NCS?
- 22) There are quite a number of different textbooks on the market, which criteria do you use to select a textbook in your Physical Science classroom?
- 23) Do you still use the old Brink and Jones textbook sometimes or did you completely remove the textbook from your classroom after the introduction of OBE?
- 24) How do you feel about the new textbooks on the market?
- 25) How often do you do practical work with your learners?
- 26) Do you think that practical work helps learners to understand the Physical Science content better?
- 27) Do your learners enjoy practical work or do they lack confidence when they are required to work with the science equipment in the laboratories?
- 28) Do you have enough time to complete the syllabus?
- 29) What extra support do you provide for your learners apart from the official contact time at school?

- 30) If you have taught grade 12 Physical Science, tell me more about their pass averages in the last three years?
- 31) What do you think is the reason for the poor/good results your learners obtained?
- 32) If you reflect on the implementation of the FET NCS, do you think it added greater value to the learners' learning/knowledge in preparation for post-school education?
- 33) Are there any other comments regarding on the NCS FET for Physical Science and the implementation thereof you would like to make me aware of?
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Appendix E

Extracts of the transcripts of the different research participants

Colin's transcript

Interviewer: Today is Tuesday the 5th April 2011. A interview conducted with the consent of the interviewee named Phillip.

Interviewer: Phillip please tell me more about yourself, where you grew up, your age, your teaching experience, your physical science teaching experience, your education, your subject majors at university, the institution which you studied at; and explain why did choose that specific institution.

Interviewee: Erhm I'm sixty two years old now and Erhm I've been in the teaching profession now for six years. Erhm I was in the oil industry for twenty five years, the Chemical Engineering sector, where I actually used the knowledge gained at University in the work place. Erhm One of my majors was Chemistry and those days we also did Botany as the major but then we had to have, we had to have courses in maths and physics erhm to supplement the courses, so I studied at UWC. I could only study at UWC due to apartheid. I Finished off my degree in 1972, in the days where it was not good for any person getting a BSc Degree to go to industry because it was accepted that you should become a teacher. I was one of those people that was a rebel that erhm actually decide no I would rather I was not born to be a teacher so I wanted to go to Industry. Life has a strange twist and fate has it that thirty odd years later I am actually teaching and what motivated me to go into teaching..... well first of all why I studied at UWC, that was the only choice really open to go to any other University you had to have permission from the then Department of Coloured Affairs.

Interviewer: Erhm why do teaching?

Interviewee: I've worked at a number of jobs, I was retrenched in 1998. Again the politics dictated that the work place had to make provision to get the demographics of the country right, so that meant leaving the Industry where I was working in the Oil Industry and going out to either find a new job or find a new career for myself. I loved the building industry and engineering because as a student many years ago I actually worked on many Civil Engineering jobs and contracts and erhm and (pause) and also during the course of my career

in the Oil Industry the twenty five odd years I embarked on building houses for myself, my family, my brothers and sisters erhm and it was challenging and this is one of the things that I love you know, the challenge of starting something and in fact see it materializing it was a great joy to complete an extension for somebody or to build their house and say ok there's your monument that you actually raised for something one can look back on and said..... then I left the building industry because of all sorts of reasons, one of the things I couldn't stand was the crookedness and the underhand dealings that went on there. I went to work in Beaufort West, my home town was actually born to work there and again there I embarked on work in various projects one of them most notable was the development of a sports field for the local municipality where we had to build a clubhouse where we had to build a lay out the hockey and the rugby fields as well as the erecting the concrete footing for the floodlight heads on the field. I think my background up to there, then was such that I enjoyed it enough civil engineering experience having done in fact a just after my retrenchment a 3 months bricklaying course through corobrick, I thought that is where I want to go in and I equipped myself so that erh at least in the building industry even if I didn't do all the work myself at least I would know what was involved in the work. Erh then I got a job as erhm with the divisional council or the what we call today the district municipality as a road inspector and erh semi road engineer where my main function was to go out to all the gravel roads, inspect the quality of the gravel roads, call on graders to come and grade the road, prepare the road we had different squads of erh of erh trucks that would go out and will call them out to go and repair a road maybe where there was erh there was a flood, flash floods erh the cover would have to be replaced.

Interviewer: Did that require Science? An understanding of Science?

Interviewee: It required a basic understanding of the knowledge of some of the components in Science. By then I built up quite a bit of an engineering background which helped me in that. The Science part came in where on particularly on on the tar roads where we had to use Bitumen and the new scientific form of slur rage that used instead of (inaudible) bitumen so I worked extensively on developing those premixes and sprays that they were using on at the industrial laboratory where I worked so they gave me, that required a knowledge of chemistry that required well that equipped me to be able to erh say one can use for instance 'cap spray' on this particular gravel because the interesting part was that erh you cannot just use any

bitumen or bitumen spray on any type of rock because of the erh ... materials some of them are cationic some of them are anionic so you had to decide which type of bitumen or spray can use to actually bond with the stone on the road.

Interviewer: Tell me what was your other major at University?

Interviewee: Erh I majored in Botany sadly though that is one of the

Interviewer: Chemistry and Botany?

Interviewee: Chemistry and Botany, sadly Botany was one of the subjects that became “n sleep vak” [dragging it along]. I must be honest when I say that, I hardly ever used botany.

Interviewer: Up to which level did you do Physics at university?

Interviewee: Erh I did both first year Physics and Math's courses.

Interviewer: Tell me more about your Physical Science Teacher experiences when you were learner at school? The methods he used at school to teach you physical science. Whether you liked his teaching style or not and looking back at your life as a learner of Physical Science, did you like the subject?

Interviewee: My life as a student go back to around about the early 60's. I was at High School and I finished off High School in 1967. Erhm I'm one of the lucky people that did not do Physical Science as a school subject as such in the old standard ten, currently grade twelve erh eleven and twelve. I did general science till grade 8. E rh I'm thinking my liking for Science came in because my father himself was very scientifically inclined. He believed that erh whatever man has made you can tackle whatever is broken you can be repaired if you got the right equipment. And also he was very innovative in the sense that erh you should improvise you must try out new things, you should explore. He himself had no qualification

but yet he went to study repairs of radios and television so, that equipped him erh to become sort of a handy man in the town where he lived erh, now similar he wanted to know more about the building industry and hence enrolled in the British building industry and studied through them to equip himself. I think my Science knowledge and passion was inspired by him for fixing broken radios and electronic equipment. I can still remember him building his first radio. I was at his arm when he build the first radio put it together and it actually played. So the science intrigued me, now I always asked myself, how did the sound come out of the radio in the first place, isn't there a human being inside the radio, erh if you pick up a particular radio station how did the radio pick up the signals it generated so erhm and then uptil standard eight I had two science teachers, they both dead today Mr De Klerk and Mr Magrienie that took us in the old standard six seven and eight teaching us science. Their methodologies where very much based on the traditional board chalk and talk method where it was a case of transmission of knowledge, you the learner sat in class in fact and listened you basically had to go and study and erh give it back in during examination or question time. Erhm up to that time, I think up to standard eight I then had the desire that I would want to go into the scientific field as that erh sort of erh pricked me. Unfortunately however because the school did not offer science as a subject as such I did'nt do physical science, I however did Biology and what was then Physiology which was science subjects but more on the human body, the physiology of the human body.

Interviewer: Are you saying you didn't do physical science as a subject?

Interviewee: I didn't do physical science as a subject at all.

Interviewer: But was it offered at your school?

Interviewee: It was not offered at the school where I was.

Interviewer: Was it offered at other schools nearby?

Interviewee: It was available at other schools, however our poverty situation did not allow me to be able to go to any other school to do that, so, my parents could not send me to a school that offered Physical Science because of our poverty situation. But we were promised that time that you could go into studying science even if you did'nt have physical science

based on the fact that you had Physiology (inaudible) - the subject was then similar to biology. At that time also one must remember that erh that the education system for the so called coloured people was geared at erh getting students to enter college or university to equip them to become a teacher hence it was not an or the subject physics or physical science was not really encouraged because what would so called coloured people actually want to do with physics. Coloured people were not allowed to study science under apartheid. It was only the parents that could afford to send their children to schools where they offered the subject and you knew then that to become a doctor engineer you actually required physics as a subject though it was not a prerequisite.

Interviewer: So how did you cope with that transition or that shift because remember you now had to do physics and chemistry at university whereas you had no background in that particular field, so how did you cope with that and how did you experience it?

Interviewee: Well, while I was in matric I realized the need for knowing more about physics and chemistry, and on my own I studied through a correspondence school erh which was called Success College that time. I studied through them and I in fact studied physics and chemistry, however the sadness of the apartheid system was such that we could not write more subjects than what the school offered unfortunately because the so called coloured people if you took the six basic subjects you could not write another subject erh outside so I never got so far as in fact writing physical science as a subject through as a matric subject however I believe that the knowledge gained then was sufficient to help me with the challenge of university line obviously when I started university I left school and because my ex primary school principal son actually qualified as a doctor about four or five years prior to that it somehow seemed or I was entice do go or encouraged to go into becoming a doctor. My very first year at UCT showed me that that's not where I wanted to be, I was not born to be a doctor erh...

Interviewer: But how did you get into UCT?

Interviewee: Well, erh I got in because of good pass marks erh a general good pass mark, a good pass mark in math's a good pass mark in physiology and a good pass mark in biology, however it was a slap to get into because you had to apply to the old department of coloured

affairs to be able to get into The University of Cape Town. UWC at that time did not offer erhm they did not offer physics they didn't offer medicine and engineering as courses one could follow.

Interviewer: So your first choice of career and course of study was medicine?

Interviewee: My first choice my first course....

Interviewer: But then you didn't do well in it based on your descriptions....

Interviewee: I pulled out realized I was not to be a doctor of medicine and erhm when I was at school I in fact toyed with the what where the scientific fields one could go in erhm I think I must admit that erhm apart from knowing that at that time we were very dissatisfied knowing that somebody went to study pharmacy so I thought pharmacy was an option, however my nature was such that I realized that looking at the pharmacist in the local town their job to me seemed very boring and the fact that they were afterwards I call them "glorified shop assistants" because that's basically what they were, they had to have the knowledge but they can dispenses the product so it's quite wide and for me it was quite a thing not to study to become a pharmacist. When I went to UWC I thought well should I go into the pharmacy or chemistry.

Interviewer: Do I understand you correctly when you say after your first year at UCT you then withdrew the next year to go study at UWC?

Interviewee: I went to UWC.

Interviewer: At that juncture which course was your first choice?

Interviewee: My first choice was to do just the plain Bachelor of Science degree.

Interviewer: That's when you did the Chemistry and Botany?

Interviewee: That's right yeah....

Interviewer: Oh now I understand.

Interviewer: Thanks you for clarifying this for me. In essence your entire background in terms of where you started you know, the schools you went to, your science teacher, then you enrolled at UCT which then made you later to end up in the petrochemical industry where you then where retrenched in the early nineteen nineties or late nineteen nineties. Then you did a couple of other lose jobs in trying to find your feet as a result of the political climate at that particular stage of our country. So then in what year did you then go into the teaching?

Interviewee: Erhm I think it was 2005...

Interviewer: What I mean is you needed at that stage you didn't have an HDE which is a qualification, a teaching qualification so what year did you then enroll for that teaching qualification?

Interviewee: In 2005 I enrolled at UWC to do the post graduate certificate of education which is a replacement of the old HEDE

Interviewer: Why did you choose teaching as a profession?

Interviewee: First of all teaching when I worked in industry I was confronted with so many of our children from my own family, my brothers and sisters' children battle with subjects such as physics and mathematics. Also it was a era where many of our teachers left the teaching profession because of the new government's policy stating that erh too many teachers at schools, many science teachers and math's teachers left the school and erh there were so many advertisements at schools looking for science teachers. At that time I said to

myself I have a number of years about ten odd years left to be a teacher. How can I contribute to the development of our young people and I then said to myself teaching is one of the most logical places where I can have a direct input into the lives of some young people erhm and having made that decision to go into teaching the natural thing was obviously to learn to science teaching and I was not scared of that because my background was science I had the privilege that erhm privilege in that I can in fact use science practically where as many other teachers started teaching they've never really been in an industrial laboratory or what requirements are chemical engineering project is. I was privilege that I worked with mechanical engineers, civil engineers, electrical engineers and chemical engineers in different fields and erhm as I said the obvious thing was if you go into teaching to go into science teaching. I must say five, six years later I have not regretted that because I realized the need for science teachers, I realized the need for people with a good sound knowledge of physics and chemistry erhm and also to be able to help our kids in a changing world for the them to carve out a career for themselves.

Interviewer: What grades do you teach currently? How many learners?

Interviewee: Right, let me just backtrack by saying that when I started teaching.....

Interviewer: No I mean right now.

Interviewee: Right now I'm teaching a class of 25 grade 12's, science learners, a class of 31 grade 11 physical science learners and then I teach a grade 10 class of math literacy learners that is also about 30 learners and with that I teach two other classes grade 8 classes mathematics both classes 45 learners.

Interviewer: How do you feel about the new changes in education that took place in our country after the death of apartheid?

Interviewee: While I was working in industry erhm I became quite involved in the education setup in a sense that the company had a corporate social responsibility section and erh that involved helping groups in the previously disadvantaged community help them setting up for instance soup kitchens helping to get a class build at a school helping to get water at a school where there was no water erh but then also just to see the need of children at schools, and erh I think that prompted me first of all to get back and to get into teaching but then also realizing there was such a big need especially when we had a change over in government and we could see that the old education system had to be replaced by a new system, I think for me the old system was too fragmented it aimed at developing a certain section of the population at the expense of the other population group. For instance erh I know one time the figures that I read was that in the old system five hundred rand was spent on a so called white child whereas only fifty rand was spent on a black child and maybe one hundred rand on developing a coloured child at school. So the old system definitely had lots and lots of shortcomings that had to be overcome and replaced so I think the new education system came at the right time because we at that time was the country was stagnated, what would we do with thousands upon thousands of young people at school that was not equipped for the workplace and in my case especially we had problems when I worked in the oil industry to get the suitably qualified young people to come and work with a chemistry and physical science background so I think the new education system where doors were open for all to be able and want to grasp and accept the education systems.

Interviewer: Oh,

Interviewee: I think the new dispensation really opened the doors for us

Interviewer: Did you, did you receive any training on how to actually implement the new curriculum? The National Curriculum Statement for FET in 2006? How long were the training sessions, was the time frames adequate? The people offering the training where they competent enough? Did they learn you new things? And did what you learn help with implementing the materials and methodologies?

Interviewee: When I started, erh when I did my postgraduate certificate at UWC, the Department of Education, in the Western Cape Education Department offered training during

the June and September holidays because the teachers were not prepared for the curriculum. They (teachers) had one week sessions where they actually trained Math's teachers in the new curriculum. I however started teaching with that sort of training in Math's but no formal other training in Physics and erh Physical Science and in my first year I taught, I didn't teach a Physical Science class but I taught a math's class and then my second year of teaching because the school had no science teacher I started teaching a grade 11 class of physical science and a grade 10 class in physical science. That was done with no in my case with no formal training from the department as such erhm the curriculum advisor in the EMDC that I worked in at that time erhm Mrs Bitchman, she erh arranged practical training sessions on a number of Saturdays and that is where I basically learned a bit more of some of the experiments and investigations that was required in the current FET syllabus. But for my part most of my knowledge came from erh my own knowledge of science, my practical experience in industry but then also at university we were gradually prepared for the new curriculum in a sense that the whole concept of outcome based education was stressed. By that time the word was banded around that, educators where responsible for their own syllabus or work plan. I must add at university we were gradually prepared for the new curriculum.

Interviewer: Are you talking now about your experience in your post graduate diploma of education?

Interviewee: In the post graduate diploma of education.

Interviewer: Now latching onto that right, the new curriculum that we are exposed to today requires what we call an outcomes based approach. How do you feel about OBE and do you apply outcomes based approach in your classroom?

Interviewee: I think I must be honest and say that for many the whole concept of outcomes-based education (OBE) is still a mystery to me in a sense that when I came from industry I had no experience of the then current syllabus curriculum. I had no experience of what was required except to know that I knew that learners had to write tests during the course of the year and in Matric they were all confronted with Matriculation final examinations. I however think that the system was not one that I looked forward to in a sense that erh my own

personal experience is such that erh in the workplace that I worked one need to be involved, if you want to know something you need to go and search for that. The old system was very much one of transition, the new system had I believe objectives of drawing learners into constructing knowledge on their own and that in fact require the educators set the scene so that learners can be part of generating and requiring the knowledge that they need. We as far as outcomes based education is concerned I think too many negatives went in around it. Negatives in the sense that erh erhm because teachers teaching in the old dispensation were not prepared to move away from their comfort zone, erh there was this whole resistance to change in education resistance to change yet many of them were not even interested in whatever training that was offered erhm if any was offered erh I still experience that teachers cannot accept the concept of outcome based education and I think....

Interviewer: So do I understand you correctly when I say you are not in favor of such (OBE) a system based on what you are saying.

Interviewee: Well, not necessarily, I think outcomes based have its merits it has its challenges. If it means getting learners to be part in a classroom of constructing knowledge if it means that learners to go out to go and search for new information and constructing knowledge, yes then I would say outcomes based education definitely has it's benefit and advantage however the reality is that most of learners in the so called townships from the previously disadvantage group have did not have and still have very limited access to resources where they could access this information.

Interviewer: Ok.

Interviewee: I think libraries for instance close very early six seven o'clock in winter. It doesn't give my learners a chance to go and research there. Learners from township schools still have limited very limited resources. Not many learners at school these days have especially those from the townships have access to a computer system where they can go onto the internet, they may have a computer but maybe not the access to the internet where they can research, so in this sense outcomes based does not really benefit them because you

as a teacher then basically still have to develop all the materials, help the learners with the materials even help them with projects...

Interviewer: So do you practice OBE in your class?

Interviewee: Erhm we try to practice OBE as far as possible in a sense that yes you give learners projects and tasks and lucky for me in the school where I am I can allow and most of the learners have access to resources. I must say though that in the last four years with matriculants, I've experienced that there are a number of learners just did not have access to resources. They were very honest and say "Sir, the library that I go to in Elsies River or Belhar or close to us just didn't have the necessary books to help us". As an educator I in fact had to bring books I had to bring resource materials, I pulled off material from the internet and gave it to these learners to be able to... one learner in particular I see her face where she simply said to me Sir where will I get such information the text books the books at the library has nothing erh I don't have access to the internet I don't have money to go and sit at the internet café

Interviewer: We know outcomes based education is a very complex curriculum, it also uses very complex jargon such as learning outcomes, critical outcomes developmental outcomes assessment standards. Do these terms have any meaning to you when you plan your lessons or are you very much familiar with the terms?, Put differently is the meaning very clear to you what's expected of you when you talk about outcomes when you talk about learning, critical, and developmental outcomes when you talk about assessment standards and assessment. Are those things very clear to you so that you at least know what to do?

Interviewee: I know I in fact have a list of the critical and development outcomes. I know the initial lot of outcomes that were more than 30, were very cumbersome and nobody actually wanted to look at it. The erh developmental outcomes that erh were scaled down to about seven critical outcomes scaled down to about four makes it much more easier to work with now...

Interviewer: My question is, do you have a good and clear understanding of these things of these concepts?

Interviewee: I think in the changing education system from what I've seen over the last couple of years I must be honest and say that erh I don't, I cannot say that I'm on top of knowing each and every one and the real need for that however I think I realize the need for assessment and I understand the assessment standard very very well. And I knew that each assessment standard had a particular meaning and it address a particular topic. I however believed that if you put your head on so called meeting requirements of assessment standards and even those critical and development outcomes you will not be able to teach and help your learners to equip them number one for matric and equip them for post matric work. So I actually questioned the need for teachers knowing what are the development outcomes what are the critical outcomes. As far as assessment standards are concerned even that one can question. Of what importance is that to know what yes you need to know what you will assess but then if you are given a work schedule which includes all the types of work that needs to be covered for the year, is there still a need for a so called assessment standards. Erh the physical science examinations the last three years have proved that never once have the question been repeated erh so you cannot say a particular assessment standard dominates or gets predominance over the other assessment standards. So I would really question the real need for assessment standards in that sense.

Interviewer: How often do you assess, when do you assess, do you assess at the end of every section of the work that you do or you know I mean do you assess throughout the year

Interviewee: I think assessment in a sense of giving a test marking scripts for learners have become such I nearly used the word a bore for educators in the sense it put such a big workload on the educator because the assessment of learners have over the last couple of years especially in the physical sciences been honed down to for the grade 10 to 12 for doing 8 assessment tasks which includes a project two investigation which are experiments and then three or four two class test and then June and September test and then the final test. However as a educator you have to work within the boundaries of the school in a sense that erh most schools because they are under pressure to show the department that they do assess the learners and they do meet the number of assessment task that must be done, schools draw a policy and schedules where they actually have certain assessments for each subject and each

grade. Erh so number one I need to comply with that but I believe that for any good teacher to prepare his learners to test them knowledge or understanding of the subject from time to time you need to assess and question them. I have a policy where my grade 11's and 12's they know that every week they can expect a ten fifteen minute test assessment on the week or two weeks work prior to that. So they know that they need to prepare for that to take away the burden of marking all the assessment standards I let the class do peer marking which takes away from the fact that you have to do all the marking. But yes I do believe that we need to assess because how you going to understand whether the learner understands the work

Interviewer: Tell me Philip, erh how does your learners feel about the assessment that you give them? Do they find it easy, do they find it difficult because now they have to go on a course they have to go and do research on it or how do they feel about this assessment?

Interviewee: Look the last three years my matriculants have seen assessment especially preparing for test as part of the preparation for the final matriculation examination. I think our system however is so examination driven in a sense that matriculation exam is the alpha and omega of all, which means that the learner class that's really interested in the class will grasp every opportunity that is given to him or her to prepare himself for any assessment or test that you give them so I can safely say that so far I have co-operation from my... they understand the need for being assessed but then also I must be honest and say that the community where I teach is a community where the parents the bulk of the parents of the children see education as the catalyst to change the old economic situation so they would encourage their children to really study and my best results have been produced from learners of these groups.

Interviewer: Philip just hold that thought, tell me the NCS document envisage a specific kind of school teacher, for example one of the qualities this teacher must have is he or she must be dedicated, committed, they must be subject specialists, they must be researchers, they must be designers of learning programmes, lifelong learners they must be scholars. What is your perception of these qualities?

Interviewee: I think they have given, I think the NCS document might have given more meaning to terminology that where in the past simply hidden or not spelled out I remember my teachers at school my encouragement have come from exactly those type of teachers that erh erh who wanted to know more who wanted to be on top of the subject erh who wanted to prepare the learner so that their students of pupils would be able to go out after Matric or after school to be able to face the world and to tackle projects or tasks head on so I think the NCS has just given names to terms that were probably there and used. In most of our educators in the past where pastors they where psychologist, sociologist, they were educators guess maybe some of them were not educators of lifelong learning but then I remember a particular teacher that was an expert in whatever subject he tackled erh he was a English teacher but he was just as good in Science he was just as good in Mathematics, just as good in History and that was because those days teachers were not necessary specialists in fact to ask for teachers to be specialists is a good thing but what do you do if you don't have a specialist...

Interviewer: It specifically says you know if you are a lifelong learner you can then become a specialist ...

Interviewee: I agree that you can become a (inaudible) so even if I am qualified in let's say being a Biology teacher it does not mean that I cannot become a specialist in let's say Physical Science.

Interviewer: Do you think that you have all those qualities you know of becoming a lifelong learner being a subject specialist, researcher, scholar

Interviewee: Well it's difficult to say yes that I have all the qualities but I must be honest when I say that I am in fact involved in post graduate studies where I'm doing research and I believe that its necessary for me to do in fact school based research it certainly has helped me in understanding my learners better, also it has helped me to understand their needs better as a researcher I have certainly discovered that erh many of my learners come to school with preconceived ideas and concepts of certain things and unless you as a teacher educator can delve deep into their erh being and discovering through various means what conceptions they have and how you can address them you will fail in your duty in helping them as an educator that challenge to in fact equip your learners for lifelong learning you need to study and I've

been involved in studying for instance ever since I left University. Erh when I was in industry I was forced to to study the methods, the systems and keep up t o date with technology. Now as a teacher I find the need is still there, I find that to fit in with OBE for instance to fit in with the requirements of the NCS document erh to produce learners that can think objectively that can critically analyze erh you need to be a lifelong you need to be a scholar and a lifelong learner so that you know also what new methodologies there are..

Interviewer: Tell me Philip, now that we on that topic of new methodology etc, which is all associated with the changes taking place. What would you say was your biggest challenge that you faced with implementing the NCS currently right now in the system and what do you do or how do you overcome those challenges?

Interviewee: I think for me the biggest challenge was and is still to be able to get my learners to the point where I can safely say that they are equipped to handle the content of the work when they are examined, that they are equipped to be able to go to university to handle the pressure that comes from studying at university. I'm not so sure whether as an educator one will be able to fulfill all those needs to prepare all your learners to be able to do that erhm I think the challenge is there and for me certainly the challenge is there I think the fact that this is now the fourth year that I am teaching this court of grade 12's I've realized now that sometimes it's necessary even to in terms of the NCS documents to change the order of work that you need to do, sometimes you need to say well instead of doing neutron one first you would be doing neutron three or discuss momentum first before you do the other work.....

Cell phone rings.....

Interviewer: On the issue of textbooks. Right now there are quite a number of different textbooks on t he market, which criteria do you use to select a good textbook for your leraners, secondly do you still use the old Brink and Jones textbooks sometimes or did you completely remove the textbook from your classroom after the introduction of OBE?

Interviewee: When I started teaching my Grade 10's, 11's, and 12's and preparing particularly the grade 11's preparing them for the first NCS examination in 2008 e rh I discovered that there where so many textbooks on the market the school by then the school

time have changed or have purchased a particular textbook which the Math's textbook got number one I said to my learners right from day I can see it's useless eh the science textbook also I will not say it was useless but it just did not have the information required for the learners to be able to pass matric examination. What I then discovered was that textbook writers were given a brief of what was required in the NCS documents however since the time of completion or writing the textbooks and the actual implementation of the NCS curriculum so many changes in the curriculum have taken place that the textbook writers just did not meet the requirement the new requirements that was now at hand and hence our learners my learners have right now the study and master textbook in grade 11 and 12. We change the grade 11 one to add a focus textbook from one of the other companies because it addresses certain issues that study and master does not address. For me one of the sad realities eh sadness of our textbooks is our examiners... our examiners in the last couple of years seem to not necessarily look at some of the textbooks that's available. No. 1 the textbooks do not have all the materials the depth where it goes to into each topic does not maybe or does not meet the requirements of the NCS eh the current examination requirements. I think there seems to be a gap between the examiners and the textbooks and the teachers and I would love to see the day that examiners sit down not only with curriculum planners but sit down with teachers and say look this is what we are looking at so one can find a common ground. We've had in 2008 a question paper which I believe was not a physical science paper necessarily it was a mathematics paper eh 2009 again changes were made 2011 again then and the unfortunate thing is that it's only once a paper has been set a paper has been written it has been marked eh at the end of the year now that we see the report now that we see the examiners want for instance. I don't believe that teachers were very finicky in the past whether the learner had the unit's right it was only while marking that I discovered that unless the learner write the correct formula down in a question he or she would loose quite a lot of marks in chemistry for instance asking the structural formula because the learner did not indicate the bond between the oxygen and the hydrogen for the alpha grouping if the structural formula the learner would loose the mark. now my question there then is: Is that really chemistry? Do we are we nitpicking on a learner not indicating a simple single bond eh as far as using Brink and Jones I find that there's so much, the textbook was written I think by people that knew what Universities wanted and knew what the school's should be offering so I find that there is still some chapters in Brink and Jones that is very very useful in my teaching.

Interviewer: Do you have enough time to complete your syllabus?

Interviewee: No. I don't think, I think our syllabus is overloaded. The grade 10 syllabus for the current load is not a problem to complete the syllabus. The grade 11 syllabus is absolutely overloaded with new knowledge with new work and as a teacher you are not doing justice to every topic. Erh grade 12 you do not have enough time to really go in depth into a topic. I'm taking for instance right now organic chemistry makes about a third or even more of the paper two, which means that if you talk in terms of roughly 50 or 60 marks that's allocated to organic chemistry one can say that if that 60 marks which is roughly a third of your paper and there is two papers you can say well then a sixth of the time, your teaching time during the course of the year should be spent on organic chemistry. If you have roughly 35 teaching weeks erh in a year or then you should spend at least 6 weeks to do justice to organic chemistry erhm I don't think there is any of us teachers that can afford to spend anything more than 4 weeks on organic chemistry. But then, what does it mean, it means that you are not covering the subject in depth. Now if you cover one topic in depth you find that you have to skimp on a nother topic and erh unfortunately you doing an injustice to your learners again.

Interviewer: Are you quite confident with the content, with the changes in the content with the new changes in the content, or are you struggling with the content?

Interviewee: I am happy with the content, I have no problem with the content. I question though why we of what importance or what relevance certain things are that's in the syllabus. I for instance believe that erh I'll be not stressing too much the fact that there's in grade 12 certain physical science concepts which if a child is not going to become a expert in physics he will not need, so why must that child be examined in detail for instance on some of the topics. Erh a topic that comes to mind is the photoelectric effect. I've question really the importance of allocating a question up to 10 15 marks in an examination on the photoelectric effect, of what benefit is that to that learner of what how will he use it, where will he ever meet up unless like I say he go into particular research or study physics in-depth at University.

Interviewer: But look you done Physics I mean I understand you were a chemistry major which makes perfectly sense that you might feel competent and confident with the chemistry section; you haven't done physics up to third year university level, which means it's also many years ago prior to you, you didn't work in a particular industry where physics is required so how do you cope with the physics section of the work? Do you neglect it; do you focus more on the chemistry?

Interviewee: No no no because of the realization that erh I have a short (inaudible) physics I can (inaudible) make sure I do enough research and study the physics topics to be able to equip in fact I've been a marker (inaudible) a marker for the matric papers and strange enough I actually marked the physics papers cause I felt that that was a challenge I need to understand and have the basic knowledge what I discovered was that many many educators shy away from the physics part and erh I however realized the need. Luckily for me in industry we may use a number of these physics concepts erhm erhm instrumentation determining for instance Newtons metals in organic substance or in water erh was developed erh by people in the industry and strangely they actually used physics concepts which university professors and researchers did not use.

Interviewer: Ya no it makes sense... ok you may continue

Interviewee: No for instance the refining gas (inaudible) topography was not developed by university researchers but was developed by the need of industry to find out what was in the gas substance and they needed equipment. However there must have been some point where learning at university and experience in industry meet at some point where you can apply what you learn at university to be applicable erhm...

Interviewer: Ya but erh it makes sense. Because look, chemistry uses the laws and principles of physics, so almost all of the laws and theories that we use in physics have been developed I mean in chemistry has been developed by physicists you know...

Interviewee: That right ya...

Interviewer: So, so therefore it makes a lot of sense you know that you do expo, but I'm asking you this question just to get clarity on how competent and confident you are with the curriculum content for your learners.

Interviewee: I personally believe that I am erh equipped erh to handle the physics and chemistry syllabus

Interviewer: There is no particular topic that gives you problems?

Interviewee: There is one topic that has crept in and become even more prominence for the last two years on the physics paper was a whole concept of erh the work energy theorem. It itself is not a difficult concept but there are so many variables that erh a learner needs to bring into handling a question like that and there are so many variations on the question. If one just think in terms of the work energy could be just a change in the kinetic energy if that is all then it would be easy but other concepts such as energy work in use on an incline uphill or downhill erh cause quite a lot of confusion

Interviewer: Which is the inter-convertedness between kinetic and potential energy.

Interviewee: That's right and particularly even more so in the sense that the examiners given us certain formula's to use now sometimes these formula are not on the examination paper so how will a learner apply a formula if he does not know that he if he is taught to use the formula in the exam paper when one particular question asks for the use of the formula and the work energy theorem simply talks of the change in kinetic energy, now the learner had to bring in the change in potential energy also now unless the teacher is equipped enough to teach that subject before hand to the learner that poor learner is going to struggle in the examination. I in fact also then questioned the need, maybe the learner should have a understanding there is a change in energy and maybe just calculate the difference in the change in energy but why spend so much energy on the work and another topic for instance is the concept of capacitors and and erh semi conductors if a subject based on physics on physical laws but does the learner in grade 12 studying physics must he or she really ask in depth questions on those aspects.

Interviewer: Tell me more about your grade 12 results in the last three years.

Interviewee: Erhm with the first in 2008 I had 88 or 90% pass in physical science. I must add that year was the (2008) was the first FET NCS grade 12 exam. I think also that was the year that the paper was the first paper was very very difficult. I must be honest when I say, that year I had a group of learners that I had for three years that were enthusiastic, they worked hard and erh most of those learners once they got to grade 12 in fact comfortably passed physical science as a subject in grade 10 and 11. In 2009 I had a 36% pass mark and my argument with that pass mark was that year I had learners about 26 out of 40 learners that should never have been in a class. Some of those learners by the time they got to Matric never passed chemistry physical science in grade 10, they never passed physical science in grade 11. The system in the education system that number one we cannot keep a learner back because of age, we cannot keep a learner back because the number of failures in a particular class would be too big, resulted in many of these learners simply being pushed over to the next grade and I believe that results in a bad reflection on the teachers ability in a class because now you sit with learners that are not capable of doing the subject and yet they allowed to do it. In 2010 I on January in March I told with the first test, I told our principal look out of a class of 32 there's 12 learners that will not make it. They failed physical science in grade 10 they failed physical science in grade 11 they allowed to do physical science in grade 12 needless to say I managed to pull one of them through which meant that eleven in fact failed at the end of the year now again that resulted in a 66% pass mark with your physic learners...

Interviewer: Out of how many learners?

Interviewee: Out of well out of 32 learners.

Interviewer: And how many learners did you have in 2008?

Interviewee: 2008 44 learners.

Interviewer: Ok, tell me erhm erhm what is your belief about state of physical science as a school subject?

Interviewee: My objective is to make physical science at my school erh erh a subject wanted to be taken by as many learners as possible, loved by as many learners as possible, I also realize however that not all learners have the ability to deal with physics and chemistry. I recognize that not all of us have the same gifts and a learner may have the gift of languages but not necessary the gift of physics or chemistry so you wouldn't want to force a learner like that in physical science. I do believe that there is a decline in the number of learners taking physics and I do believe there is many reasons for that. First of all I think the last number of failures in 2008 2009 2 010 put many learners off from taking physics. Erh I think our township learners unfortunately are not exposed to the physics and chemistry concepts from primary school onwards hence they are simply fearful of the subject. For them it's an unknown entity in grade 10 erh hence they refuse to do that or take that as as physics. I remember one one girl in 2010 I told her in 2009 why does she take physics because having taught her in grade 10 maths I said to her but you have the ability to do and she simply said I'm scared of science and I said but no need to be she proved that she was capable when she got a A pass mark in maths in 2010 so she definitely had the ability erhm I believe that too little is done to encourage science as a subject at school. The science teacher number one is so loaded with others work that he does not have time to prepare interesting practical's experiments to encourage learners to come and do physics.

Interviewer: Tell me on that note how do you fell about practical work, how often do you do practical work, do you think learners learn best through practical work?

Interviewee: I'm sitting right now with some learners in grade 11 and 12 as doing physical science for the simple fact that erh when I even taught them other subjects I've certain what I call base experiments that I always do with my learners erh I just for instance the last couple of weeks before the school closed I did what I call my "jelly baby" experiment in the lab where I would simply generate oxygen in a test tube from potassium chloride and then in the hot tube take the flame away in the hot tube dump a jelly baby and get the learners to guess what possible would happen to the jelly baby.

Interviewer: That's a sweet hey?

Interviewee: That's a sweet. They are of course amazed when the jelly baby that's hypo carbon actually catches alight and burns to carbon in a test tube and they love to see that. One learner said to me that experiment encouraged her to take up science as a subject and she is doing science in grade 12 now. Then there are some other experiments that I would be doing when I deal with things like (inaudible) colour changes erh reaction rates I would leave the equipment up in the laboratory so that my grade 7's and 8's and if I teach grade 9's can see the type of experiments and the objective is to encourage them to to see the intricacies but also the challenge of doing experiments. Many of these learners in the lower grade often ask Sir when we going to do experiments. I believe there is an absolute need for doing experiments. I learned in life that erh you learn by doing and I found that my learners in grade two years ago in grade 12 erh they learn by doing, it was my first year with grade 12's we performed more investigation experiments than required from a student whenever I could do an experiment I would do this.

Interviewer: But why do you do that? Do you think learners learn more, do learners learn best with practical work?

Interviewee: Well I just gave an example now that erh to understand the concept of oxidation of alcohols oxidizing alcohol to to a type of zilic acid I show them what we call the the breatherliser test they were quite amazed when we in fact did the breatherliser test in a test tube in a classroom, a simple colour change and we all read about drivers going out on the road and being tested and it's a simple experiment and erh all my learners so far this year and last year have shown that they have no problem in handling that topic when it comes in the examination so certainly they must have benefitted from that.

Interviewer: What does this breatherliser test involves?

Interviewee: Erh the breatherliser test involves a driver blowing into this bag and this the air in this bag is then injected into a test tube or tube and erh there is some potassium dichromate and acid in there and erh the alcohol in that with erh the alcohol gets oxidized by the potassium dichromate and the dichromate itself changes from an orange colour to a green

colour and that gives an indication of the amount of if you have it setup properly proper stand is prepared you can actually determine the alcohol content now that is something that is done by the police on the road but in a classroom I showed my learners by breathing in just a mouthful of ethanol and then blowing into a test tube and the colour change and they were quite amazed, now in 2008 '09 and '10 that I did this and this is not even one of the prescribed experiments I found that my learners could handle the topic much easier.

Interviewer: Was it examinable?

Interviewee: It was not examined as such erh there was a question on preparation of assets from our course I do believe that my learners had handled that erh got good marks for the question erh another typical experiment (inaudible) I think that every science teacher should be doing is experiments on reaction rates. There are so many of them erh one is restricted to time one is restricted to equipment. In my laboratory I borrow equipment, I borrow chemicals from other teachers at the other schools which we don't have for the last four years we haven't purchased, the school did not have money to purchase a single chemical or piece of equipment.

Interviewer: Ok Philip let me take you to a different stance now. Do you think that the implementation of the FET curriculum in 2006 reflected erhm, or shall I put it this way, do you think this new curriculum added greater value to the learner's learning or not?

Interviewee: I want to believe that the new syllabus erhm should envisage to equip learners with real life situations, one of them that I can think of for instance is the grade 11 syllabus where learners learn of the extraction of gold and iron from the ore's and to me that's a real case where erh the physics or chemistry that you study at school has practical application so that it's done is relevant and is done in context and I think for me this is a big difference from the old curriculum, I do believe the old curriculum had its benefits not having taught the old curriculum I can't talk much about that but definitely the new curriculum I think for me definitely seems to be relevant. I think one of our problems is that we sitting in a chain situation where erhm many of our learners at schools are discouraged to do science because if the learners is very bright he or she would end up failing, it will be a reflection on the school and the school's pass mark will be affected. I think many principles and to this extent I know

of some schools in our areas that have stopped offering physical science because of the high failure rate.

Interviewer: Tell me Philip how do you feel in this system, do you feel alone, is there times when you feel lonely, frustrated, angry, disappointed?

Interviewee: Erh I feel disappointed and I'm still disappointed for instance when I know I could teach a learner or help that learner to pass matric when I know that learner could not pass physics in grade 10 that learner could not pass physics in grade 11 and I ask myself the question: How will I get this learner to pass physics in grade 12. Now my last three years results have proven that if the learner is not able to pass physics in grade 11 he or she will not be able to master the work of both grade 11 and 12 in grade 12 and this frustrates me cause you have to teach learners that you know that's not capable however all the documents says the parent and the child has a right to choose the subject I think in the good old days where you were simply told you are not capable of doing mathematics so you mustn't do mathematics, I think the teacher and the school should have the right to tell the parents your child is not capable of doing the subject.

Interviewer: Do you sometimes feel bitter towards the department what they expect from you to do?

Interviewee: I came late into teaching and for me the privilege and the joy is to teach my learners so he can leave school to equip them best erh I get frustrated when I sit with big classes, when you complain about learners that are not doing the work that's rude that's disruptive that should not be in a class and the policy of the department is such that you basically tie the hand of the school in any sort of disciplinary action against the learner so often you never ever see the parent of the rude and disruptive learner, erh I remember a girl that failed matric failed grade 8 no failed grade 10 came to class always late, sit and sleep in class or never paying attention spoken to very cheeky and erh never did any work in the class when she failed her parent, you could never ever get her parent to come to school however when she failed the parent appealed and tried to paint a picture of how wonderful her child is and how bad the teacher is. Luckily, now those are the things that really put a teacher off because it makes you bitter if you think that those are the type of learners that you sit with in

some of the classes not all learners but so often you find in a class there are a handful of learners who can be rude, disruptive and you have no means of what also is very dissatisfying the fact that the new generation perhaps don't seem to have respect for teachers, for elders erhm and simply come to school as if the teachers job is not only to educate them but also to teach them manners.

Interviewer: Tell me Philip what is your view on the nature of science?

Interviewee: Erhm pause You know I've never ever viewed, we were never taught about the nature of science, never learn anything about when I was at university and I believe its new concepts that has appeared, it was probably there but I believe its new concepts that appear on the science scene in the last twenty odd years erhm one of the things that I always believed in was that erh science changes, laws, theories, hypothesis all these things can change it needs to be investigated I believe that what holds true today will not necessarily hold true tomorrow because tomorrow you may have a better means of detecting or analyzing something and you may find that things don't hold true anymore, not that you necessarily throw the old out because the old helps you to discover the new, so to me it's the whole constructivism building on from the one to the other erh I think one must be very careful in the saying that science is absolute and everything in science is true which is not the case erh...

Interviewer: I mean and of course this tie very close in with indigenous knowledge, so how do you feel about it because all of a sudden there is a high priority being placed on indigenous knowledge in schools you know, how do you feel about that?

Interviewee: I believe that the background, my childhood background was such that erh I come from a society various herbs was used by my grandmother and other elderly people in our area and erh they definitely used herbs. To me I remember a case where I had a horrible ear ache and my grandmother put a bit of a ointment and a herb of my plant into my ear a piece of cotton wool and she rubbed me out I fell asleep and when I woke up the ear pain was gone it was no need to go to a doctor erh so I believe the science that we have today must have originated from the indigenous knowledge erh neuton might have observed a falling apple while was he sitting under a tree maybe so there must have been some sort of knowledge and the people questioning what was happening around that and today we have a

westernize modern science which I believe has its roots in indigenous knowledge. I've just looked at gold extraction and I still ask the question that in the bible a story was told of the Israelites making a golden calf, now if I think in terms of a golden calf it was visible it was big it stood there a whole nation of more than 20 000 people could see now how was that golden calf made how did they make it, what did they use, first of all where did the gold come from, the gold couldn't be lying there so somebody must have used some methods of extracting the gold from the soil. Erhm my studies have proven that erhm we use modern techniques to make it easier, cheaper less costlier than those methods but erh and quicker, but maybe indigenous knowledge rightfully should have its place in the schools also sadly though not many teachers want to hear of indigenous knowledge because I think it disturbs the own comfort zone.

Interviewer: Philip one last question, how would you describe your journey with reference to your emotions your feelings in short up until now, ever since you entered the teaching profession?

Interviewee: I think working in industry had its benefits and its merits erhm I think I'm privilege in that I in fact late in my life could enter a new career pathway, I think the fact that I am privilege to deal with shaping the minds of children is very exciting and to me it will be a continuous excitement to see a young child's eyes erh glitters when he or she says, Sir now I understand the concept. When the child comes and having whole year or two years got 20 out of 100 20% 30% and all of a sudden the child says Sir I really realize I need to work hard and hence the child ends up with a 50 or 60% so that I believe makes my day, makes my life it makes it worth the living for.

Interviewer: Thank you Colin, thank you very much for your time and energy and your effort to partake in this research

Interview ends.

Edwin's Transcript

For the record this interview is recorded with the consent of Mr Edwin and permission granted by the WCED. All the details of the research project have been explained to Mr Edwin. Mr Edwin please be as open and as honest in your responses to the interview questions. The date is Wednesday the 23rd March 2011. The interview is conducted in the school laboratory at 15h00.

Interviewer: Mr Edwin, please tell me more about yourself, where you grew up, your age, your years of teaching experience, your Physical Science teaching experience, your tertiary education, subject majors at university and which institution you studied at?

Interviewee: Erhm yes, my name is Johardien Edwin, I grew up in Bishop Lavis, I am now 48 years, I'm teaching Physical Science, Grade 10 till 12 for the past 26 years. I studied at the University of the Western Cape. I majored in Plant Pathology and Plant Protection, however at a time of qualifying in 1984 there was a dire need for activist to go into the school's and I was actually approached by leaders in the anti-apartheid struggle to go to a specific school 'erhm' also at the time the field in which I qualified for, was reserved for whites only and the only choice I had was to go teach with my qualifications. I then started out in Physical Science because I've done some physical sciences in my second year ok and I did this at UWC during the difficult years of 1980 to 1984.

Interviewer: Why did you decide to become a Physical Science teacher?

Interviewee: Number one, there was a need at the school I was sent to for Physical Science and erh I actually enjoyed teaching the subject because it was one of the very few subjects where one can actually practically reinforce the theory so one can always relate back to the practical side and show learners that what you are talking about is actual truth which is very difficult with other subjects.

Interviewer: Will it be fair from me to say that your choice to become a Physical Science Teacher was a second choice of career?

Interviewee: It actually wasn't a choice, it was the requirements of the situation which I found myself in because I wasn't trained to be an educator in the first place I was trained to be either a researcher or to go into the private sector but erh both avenues where closed

because of detentions in the mid eighties I could not continue with research and erhm number two I could not go into the private sector because of job reservations.

Interviewer: Tell me more about your Physical Science Teacher at school, the method he used, what you liked or what you did not like about the subject or his teaching style. Also look back at your life as a learner of Physical Science, did you like the subject?

Interviewee: My early high school years was spent at John Ramsey which at the time did not have Physical Science, I had to go to the neighbouring school Bishop Lavis High School that offered Physical Science so there you can already see that there was a huge interest in the Physical Science on my side because I had with the poverties and the difficulties I still made the choice and the decision to move to another school for Physical Science. I found myself in a school where their Physical Science educator was unqualified the Physical Science educator at the time erhm left for Namibia and the mathematics teacher had to take Physical Science so, and I also found out during my first year at university that we writing the same math's paper on t he first semester so you get an idea of what I'm talking about so his teaching method was the entire class need to read through the text book from one page to wherever the bell takes us. That actually was the method for three years so we had no teaching of Physical Science we actually became very good readers to the advantage of our Afrikaans and English educators we never had a problem with our reading never knowing that we read everyday for one full period each one of us one paragraph of text book

Interviewer: No practical work?

Interviewee: No practical work, no explanation, because this is a person who taught Math's but who also struggled to get through Math's 1 at University

Interviewer: So where did it leave you with the subject, did it leave you with some form of disliking the subject, hating the subject maybe?

Interviewee: Actually no, it left me with erhm with a desire to know more and that resulted in me reading extensively advanced textbooks and so forth which actually allowed me to successfully write the examinations.

Interviewer: In other words the content that you were trained in at that stage had no relation to the application of the knowledge in the real world?

Interviewee: Absolutely. It had no link absolutely no link and whatever I knew about the subject was self taught.

Interviewer: So now you entered the teaching profession, normally if you qualify as a teacher of Physical Science every teacher's got some kind of vision or an objective he or she aims to achieve like one of the things of course is that we as Physical Science teachers or any teacher for that matter go into the profession by saying look my work is socially meaningful or I want to make my work socially meaningful, so what was your particular objective when you entered the profession and what did you aim to achieve and did you achieve that?

Interviewee: When I entered the profession erhm the educator was still teaching at the neighbouring school and I found that there were quite a significant percentage of similar educators placed at different schools so... where as I was approached by the.... By the political seniority at the time to go to John Ramsay High School and apart from educating and teaching I had a political role to play that is why I was detained in the very first year of teaching at the school I then realized that I need to stay in education because our learners encounter problems after school getting into universities because they are not well prepared and from there (inaudible) the passion to do Physical Science in a practically meaningful way and that has been the hallmark of my teaching up till now. You are two weeks late, because if you came here two weeks ago you would have noticed that this school was used as a base to train grade 12 Physical Science educators in this area in practical investigations as a matter of fact the dirty stuff is still right at the back of the room that the subject advisor used to do the training. This school has been instrumental in teaching Physical Science educators in this whole north district in practical work since 2003, whenever there is practical work that need to be taught to erhm educators, practical workshops is done here.

Interviewer: So you do the teaching?

Interviewee: Erhm no, I facilitate it, because we do usually get people more senior than us to do it for ethical reasons. It's easier for educators to come here and find out that a certain doctor of physics or chemistry is going to do investigations with us and to find out that your fellow educator..... You get that problem "what can he teach me" so to be above board on that level the education department always gets senior people to do it but we facilitate it here ok. And if you look there you'll see that this lab is actually completely out of place, you don't expect to have a lab like this and the facility like this and the equipment like this at the

school and that is because of the passion that I have for teaching Physical Science on a practical level.

Interviewer: Tell me what grades do you teach and how many learners per grade?

Interviewee: I teach grade 10, we have roughly 75 learners there and grade 11 we have roundabout 65 and our grade 12's are all more or less in that number 60, 65

Interviewer: And is this all Afrikaans?

Interviewee: No, the two medium separated.

Interviewer: I like your intro in terms of the role that politics has played in this subject and of course there was a lot that didn't reveal itself through your discussion or reference to this but how do you feel about the new changes in education that took place since the inception... or let me put it this way since the death of apartheid?

Interviewee: Ok, since the death of apartheid what we have realized is that in the sciences there are two roots to be followed. The one root is to bring every science facility in every school in this country up to a functional level. That would be the one root that one can follow. This has huge logistical as well as financial implications for the powers that are in government, because it means that virtually in 95% of schools new laboratories had to be built, equipment provided because in the previous system we were required to have conducted 10 experiments on a grade 12 level ok. Now those experiments were prescribed, once you prescribe you got a responsibility to provide. Now bringing all the science facilities in all schools up to a certain level requires a lot of money ok, so the first thing that went out by the window was prescribing, prescribing certain experiments. In its place came practical investigations that weren't limited to a laboratory set up, actually the preferred investigation is one that the learner performs at home using household equipment. That immediately... releases the government from providing equipment, and as a matter of fact in the past 5 or 6 years not a single piece of equipment has been sent to any school not a test tube nothing. Because there is no longer a prescription and you are no longer compelled to do a boils law experiment... there is no expectation and there is no prescription that you must do e rhm acceleration, Newton's law determination using timers and so forth, ok so the learner must go do an investigation at home, drop a brick from a certain height and measure the height with a measuring tape and the falling of the brick with a watch and then write up a practical for investigating the acceleration ... (inaudible) gravity for instance so that is where we are

moving towards, which seems to be very interesting but the problem is that we are moving away completely from practical work in the laboratory because you just need to do one investigation the first term and another one in the second term finish... and it need not be done in the laboratory preferably the learner need to go home, so what you do with a grade 12 learner you should tell the learner that he must design and execute a practical investigation to determine the effect of temperature on the rate of a reaction. It's a matter of time before a learner blows up his house doing these investigations.

Interviewer: So, so how do you then as a teacher measure the process skills that a learner acquires in preparation for university?

Interviewee: Yes, they do the practical's here, they use the equipment here I don't allow them to use erhm coke bottles and those things they use all the apparatus they need and as a matter of fact from grade 11 onwards they work with high tech equipment. If you go into the Lab now you'll see there is a apparatus that the grade 11 and grade 12's are using to determine the accurate value of "G" at the school not the value of "G" in general but the value of "G" here, they've got the apparatus there with a electro magnet that releases a ball that falls onto a stage and the timer measures the time. We have the learner air track for all motion investigations with four optical light gage connected to a velocity meter so the learner can within a matter of of a few minutes do all Newton's Laws because he had no longer calculations that we done, but now you going to say that the learner don't get process skills but the learner has learnt those skills already in grade 10 because in grade 10 he does the track with the ticket timer so no need for him to do that in grade 11 and grade 12 anymore because he knows those skills, ok. Erhm as a matter of fact I've had some of my learners coming back to tell me that in their first year the equipment that they've used at university has been so archaic compared to what we've done especially in the learner air track with blower with the optical light gage and the velocity meters attached to it where all the information is there, and for instance last year one of my learners got into Engineering at Stellenbosch University had he did motion on a learner air track with a static erhm erhm erhm track where dots are still made onto a ticker tape, ok and nobody knew how to do it, so he got up and he said "ok, this is something that is in between my grade 10 and my grade 12 work. In grade 10 I did something that made the dots so I know how to interpret the dots but in grade 12 I did the same experiment with the same equipment with blowers and so forth but we didn't have dots we had accurate readings of velocities" and he took over ok and to the amazement of all the learners coming from other schools and that he came to tell me that

specifically so our learners here at grade 12 level they do actually all levels, every perceivable experiment that's necessary for him to understand ok. You can just an idea of the equipment because we had to pack it out again you see there that is equipment, there is a dual stage (inaudible) scope we use that for electronics.

Interviewer: Tell more about the training you received. More specifically on the preparation for implementing the new curriculum. Was it adequate, did you learn something new from it? The teachers who actually presented these training where they competent enough to your knowledge?

Interviewee: One now needs to look at the components of that training: 1) No Physical Science educator should have a problem with the content and that is where the emphasis is actually at this point in time. We've got teachers that got problems with content and that are utter nonsense. No Physical Science educator should have a problem with content that means what must be taught it just there had to take place an entire paradigm shift with: "how am I going to teach this"; "how am I going to assess the skills that need to be developed in this specific, ok because in the past we followed the route that most of us had at university and that is that we just confirm practical's that have been done in the past, ok from now just investigating a phenomenon, ok but I think it's important that you don't throw out the actual confirmation practical's because the learner should get an idea of the process as it developed historically in science. Only when the learner is exposed to a variety of practical's done in the laboratory to confirm existing knowledge from that basis he can now proceed and investigate new phenomena and that is where the education system fails because you must just do two investigations and the emphasis is grade 10 you must guide the learner through everything. He already have a problem because I'm going to assess an investigation that you guide the learner in all aspects. Then you wean them off threw to grade 12 of dependency. So in grade 11 you don't guide them fully but you significantly guide them with the idea that in grade 12 they must be given an investigation, go and conduct it on their own, you only advise on request. So that is the whole process. And that is for 6 investigations over a period of three years.

Interviewer: So did those things happen? The explanations in the workshop or in the training that you received?

Interviewee: Not specifically. Because the workshops still concentrated on content, and that's not where our problem is.

Interviewer: Elaborate more on this new curriculum training course that you were just latching on. For example, the technical issues of the curriculum talks about critical outcomes, developmental outcomes, learning outcomes, assessment standards. How do you feel about these concepts, is it clear to you? Does the NCS document makes it clear when you prepare your lessons? Are you cognizant of these concepts when you plan or deliver your lesson?

Interviewee: Yes, yes. The training in that field has been satisfactory. However, Physical Science lends itself open to that. I mean there is nothing new to us as Physical Science educators in that whole approach because our whole teaching and our field has to do with skills, graphing skills, documentation skills erhm thinking on different levels, application ok, so those skills that's written in the NCS has always been part of our of our teaching we just never emphasized it so much and we just never made it a major part of the of our teaching it's always been there.

Interviewer: So how do you personally feel about outcome based education?

Interviewee: In theory it is a very good erhm approach, but it can only work in this country when the playing fields are levelled and this brings me to that very first statement the responsibility of bringing every science facility up to a certain level. Once every facility in every school in this entire country are on a minimum level then it will work. Our learners here are slightly fortunate compared to other schools in the vicinity ok, but if you just take the average school in the vicinity here, classes are 45, 50 that's the size, our learners come from impoverished homes the only access to the internet they have is probably at our school and other schools is non-existent. The outcome based education requires the learner to have a wide variety of resources at his disposal to do, so this new idea that we had now becomes a tool to differentiate again.

Interviewer: So do you practice it? Do you practice OBE in your classroom?

Interviewee: Yes, yes, I practice it but I also make sure that the learners are provided with the resources.

Interviewer: Because you see one of the biggest challenges facing OBE is assessment. How do you assess? When do you asses?

Interviewee: Assessment is actually no longer that big deal with OBE, because despite the fact that many people complain about the big work load you are then just required in the first term to assess a control test and investigation, that's not a lot, that's not a lot. In the second term it is an examination and an investigation and in the third term it's either a control test or examination and a research project that's all you have to assess.

Interviewer: But now do you only do the minimum or do you do more, do you do more tests because if the requirement is only one test how many test do you do?

Interviewee: No, so that's what I mean by by erhm merging the old system and the new taking the best out of both, ok so we write our normal class tests which we had in the previous. Yes in the OBE system you can do that but there is no compulsion on you to actually mark them and record those marks you can mark them if you want to but you don't have to record them because the only mark that is used for promotion is the controlled test and the investigation as is set out per term and all of that adds up to 7 or 9 pieces that contribute towards his year mark at the end of the year ok, so here at this school we take the best out of the previous system so we still hammer on tests with a strict memorandum to mark ok, we still do every practical that confirm the most important part of every chapter, we still do that and we still do them on the same way number one we record the details and then the learner converts all the information into a report.

Interviewer: So even though those marks are not recorded or required by the NCS

Interviewee: They are done here and they are recorded and they are tracked so the learner know.

Interviewer: Do you think that learners learn more when they do practical work or when you teach?

Interviewee: You will be surprised, you will be surprised when you do practical work ok, for eg. Last year we had a group of learners grade 8 determining the refractive index of Perspex in the class, the group of learners three of them that academically where at the bottom of the class list with regards to their marks during the third term so we already had an idea ok, they came the closest to the refractive index, they performed their practical most meticulously compared to the other learners, you also will find in a mix group that the academic achiever is afraid of dealing with apparatus it is the under performer that has the so called guts to just plug in plug in doesn't work plug in plug in now it works. So practical work is an ideal, ideal

leveller in a physical sciences because learners start to appreciate each other. The top learner no longer looks down on the learner that doesn't achieve because he is dependent on that learner at least once a week when we do a practical because that is the guy who does the practical things. So you have that harmony and inter dependency on each other that comes out clearly in a practical session.

Interviewer: Tell me when you prepare your lessons and your work, do you use the NCS document as your guide or do you do it different or separate from using the NCS?

Interviewee: No the NCS document is always the guide. That gives you the content that must be covered ok, but how it is covered that is my decision.

Interviewer: Ok maybe I should rephrase it, what challenges did you face when you had to implement the NCS and how did you overcome those challenges?

Interviewee: Ok, I actually did not experience any problems with using the NCS document because you need to have a paradigm shift and once you done that shift then it's just a new system that you need to teach ok, it's just have a different outlook on how you teach and it's actually just a little bit difficult if you have been teaching for at the time probably erhm fifteen eighteen years an old system but I am fortunate in this sense that I've seen a number of syllabi pass me so when I started teaching in 1985 we still had the old syllabus then in 1985 a new syllabus was introduced ok so I ran that entire new syllabus also having taught a couple of years the old system in which I was taught ok and then after that there was a couple of changes to that syllabus and then the NCS so I became very much use to changes in education and teaching so it's something that one expects and one then needs to embrace it, you need to embrace it and you need do the best of it and you need to take the best practice out of that to benefit your learners because at the end of the day when you prepare you always look at your learners. How will this benefit... so if that is your point of departure then you make a success out of every system that comes your way, at the end of the day it is about the benefit of the learner and not how I feel about the system.

Interviewer: The NCS you know erhm envisage a specific type of teacher for example, some of the qualities is that they must be dedicated, committed, subject specialists, researchers, designers of learning, lifelong learners, scholars, etc. What is your view or perception of these qualities?

Interviewee: They are all noble ok, but one needs to really implement it ok, erhm and at this school we implement most of that erhm we have a science club through which our learners who show a great interest in science beyond our school are (inaudible) a part of and we never loose touch with them so we allow them to come in here on a regular basis in the afternoons to come talk to our learners, do workshops whatever. I think within the next few minutes there will be some knocks here and if you go out you will notice a large number of learners actually coming into the lab and that is to do work, to do homework because I am around. So there we get the dedication in, most of my intervals are spent in the laboratory and my Physical Science learners come voluntarily in some of them already make appointments during the normal lesson Sir I'm going to come first interval because I need you to look at my prac report or I have a problem with the equations of motion you need to explain it to me ok, so that passion that I have for helping them brushes off on them because they are even prepared to sacrifice their breaks to come in here ok, so those are very noble qualities and you can make a success if you envisage that but but you need to implement it and you don't have to implement it big, you implement it small piece by piece because every little bit helps.

Interviewer: Tell me Mr Edwin erhm there's a lot of textbooks that has been written to implement this new curriculum you know erhm NCS erhm how do you feel about the new texts books that's been placed on the market in comparison to the old Brink & Jones that was part of the old system and erh what criteria do you use to select a good textbook.

Interviewee: Ok, erhm just to show you that I think I know what I'm talking about there they are: these are all the textbooks currently on the market samples of them ok erhm The old Brink and Jones and Pienaar and Walters only two textbooks ok, erhm on the market they were pretty good textbooks but what was important about those textbooks was that examiners had only those two textbooks to consult. What do you consult if you get a contact to setup a question paper for matriculants, you are going to look at what textbooks are used in schools and if there are only two textbooks you only have two textbooks to look at to get an idea of what you think educators are teaching when you set up a question paper now where do you think examiners look now look here.... Grade 12 twenty books? Now the problem with these authors they all jump the gun and they wrote these books interpreting the N the the NCS document to the best of their ability prior to the implementation of it with the result that every one of them have critical shortcomings being the result of the majority of failures in this country because none of them are on the level of expectations of the examiner quoting Don Francis. He is the Chief curriculum planner for Physical Sciences in the Western Cape.

Realising that at the end of 2009 Don Francis contracted three Physical Science educators to rewrite erhm the entire Physical Science curriculum for him which he compounded into booklets which are now currently used in the erhm Telematics programme and it was used in the small group tutoring last year and I got the contract to write the section on mechanics and the section on waves and two other educators wrote the rest so that was one third ok, so actually at this point in time the Western Cape Education Department we have the entire syllabus rewritten and if compare any of those booklet with what we have here you going to be extremely surprised because our brief was to write according to the NCS document not to consult any textbook because none of them are on par where we require Physical Science to be and all three of us had a very good idea of what the expectations of the examiner where, so that is all I have to say about these textbooks they are of no use. If we call now any one of the learners in here of grade 12 and ask them which textbook they using they will tell you we not using a textbook which textbook did you get in the beginning of the year, we got this physical sciences textbook, so they got a textbook they not using it....

Interviewer: They got it for free?

Interviewee: No, we must give them textbooks, the school gives them textbooks they not using a textbook, they have'nt opened a textbook since the beginning of the year.

Interviewer: Tell me Mr Edwin, in the textbook the syllabus must be covered do these textbooks cover the syllabus extensively because I know you said they've got critical shortcomings you know. Number two do you have enough time during the year to finish your syllabus?

Interviewee: Erhm Look you cannot finish a syllabus a grade 12 syllabus in one year teaching it properly during the allocated time so yes we do get to finish the syllabus - not in the allocated time. What do I mean by that? We use extra time like Saturdays and the school holidays not at this school not to teach new content but to reinforce already taught content; you with me, so learners come in for an hour and a half per class in grade 12 every Saturday morning but that Saturday morning we reinforce the content taught in the week. At the end of the term during the vacation we have one week reinforcing the work that's done in the quarter so we use extra time but we never cover new content we just reinforce and using that model we do get through erh the syllabus. There are other schools around here who do it in a different way they start to cover grade 12 content from grade 10 onwards already.....

Interviewer: So they spread it over three years?

Interviewee: Yes. So when they start with the (inaudible) sub (inaudible) in grade 10 they 'somer' cover vertical projectile motion ok, so when they start with types of reactions that should be very basic in grade 10 they already go into illumination substitution reactions (inaudible) chemistry.

Interviewer: So will you say that erh to them the grade 12 examination is more important than covering the syllabus?

Interviewee: Exactly. That is what happens at our so called erhm ex Model C schools. They get away with that, but you just try to do that at some of our schools then you will find the education department by means of subject advisors coming and clamping down on you.

Interviewer: Tell me more about your grade 12 pass averages.

Interviewee: Our grade 12 pass average at this school is not where it should be. Last year we had a dipped I think we had around about 48 percent

Interviewer: 2009

Interviewee: 2009 we were just under 60% and 2008 we were above 60%

Interviewer: About 60%?

Interviewee: No above 60% but those are percentages for huge numbers of learners.

Interviewer: I know, I know.

Interviewee: Tell ,me what do you think were the reason for the dip from 2009 to 2010?

Interviewer: At this school? You see too much of a good thing becomes bad. We have over taught our learners last year. Let me give you an idea of the life of an average grade 12 Physical Science learner last year at this school. He came to school eight o'clock, he got taught until 2:45 he go home, he arrive back at school at 5 o'clock for Telematics. That was Monday to Thursday. Saturday morning he arrives back at school 8 o'clock till at least 1 o'clock 2o'clock he has classes. Sunday just after two o'clock he arrives again and he stays here until about six o'clock. So what do you think? I teach my learner I teach him in the day, tonight he comes for Telematics Physical Science okay then Saturday morning he comes in again and hour and a half for me the Sunday again for Telematics. You ask yourself the

question when does he have free time to study himself, virtually little so he goes along with the belief that I get taught work (inaudible) by Mr Edwin I get revised on work (inaudible) on Saturday I watch it again on a big screen on Sunday so why do I have to learn. So most of my learners last year with this vigorous programme suffered with what I call burn out syndrome.

Interviewer: Tell me what is your belief about the state of Physical Science as a school subject in the country?

Interviewee: Erhm it is dying out in many schools and nobody notices that, nobody notices that and the major reason for that is we loosing educators I'll give you an example; myself I taught Physical Science for twenty years at John Ramsay High School with brilliant results, most of the years 100% but the numbers were dwindling because of an Exodus of learners out of the area to surrounding schools were perceived to be of a better quality. So if a learner is good in Bishop Lavis the parent will come look at this school for a place for him. If the learner is doing well and the parents have a lot of money go across the line to the ex model C schools. I left the school because of dwindling numbers and I came to this school. That was the last year that Physical Science was taught at John Ramsay because they could not find a replacement for me. So what we don't notice is that in townships Physical Science is dying out. In top ex Model c schools and private schools Physical Science is compulsory. At Wynberg Boy's High every learner does Physical Science every learner so as we are looking at these problems the matric results and that this disparity just continues to grow and grow and grow all the time.

Interviewer: Will you say that the introduction of the FET in 2006 contributed or added greater value to the learners learning of Physical Science or not?

Interviewee: Erhm actually not. Not the problem of the FET system one need to look for reasons. A learner lands up in a high school in grade 8 and he can't read he can't write he can't do basic Arithmetic. One need to look for reasons why that happens we seem to get a significant number of under achievers from our primary schools that is our major problem.

Interviewer: Which also impact on you as a teacher?.

Interviewee: Yes especially with the expectations of the of the FET and the NCS document. The emphasize is on application on developing skills ok, so learners come here lacking, not even basic skills for our subjects but basic skills for their own survival they don't. We

frequently we take out learners that cannot functionally read or write, they can read and write but not functionally at grade 8 level you mark a script and you find that the learner has rewritten the entire question paper. There are educators here that can tell you there are learners that can't read, you give them a page to read, and they can't read. So if we get a minority of learners who are at that level then something must have happened during their first six seven years that got them there so our problem lies down there as a matter of fact at this school matric educators are performing miracles, we are performing miracles. To give you an example last year there was a national examination in math's and language... I wonder if you know about that. The summary of that is in our staff room. The school had a 2.8% pass rate with two classes achieving zero percent in that examination. I'm teaching them now grade 10 so despite the results that they achieve at school in a national examination that is pegged at their suppose to be at their level 2.8% of our grade 9's passed. So you take those learners that have written a national examination 2.8% and get them above 60% in matric must be a miracle, must be a miracle.

Interviewer: What is your view on the high priority now on indigenous knowledge in the curriculum with reference to school science?

Interviewee: It is important, it is extremely important because Physical Science has not been purified from racism. You might not think that there is racism in Physical Science because it's a science, you read through a Physical Science textbook you'll come to one conclusion that 99.99% of all discoveries were made by whites and to to emphasize that most of our laws are named after them so I want to move away from Newton's first law of motion to the first law of motion I want to move away from Boyle's law to pressure volume relationship or pressure volume law so getting to indigenous knowledge actually balances that out because yes Newton excelled in motion but the mathematics that he used was covered by the Arab's.

Interviewer: There is also the belief that he stole the ideas....

Interviewee: Yes Copernicus and those people had brilliant views on the on the astronomy but their theories were based on more than 500 years of astronomical observation in Arab Universities. When they got to Baghdad and they found that there is a record of 500 - 600 years of the motion and the (inaudible) of our stars ok for instance when the Europeans believed that the Earth was flat the Arab world already worked out the circumference of the Earth I mean that's a contradiction. In the 15th century when they were afraid to go beyond the horizon because they thought they going to fall down there the radius and the

circumference of the earth has already been calculated in the Arab world and now you can go to the Far East and so forth. Those things are addressed from day one in my class.

Interviewer: Oh you address these issues....

Interviewee: Yes, yes we start from day one I get them the word Algebra, find out for me what is Algebra, then we go back to the Arabic word is "Ashiebra" it's an Arabic word it's a complete innovation into math's the whole section of Algebra for instance ok, and I take them to 10 century developments in optics in the Arab world but the first stuff we get is only in the 17th century so they need to realize that all of a sudden from the 16th century onwards science developed in the western world where did it come from but because in every section of physic of science you get to this miracle 16th century 17th century and from there onwards everything.

Interviewer: Tell me now that you mention these points what is your view on the nature of science? That science is tentative, that science is based on a empirical testability where of course the Western world you know are far more advanced in terms of providing what they use what they call a hypothetical inductivist approach towards science, you know its very difficult of course in our country if a black man comes up with a particular cure for aids or a particular indigenous kind of solution to a problem but there is no documented evidence to show this is the empirical study that have proved that this particular products works you know, how do you feel about that about the nature of science?

Interviewee: I think that at this point in time science is a slave of technology I also believe that brilliant scientists in third world countries are funded to do all the basic research work while the scientists in the first world actually searching research done in the third world to find research that they can take further in the development of a technology so I believe that we in the third world are doing all the dirty work whereas scientist in the first world are just looking at what research have I done inside and can that be used to develop a marketable technology without them doing the basic work and I also imprint that in the minds of my learners that they know this is exactly the role that the world envisage for us.

Interviewer: Is there anything else you want to state for the record Mr Edwin?

Interviewee: No.

Interviewer: Sir I want to thank you so much for your time, it's a very interesting kind of comments that came from you in terms of this research and I want to thank you so much for your time.

Interviewee: Ok, no problem

Interview end.

Thabo's Transcript

Interviewer: This Interview is conducted at Cape Peninsula University of Technology in my office in E8. Present is the researcher and the respondent. Permission has been granted by the WCED, and the teacher and he agreed to meet in my office. The date is: Thursday the 24th of March 2011

Interviewer: Am I right?

Interviewee: Yes, you are

Interviewer: Jimmy give me some more background details about yourself. Where you grew up? Your age and years of teaching experience your physical science teaching experience? Which university you studied at, as well as your subject majors?

Interviewee: Uhm Mr Koopman I grew up in the Western Cape that will be in the location of Khayelitsha. I went to school at a school called Ilushlaza Senior Secondary School. very good school I can still remember my senior years. Uhm after after Lushlaza I came to Pen Tech in 1995 and then I graduated.. I completed my diploma in 1997, that's when I went to teaching. I taught at a school in Wallacedene and that's where I am now. Currently I'm still a post level one

Interviewer: Ok and why did you decide to become a teacher?

Interviewee: I became a teacher after I did not perform very well in my maths and science. I wanted to be an engineer and then when I came at Pentech you know they were starting their course by the way they were starting their physics their physics courses in teaching. Uhm I was approached by one of the lecturers to register to be a science teacher, that's how I got to be a Science Teacher.

Interviewer: Is it your first choice or your second choice? Did you always... so you said you wanted to be an engineer so now you opted to become a teacher so so is it fair to say it was your second choice?

Interviewee: Honestly, honestly it never crossed my mind that I would ever be a teacher. It was not even my second choice

Interviewer: Ok, is there any family members of yours that become a teacher

Interviewee: No. No one in my family was a teacher. So I am the only one that is now in the teaching career. I must say it is still a shock to me to know I became a teacher. Like I said my idea was to become an engineer. So I am the first one in my family to be a teacher.

Interviewer: Tell me more about your physical science teacher at Lushlaza High

Interviewee: Mr Fleischman...yow... very bright teacher, and very enthusiastic he loved he loved his subject. He used to take us on excursions aaaa he was a great great test teacher that really taught me in Secondary.. I still remember his name Fleischman.. Mr Fleischman

Interviewer: What did you like about his teaching and what do you mean with a 'great' teacher?

Interviewee: His teaching you know, Mr Fleischman he was coming from England. So it was the first time a teacher would teach mixing his teaching with practicals. Throughout my schooling my secondary schooling that was the first time when a teacher will teach and mix teaching with practicals mainly he did practicals in our classes and learners and students we had to do some report backs in classes it was not only about him standing in front giving us all the knowledge yeah that's why I still remember his method of teaching.

Interviewer: Would you say that you liked the subject then?

Interviewee: I..... really liked the subject. Now the reason the reason I didn't do very well really I'm suppose to have gone to the field of engineering... the reason I did not perform very well I think Mr Fleischman he left us in grade eleven we had a new teacher in grade twelve we never understood our teacher unfortunately so there were many times when we went to the office to complain that we don't understand his teaching method and work. So we we we I think that the grade twelve syllabus we taught ourselves we never got anything from the teacher even the name of the teacher I can't recall.

Interviewer: Was he a Physical Science teacher?

Interviewee: He was a Physical Science Teacher

Interviewer: Was he well qualified with a good understanding of physical science?

Interviewee: I don't know... went to the office to find out whether we can't get a substitute we never got a positive answer

Interviewer: If you reflect back on your childhood as a learner of Physical Science you know uhm you mentioned your first teacher, Physical Science Teacher and then you mention this new teacher... the kind of content that they taught you was the content meaningful to you? Could you relate the information with the world out there as a child when you go and play or at home?

Interviewee: Never Never

Interviewer: Even the other teacher you mentioned?

Interviewee: The other teacher Mr Fleischman? No, Mr Fleischman, he made it..... but even even then the whole view that he was using.. he would take us... you know.. he would take us on excursions those excursions we really enjoyed them but honestly relating to our culture it was totally different science but we used to enjoy it because he made us to understand what he was teaching us as to whether it was meaningful in terms of of taking back to our way of doing things never make sense in that regard

Interviewer: Ok, When you started your career as a Physical Science Teacher, what did you aim to achieve?

Interviewee: I still have to achieve this to see a 100% pass rate in Grade Twelve for my learners.. I still have to achieve that and also to to because of the way that I was taught Science by Mr Fleischman I also wanted to establish a S science science science group a science club at my school, I still have to achieve that after thirteen years... (laughs)

Interviewer: Tell me and uhm what grades and how many learners do you teach?

Interviewee: Currently I am teaching Physical Science Grade twelve I have 100 learners in grade twelve. I know I know their timetable is going to be changed for the second term I'll have a third class in grade twelve in total by the end of this year I'll have 160 learners in grade twelve

Interviewer: How do you feel about the new changes that took place in the education system after the death of apartheid?

Interviewee: You know I started, I started during a time where there was a lot of confusion uhm when I started teaching it was the introduction of OBE many of us where confused but I was in a better position because I was coming out I was coming out I was fresh coming out of

school but we were always in logger heads with teachers that started teaching some time ago because of the new teaching styles I went through that that would be the curriculum 2005 there were lots of confusion let me say because you see the people that were my my my subject head my HOD he's coming from the old way of teaching the traditional the old way of teaching which was in the apartheid era so we are always in logger heads as to how much must we teach how much mus'nt we teach the learners if all the curriculum all the curriculum assessments standards and what from there we are busy with the NCS which we are grasping it we are we are I think we are fine with the NCS because at least with the NCS it is more content based than the curriculum 2005 which was more of integrating bits and pieces of information from different subjects ya

Interviewer: And tell me how do you feel about the new FET NCS school science curriculum that was introduced in 2006?

Interviewee: One has no choice but to implement the NCS. , because you see OBE goes along with lots of things. There are many things that one has to consider, even the seating of learners to be sitting alone or on their own. This curriculum this curriculum is fine, the problem is you see the department when they saw that there are many there are many educators that were not familiar with the content they tend to chop and change, there are sections that where they changed them for my own view I think those subjects those topics that were changed, we could have had them so that they can help the learners to understand science better

Interviewer: What topics are you talking about?

Interviewee: I'm talking about momentum two dimension

Interviewer: Oh

Interviewee: Anything that has to do with two dimensions they took it away I'm talking about the electronics in grade twelve

Interviewer: Did they took it away now?

Interviewee: They took it away....

Interviewer: For the CAPS? Are you talking about the CAPS?

Interviewee: No I'm not talking about the CAPS

Interviewer: Oh no it is still there but it is not examinable

Interviewee: It is not examinable that's correct.

Interviewer: Were you confident with those topics teaching it?

Interviewee: Pause. I was never taught those topics at school even at here at Pen Tech I was never taught that but most of the things that I am teaching currently I had to read them on my own to understand them to say I am confident that would be far fetched

Interviewer: So how do you feel about that?

Interviewee: No

Interviewer: When you teach it how do you feel?

You know most of the time when I'm teaching I'm teaching with confidence because when this new subjects were being introduced I spent a lot of time on my own studying to understand them. Even the topics and I made sure. You know what helped me would be the exemplars that were provided by the WCED those exemplars they helped me a lot to understand those topics I can ya

Interviewer: And tell me you know of course you got some training from the WCED before the introduction of the NCS. How long were the training sessions and was it adequate and the people offering the training were they competent enough? Did you learn new things from it that you could use in classroom?

Interviewee: You know the workshops that were conducted by the WCED, they were not helpful at all. I'd say if I can rate them they would be 20% useful. You know why I'm saying so its because the WCED they took some of us and made us curriculum advisors. Those where the teachers that were also confused as to the (inaudible) standards so those guys they were given an opportunity to come back to us and and conduct workshops on those curriculum assessments standards even themselves one could sense and see that they were not confident they did not know what they were saying in those workshops but at least when it comes to the content at least now we there were professors I still remember Mr Frans his working for the WCD Metropole North ya those were the guys that were that helped us with the content their workshops at least made sense.

Interviewer: What kind of training was that? Was it on two dimensions that you talked about.....?

Interviewee: On the new topics.

Interviewer: New topics

Interviewee: New Topics?

Interviewer: And it helped?

Interviewee: Really helped to some degree. Why some degree is because the time spent on those workshops the time the time spent was very short.

Interviewer: How long was it?

Interviewee: I remember we'll stay after school one is tired we'll stay for two to four hours or on Saturday's two to four hours. That is the maximum time that we spent on those workshops.

Interviewer: Oh?

Interviewee: Some workshops were also conducted during June holidays over a period of a week.

Interviewer: Who conducted those workshops also the professors?

Interviewee: The curriculum advisors and ya curriculum advisors

Interviewer: Ok, The new curriculum on outcome based approach, how do you feel about OBE and do you apply OBE in your classroom?

Interviewee: One has no choice but to apply OBE because you see OBE it goes along with lots of things. There many things that one need to assess even the seating of the learners, you can't allow learners to be sitting alone or on their own you have to arrange them accordingly to (pause) to accommodate the style of OBE. Now teaching for OBE one has to teach with a context in mind I think ya I've been there I'm comfortable with teaching with a context I've always done that.

Interviewer: Oh Ok Good.

Interviewer: Tell me uhm the curriculum as described in the NCS uses complex terms such as outcomes, critical outcomes, developmental outcomes, learning outcomes, assessment standards. How do you feel about those words those concepts and does these terms have any meaning to you when you plan your lessons?

Interviewee: No those concepts we have grasped them we are confident of them now they were a problem when the new syllabus was being introduced like the curriculum 2005 when they were being introduced we had to implement them but now ya after about 5 13 years of teaching I think I understand and how to prepare my lesson according to have the assessment standards and critical comes in mind

Interviewer: Do you uhm when do you assess?

Interviewee: When do I assess. Everyday.

Interviewer: Everyday?

Interviewer: What kind of assessment do you use?

Interviewee: uhm Excercises, giving exercises, giving question, asking questions allowing learners, grouping learners even test, exams all those tools I'm using them but I'm when it comes to assessment I'm assessing everyday

Interviewer: And the marking of those assessments?

Interviewee: The marking of the assessment if it's not formal if its informal, the learners they do that but for formal activities or cass activities I do the marking

Interviewer: Oh you only do the cass activity marking?

Interviewee: The cass activity marking yes.

Interviewer: How does your colleagues feel about what you assess and how you assess? What do they say?

Interviewee: When it comes to your assessment you know it's only departmentally based I'll speak about what my colleagues within my department feel about the way that I'm marking. When it comes to that we have a monitoring system where we give each others work after I have marked it to moderate so that way ya it depends sometimes they report will say I was not fair or I was harsh with the learners it depends on my marking on that particular assess.

Interviewer: Do you or what was your biggest challenge that you faced with implementing the NCS?

Interviewee: Pause... My biggest challenge was.... first of all... did'nt know how to prepare a lesson with the critical outcomes development outcomes in mind during that time I only went to class not knowing whether I'll be while I'm teaching am I meeting the demands of those critical outcomes but ya that's ya

Interviewer: Uhm What did you find most useful of the NCS in improving school science?

Interviewee: In improving school science useful pause... that's quite a challenge for me... you know(stutter) I don't know how to answer this one (laugh)... how did I find the NCS in improving the school science?

Interviewer: Maybe learner understanding..

Interviewee: Learner understanding ya

Interviewee: You know the NCS unlike the old syllabus that I went through in high school there are lots of new topics that are challenging even to the educators so those topics I believe I feel they are preparing the learners for their tertiary.. tertiary... tertiary life.

Interviewer: But do you think it's a good thing? How does it affect you?

Interviewee: As an educator: "How does it affect me?"

Interviewer: How does it affect you yes, the fact that you now have to prepare these learners for higher education?

Interviewee: That I am preparing them...?

Interviewer: Yes.

Interviewee: Not it affects me I'm very I'm very happy when I'm seeing my learners progressing and also doing very well in varsity. Learners that are coming from my school by the way they are in UCT doing engineering they are in Stellenbosch, they are all over the Western Cape.

Interviewer: Tell me, the NCS document envisages a specific type of teacher, for example one of the qualities that a teacher must have is he must be dedicated, committed he must be a

subject specialist, a researcher, designers of learning programme, life long learners, scholars. What is your perceptions of these qualities and do you think you live up to these standards of this qualities set by the NCS?

Interviewee: Mr Koopman you see (pause) I started teaching at a very young age I started teaching at a very young age the the uhm the thing that I uhm and when I started teaching I had only a diploma somebody my colleagues will be asking me why am I completing my degree now. Because of the demands of the NCS basically. I was one of the educators that would stay until very late after school, the first one to come in the last one to go out. When it comes to NCS that's what stripped my livelihood because there were many confusions when it comes to NCS so one has to go and read a lot and try to study to understand the subject matter the content so my my my education suffered but most of my colleagues they didn't bother they continue studying.. ya... but basically...

Interviewer: So how did they cope?

Interviewee: They finished their studies while they were still offering... I don't know... I couldn't cope I couldn't come outside and finish my studies because of the demands of the NCS.

Interviewer: So what do you use as your main source for planning your lessons?

Interviewee: My main source it's many resources as possible, exemplars, previous exam questions different text books, even the uhm the uhm examination guidelines the study guides, every resource that I can going to the library to get different textbooks.

Interviewer: It's a lot of hard work hey?

Interviewee: It is.

Interviewer: And how do you feel about the text books? Is it good? The quality of the textbooks, is it written, does it help you is the explanations easy?

Interviewee: Most of the textbooks are jokes!

Interviewer: What do you mean?

Interviewee: No they have this in mind, this context this context they will dwell on context of a certain topic and then if you have to deliver this to the learners there's little information

about a certain topic that one can impart to the learners so basically in order for one to have a lot of content, knowledge of a subject this is how I found out is that one has to use the exemplars actually

Interviewer: Oh

Interviewee: Exemplars and previous exam questions...

Interviewer: And ignore the....

Interviewee: Not really ignore them but even the activities in those text books they are totally not relevant they are that's something that won't even be tested. Those activities are a waste of time.

Interviewer: How often do you do practical work with your learners?

Interviewee: Erh how often, only the times when they have to do their case work there is no time at all, there's no time to do practicals every day you cannot even weekly totally out of the question.

Interviewer: Do you think learners that practical work help learners to understand the work better?

Interviewee: Definitely practicals will help learners to understand the work better but with our schools which are ex DET one's that are in the township there's lot of lack of resources so ya there's lot that need to be done in equipping those science lab's to have all the necessary chemicals in order to conduct a practicals.

Interviewer: You you have it?

Interviewee: Not at all.

Interviewer: Tell me does your learners enjoy those practical work that you do that you say is only for your formative assessment?

Interviewee: I'd like to think they do, because I don't simply give them for the sake of giving them first of all I go to them and explain what is needed of them when they are collecting a practical I'll conduct one with them and then allow them to take it from there and complete the practicals.

Interviewer: What extra support do you provide for your learners?

Interviewee: I do a lot. I'm teaching Saturday school I'm there I offer afternoon classes

Interview ends.