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EXPLORING TEACHERS' EXPERIENCES OF IMPLEMENTING AN INTEGRATED NATURAL SCIENCE AND TECHNOLOGY CURRICULUM IN THE INTERMEDIATE PHASE

by

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DECLARATION

I, Tashmika Pirtheepal, hereby declare that:

1. I have familiarised myself with the University's code of conduct and have fully adhered to it.
2. I undertake that this research study is my original work. Where the work of others has been used (in the form of electronic and printed source), it has been appropriately and accurately acknowledged with referencing that follows the requirements of the university. All text, diagrams and tables that have been adapted or used in their original form, has been specifically acknowledged, with the source being detailed in text and within the reference sections of this thesis.
3. Where research has been conducted in the form of data generation, it has met the university's ethical requirements.
4. This dissertation has not been submitted to any other university for another degree.
5. I have not handed over work that was once produced by another person/s or student to advance as my own.
6. I have not allowed, and will not allow, any other person/ student to duplicate my work with the intent to advance it as his/her own work.

_____ _____

Signature of Researcher **Date**

Tashmika Pirtheepal

DECLARATION BY SUPERVISOR

I agree to the submission of this dissertation.

_____ _____

Signature of Supervisor **Date**

Dr Pryah Mahabeer

ABSTRACT

Curriculum for the 21st century that promotes the integration of Natural Science and Technology (NSTech) seeks to transform and develop curriculum by advocating for the flexibility of teachers' knowledge and skills as opposed to traditional curriculum where subjects were taught in isolation. The restructuring of the curriculum has been an ongoing process for teachers in post-apartheid South Africa. Some studies on curriculum integration have rendered it effectual as it allows for flexibility in knowledge and skills that seek to offer solutions to the problems that exist in society. However, NSTech has attracted considerable scrutiny over the past few years. Studies note the problematic nature of integrating the curriculum, as teachers experience numerous setbacks in the form of contextual factors, inadequate experience and training, and the prescriptive nature of the curriculum. In this study, the problematic nature of NSTech is addressed by exploring the experiences of teachers who implemented an integrated NSTech curriculum, which was the core focus of the study. Additionally, the study sought to explore the reasons for teachers having these experiences, and how it influenced the way in which the NSTech curriculum was implemented.

Through the analysis of interpretive qualitative data, this case study involved coding and categorising data into themes under the guiding research questions. The data sources included semi-structured interviews and semi-structured questionnaires with six Intermediate Phase teachers from three schools within the province of Kwa-Zulu Natal. These teachers were selected using purposive sampling with specific criteria. The results that emerged from this study, communicated the vital nature of teachers' experiences in the implementation of an integrated NSTech curriculum. The key finding of the study showed that teachers had a multiplicity of experiences when implementing the NSTech curriculum. These experiences included an inclination towards either Natural Science or Technology which led to a disjuncture in the way NSTech was taught as an integrated subject. Teachers inclination resulted from their lack of content knowledge, pedagogical skills, contextual factors such as inadequate time and limited resources to implement NSTech as well as a lack of support offered in pre-service and in-service teaching. Teachers' experiences were further exacerbated by personal, contextual, political and socio-economic factors that influenced the way in which NSTech was implemented by Intermediate Phase teachers.

The study's findings could be valuable to policy makers and schools alike within the Department of Education, and consequently guide decision-making processes and curriculum

changes in the years to come. Bernstein's theory of Classification and Framing was used to used to analyse and classify Intermediate Phase teachers' experiences of implementing an integrated NSTech curriculum. Recommendations emanating from this study saw the need for policy makers to collaborate with teachers to understand how curriculum changes can affect their experiences when implementing an integrated NSTech curriculum and vice versa. Additionally, teachers need relevant and on-going support from the Department of Education to adequately implement the vision of policy makers.

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DEDICATION

An immense feeling of gratitude goes to God for granting me endless blessings and the strength to face challenges and celebrate my achievements with humility and devotion.

This study is dedicated to my mum who has always put aside her own aspirations to make sure that I could fulfil mine. Mum, I thank you for instilling in me all the values and morals that I possess today. It is because of your care and love over the years that I have been moulded into the character that I am today. You have looked ahead in times where life was tugging you behind. Always know that, your strength is admirable and always appreciated. You never stopped believing in me and I hope that I have made you proud. My perseverance for success will forever be given impetus by your strength and sheer belief in me.

LIST OF ACRONYMS USED

NSTech	**-**	**Natural Science and Technology**
NS	**-**	**Natural Science**
C2005	**-**	**Curriculum 2005**
NCS	**-**	**National Curriculum Statement**
RNCS	**-**	**Revised National Curriculum Statement**
CAPS	**-**	**Curriculum and Assessment Policy Statement**
OBE	**-**	**Outcomes Based Education**

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CHAPTER ONE

BACKGROUND AND INTRODUCTION TO THE STUDY

1.1 Introduction

The intention of this study was to explore the experiences of Intermediate Phase (grade 4 to 6) teachers implementing an integrated Natural Science and Technology (NSTech) curriculum. Traditionally NS and Technology were taught as two separate subjects, and in recent with the CAPS curriculum, these two subjects have combined into a single subject. Despite their links, NS and Technology often exist as isolated subjects as these trickle down into the classroom context. During the implementation of NSTech, the researcher as an NSTech teacher has encountered numerous challenges such as the overload of content from having two subjects combined which leaves the teacher with inadequate time for implementation. Moreover, there is a lack of resources and facilities when implementing NSTech which hinders learner's ability to fully understand what is being taught. This study was therefore motivated by the researchers experiences as an Intermediate Phase teacher, teaching NSTech in an attempt to provide insights into the implementation of an integrated curriculum.

Studies show that teachers' experiences are of vital importance as these experiences can affect teachers' orientation in the subject, their professional development, as well as future professional goals (Timostsuk, 2016).In addition, when teachers are overburdened or not properly equipped to take on a task, they often feel anxious and uncertain (Kauffman, Moore, Johnson, Kardos, Liu & Peske, 2002). This study closely explored the efficacy of implementing NSTech as an integrated subject which has come to the fore in the present-day Curriculum and Assessment Policy Statement (CAPS). Policy documents such as CAPS often neglect that implementation takes place at school level as this is where the harsh realities often begin to question the ideals of policy that are developed in isolation to those who actually implement the curriculum. Data was sourced, using semi-structured interviews and questionnaires, on the experiences that Intermediate Phase teachers had when implementing an integrated NSTech curriculum, and the reasons for their experiences. The research revealed how teachers implemented an integrated curriculum such as NSTech in their daily teaching practices.

Due to the changing curriculum in South Africa in the recent years, literature has revealed that teachers attempt to change their practice to suit the changing curriculum (Scholtz, Watson & Amosun, 2004). This concept of continuous change was evident throughout the study in the

ways that teachers implemented the NSTech curriculum. It can therefore be said, that the curriculum shapes teachers' experiences and is shaped by teachers' experiences (Fishman, Best & Marx, 2001). This study was undertaken to provide insight into the experiences of NSTech teachers, the reasons for teachers having those experiences, and how their experiences allowed them to navigate through changes in the curriculum. I argue for the relevance and necessity for this study, as there has been a dearth in research on Intermediate Phase teachers' experiences in implementing an integrated NSTech curriculum within South African schools, with previous research mainly focussing on learners' experiences (Guzey & Roehrig, 2009; Izci, 2017; Nampota, 2008; Weber, 2008). The study and understanding of teacher experiences towards curriculum change may assist teachers in embracing curriculum changes more openly and make curriculum implementation more sustainable for future generations. Consequently, if teachers embrace curriculum change openly, this could improve the quality of teaching and learning in South African classrooms. This chapter focuses on the background and contextualisation of the research study.

1.2 Background to the study

Twenty first century educational goals exhibit flexibility in terms of knowledge and skills (Costley 2015; Jonsdottir, 1995; Yildiz-Dubun, 2014). Awareness of the possibilities that present educational systems offer, may assist in developing interconnectedness and integration in learning, by drawing on connections of various viewpoints and fields of knowledge in order to create solutions to problems (Guzey & Roehrig, 2009; Turiman, Omar, Mohd Daud & Osman, 2011).

To appreciate where the school curriculum is, presently in South Africa, it is important to understand the background of South Africa's education system. Driven and motivated by the South African Constitution, the present CAPS document sought to address the disparities of the past and improve the overall quality of life by establishing a democratic society for all citizens. The disparities in education, prior to the first democratic elections in 1994, saw the launch of Outcomes Bases Education (OBE) in the form of Curriculum 2005 (C2005). According to a recent government report by Umalusi (2014), C2005 was drawn from highly developed countries and sought to place South African education on a global scale. However, due to the stakeholders of the curriculum being inadequately experienced to teach using OBE, the curriculum was revisited. Such revision brought into effect the National Curriculum Statement (NCS) and Revised National Curriculum Statement (RNCS) (Department of Basic

Education, 2011; Umalusi, 2014). However, the NCS was criticised for its demands on teachers' time as well as widespread learner underperformance in international and local assessments (Umausi, 2014). In 2012, the NCS and RNCS were reviewed once again and replaced by CAPS.

Within the CAPS handbook, content knowledge, teaching and assessment became very prescriptive (Umalusi, 2014). The focus was on knowledge and skill acquisition with principles of social transformation and the inclusion of all learners (Deparment of Basic Education, 2011). One aim of CAPS was to produce learners who could demonstrate an understanding of the world as a set of related systems, by recognising that the contexts of learning and problem solving do not exist in isolation (Department of Basic Education, 2011). In so doing, CAPS integrated the knowledge, focus, goals, theory and practice of Natural Science (NS) and Technology (Tech) and introduced an integrated Natural Science Technology (NSTech) curriculum (Department of Basic Education, 2011). The implementation of NSTech in CAPS was quite different to the implementation of NS and Technology as separate subjects in the NCS and RNCS curriculum. With CAPS, NS and Technology was now integrated into a single subject in the Intermediate Phase, having one teacher allocated to NSTech with a reduced amount of time. Once learners entered the Senior Phase (grade 7 to 9), NSTech once again separated into NS and Technology to prepare learners to become subject specialists as opposed to generalists which NSTech aims to achieve within the Intermediate Phase.

Educational reforms introduced by CAPS, such as NSTech, seek to rehabilitate the curriculum of the past. However, these policies are developed at national level and implemented at the classroom level. This implies that, at the national level, policies are created with the ideal school environment in mind, whereas at the school level, the realities and problematic nature of implementing an integrated curriculum prevail. Although teachers' experiences are of vital importance in curriculum implementation, their role is instrumental and almost non-existent in curriculum change and development. Studies conducted in China concur that teachers' experiences affect their professional identities (Lee & Yin, 2011). Therefore, when reforms such as CAPS are imposed upon teachers, this may directly affect their experiences of implementing NSTech, leaving them with a sense of insecurity in their teaching (Kelchtermans, 2005). It is not adequate to solely consider teachers' experiences in implementing an integrated NSTech curriculum, but also the reasons for their experiences.

The concept of integration has experienced a tremendous deal of attention, with CAPS's primary concern being transforming the curriculum that existed during apartheid (Department of Basic Education, 2011). This resulted in breaking the barriers that existed between NS and Technology as separate subjects, and the introduction of a compulsory integrated NSTech curriculum for all Intermediate Phase learners. This study explores the experiences of Intermediate Phase teachers implementing an integrated curriculum such as NSTech.

1.3 Purpose and rationale

The purpose of this research study was to explore the experiences of Intermediate Phase teachers when implementing an integrated NSTech curriculum. In an attempt to understand their experiences, another objective was to identify reasons for teachers having these experiences, and how these reasons influenced the way in which they implement an integrated NSTech curriculum.

Although many studies have been done on an integrated curriculum, there has been limited research conducted on how South African teachers implement an integrated curriculum, more especially an integrated NSTech curriculum (Harell, 2010; Kelly, 2010). Since the pedagogy of teachers is central to the implementation of an integrated curriculum, the focus of this study was on curriculum integration as experienced by South African Intermediate Phase teachers, who directly engage in the implementation of an integrated NSTech curriculum on a daily basis, as opposed to studies that have analysed textbooks and policy documents (Gresnigt, Taconis, van Keulen, Gravemeijer & Baartman, 2014; Izci, 2017; Rohaan & van Keulen, 2011). Due to the gap that sufficed in the reviewed literature, this study aimed to explore the similarities of present research regarding teachers' experiences whilst drawing on inferences of implementing NSTech in the Intermediate Phase of South African schools.

With the adoption of CAPS, the literature review sets forth the complexities that teachers were faced with during the transformation of the school curriculum over the years. Although scholars argue for an integrated curriculum, the main focus of these studies was on how the curriculum is integrated and its benefits for learners rather than the experiences of teachers implementing an integrated curriculum (Harell, 2010). If properly implemented, an integrated curriculum can prove to be advantageous (Kelly, 2010). Therefore, this study sought to gain an understanding of teachers' experiences when implementing an integrated NSTech curriculum.

The views and experiences of the participants in this study provide invaluable data on how teachers experience and implement an integrated curriculum. Proceedings from the Academy of Science of South Africa Forum reveal that when learners perform poorly in a subject, it discourages them and reduces their desire to pursue the subject, which in turn, leaves teachers with low morale for teaching (Grayson, 2010). Additionally, with the pedagogical impediments in current schooling systems, such as the lack of infrastructure, scarcity of resources and regular policy changes, the successful implementation of integrated subjects is tested considerably (Guzey & Roehrig, 2009; Izci, 2017). Literature observes the importance of teachers' experiences in the successful implementation of an integrated curriculum (Oloruntegbe, 2013).

The rationale for this study stems from my personal engagement with the NSTech curriculum, both separately and as an integrated subject. My passion for teaching NSTech over the years and my firm knowledge base from being a Natural Science and Technology subject specialist when these were offered as separate subjects, further gave impetus to this study. As a NSTech teacher, I often attend departmental workshops and have been exposed to colleagues expressing their experiences implementing NSTech, emphasising its vast content knowledge, lack of resources and limited time. The experiences of teachers were rarely considered at these workshops, with focus being placed on curriculum delivery and supervision of records. This research will afford NSTech teachers, a platform to voice their experiences and feelings on implementing NSTech as an integrated curriculum.

Furthermore, from my experience, I am aware of the demands that present day education places on teachers in terms of inadequate time and resources, contextual factors, ongoing policy changes regarding pedagogy, content and assessment that have taken place over the years. As a teacher who has implemented the current NSTech curriculum, in both resourced and under resourced schools, I believe that teachers' experiences are rarely considered when designing such a curriculum, and as a result, this affects the way in which it is implemented in the classroom. Personally, I have experienced numerous challenges when implementing NSTech. The improvisation of resources, large class sizes and the overwhelming content have all proved to be impediments in the successful implementation of NSTech. As a NSTech teacher, I possess the knowledge but lack the know-how of implementing an integrated NSTech curriculum. These challenges have been revealed in my pedagogy and have therefore played a significant part in the rationale for this study. The afore mentioned reasons prompted me to explore what other teachers experienced with the hope of improving or understanding NSTech as an integrated curriculum.

It is anticipated that this study will bring to light, the experiences of other NSTech teachers and provide reasons for their experiences, from which solutions could emerge. Furthermore, the research allows me to reflect on my pedagogical practices as a NSTech teacher and generate solutions to the challenges faced by NSTech teachers. This would ensure that pedagogy is improved, contributing to better experiences of learners, and strengthening the role of NSTech teachers. This study sought to get the attention of policy makers and departmental officials, which could prove useful in administering future changes in the NSTech curriculum. Additionally, policy makers would be guided by the experiences of teachers, as elucidated in this study.

Since teachers' pedagogy is key to the proper implementation of an integrated curriculum, the focus of this study was on curriculum integration as experienced by six South African NSTech teachers from grade 4 to 6. Kelly (2010) posits that if properly implemented, an integrated curriculum can prove to be advantageous. Through this study, I sought to understand teachers' experiences as they implemented an integrated curriculum with the hope of enhancing the NSTech curriculum.

1.4 Location of the study

The study is located at 3 primary schools in Phoenix, Tongaat and Groutville. These schools are in the northern KwaZulu-Natal region of South Africa, and fall within the Pinetown and Ilembe districts, which are urban and peri urban areas respectively. This study is restricted to the Department of Education. Each school comprised of approximately 1200 learners, with the staff complement of between 35 to 45 teachers at each school. The focus of this study was restricted to Intermediate Phase (grade 4 to 6) NSTech teachers. The schools were resourced differently, and incorporated a diversity of teachers, learners and pedagogical contexts. The contexts and location of the schools added to the suitability of the location for the research study. The three schools exhibited similarities and differences in various respects. Each of the three schools catered for a variety of learners from the middle to lower-income groups.

1.5 Key research questions

The topic of this study was to explore teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase, in selected KwaZulu Natal schools. The research questions were separated into various sections that lead to, and highlight the, similarities and differences in the experiences of NSTech teachers. This research study sought to better

understand Intermediate Phase teachers' experiences in implementing an integrated NSTech curriculum. The study was guided by the following key research questions:

1. What are teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?

2. What are the factors contributing to teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?

1.6 Overview of the research design and methodology

In this study, the research design and methodology assisted the researcher in gaining precise responses to the research questions. This section briefly discusses the research design and methodology used in this study. The purpose of the research determined the **research design** and methodology used in order to achieve coherence and practicality in the study (Cohen, Manion & Morrison, 2007). This research study was informed by the **interpretivist paradigm** which places the individuals' everyday experiences at the forefront of the research, with the aim of attaining in depth and subjective understandings of their experiences (Leedy & Omrod, 2010; Rubin & Babbie, 2016). It aimed to gain an insider view of the experiences of Intermediate Phase teachers when implementing an integrated NSTech curriculum.

The **qualitative approach** to research guided this study as it allowed the researcher a variety of choices regarding sampling procedures and data generation methods, due to it being a large, diversified and evolving field (Draper & Swift, 2011). The **research** made use of a **case study** as it conducted an in-depth and subjective analysis of teachers experiences in order to interpret the uniqueness of their experiences (Cohen et al., 2007). Grade 4 to 6 NSTech teachers' experiences within three schools in KwaZulu-Natal were analysed, to describe the "complexities and situatedness" of their experiences with the hope of contributing to "action and intervention" in teaching NSTech (Cohen et al., 2007, p. 12). This study applied purposive sampling where participants were handpicked for this study on the basis that they possessed in-depth knowledge of NSTech within the Intermediate Phase.

Data generation was conducted through semi-structured questionnaires and semi-structured interviews in order to allow complementarity (Creswell, 2014). Ethical clearance from the

Department of Education was sought and granted for research conducted at all sites with all participants. Ethical clearance was also obtained from the University's research office prior to proceeding with the study.

A more comprehensive explanation of the research design and methodology, as well as issues of validity, trustworthiness and ethical principles are discussed further in chapter three of this dissertation.

1.7 Organisation of the dissertation

This research study is composed of five chapters. Below, a snapshot discussion of each chapter is provided.

Chapter one presented the contextual background and introduction to the research study. This included the focus and purpose of the study, which put forward the critical research questions that this study attempted to answer, the rationale and overview of the research methodology, as well as the overall organisation of the study.

Chapter two presents the relevant literature reviewed, where insight is given into what scholars have written about the implementation of an integrated curriculum such as NSTech within a national and international context. The review of literature focuses on: the rationale behind integrating Natural Science and Technology; implementing an integrated Natural Science and Technology curriculum in South Africa and internationally; factors influencing the implementation of an integrated curriculum; and teachers' experiences of implementing an integrated curriculum. This section encompasses the theories that underpin the experiences as well as the hindrances in the implementation of an integrated curriculum. The literature review is followed by the theoretical framework which concludes chapter two and will be used to analyse the findings presented in Chapter 4.

Chapter three carefully structures the qualitative research design and methodology applied to this study. It focuses on the explication and justification of the research approach and research paradigm used, the location of the research sites, the sampling procedures, and methods for data generation as well as data analysis. It goes on to explore the way in which rigour through validity, trustworthiness and reliability was established. It concludes with the ethical considerations and limitations of the study.

Chapter four is the core of the study, as it presents the main qualitative data findings, acquired through the interviews and questionnaires. Further, this chapter analyses and discusses the findings in light of the research questions that guided the study, a detailed discussion linking it back to the reviewed literature and the application of the theoretical framework.

Chapter five puts forward the concluding discussions through a summary of the main findings. This study is drawn to a close through recommendations for further studies and areas for future research.

1.8 Conclusion

Chapter one provided the background and introduction to the study. In brief, it discussed the location and focus of the study. Thereafter, the key research questions were mentioned along with the overview of the design and methodology. Finally, the organisation of the dissertation concludes this chapter. The subsequent chapter reviews the literature in relation to the experiences of implementing an integrated NSTech curriculum and goes on to discuss the theoretical framework on which the analysis of data is based.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This literature review explores aspects central to the phenomenon being addressed and is used to frame the problem by summarising and locating studies related to the topic (Creswell, 2009; 2014). In the previous chapter, the background to the study was discussed. This chapter thematically reviews scholarly articles on curriculum integration, with the discussion of studies which have been conducted internationally and within a South African context. There are numerous factors that affect the successful implementation of an integrated curriculum. These factors include: the experiences and professional development of teachers, content knowledge associated with the subject taught, as well as physical factors of the learning environment (Harell, 2010).

This chapter is organised thematically, and its focus is twofold. It begins by explaining the rationale for an integrated curriculum, exploring teachers' experiences of implementing an integrated curriculum such as NSTech and how their experiences shape their teaching. Secondly, this chapter discusses Bernstein's (1971) theory of Classification and Framing of knowledge within the curriculum, which is used as a theoretical framework to guide this research study. It is imperative to initially explore the phenomenon of teachers experiences more closely in order to contextualise experiences within the body of literature and its significance in the research study itself. To understand this study, it is important to first understand curriculum integration and the ideas behind its existence. The subsequent section explicates teachers' experiences in order to provide insight into the study's phenomenon and discusses the rationale behind the integration of the Natural Science and Technology curriculum.

2.2 The rationale behind integrating Natural Science and Technology

As this literature review discusses aspects central to curriculum integration under the various themes, it is imperative to initially understand what curriculum integration means within the context of this study. Curriculum integration has been widely researched in South Africa and internationally (Izci, 2017; Wei, 2009; Zhou & Kim, 2010). However, most of the research has focused on the need for curriculum integration, and theoretical models of curriculum

integration (Aceska, 2016; Etherington, 2011; Gresnigt et al., 2014; Guzey & Roehrig, 2009; Park, 2008). Research has also reported on the effectiveness of integrated approaches to teaching and learning, as well as the challenges, limitations and obstacles involved in its implementation (Gecer & Ozel, 2012; Gömleksiz, 2012; Park, 2008; Zhou & Kim, 2010).

Few studies have been done on how South African teachers implement an integrated curriculum, and more importantly what their experiences are during its implementation. Studies that describe South African teachers' experiences of implementing an integrated curriculum strictly focus on the experiences of high school teachers or those teaching Maths and Science as an integrated curriculum (Johnston, Riordain & Walshe, 2014; Kok & van Schoor, 2014; Sen & Ay, 2014; Wei, 2009). In contrast, the focus of this study is on curriculum integration as experienced by South African teachers from grades 4 to 6, who directly engage in the implementation of an integrated NSTech curriculum on a daily basis, as opposed to studies that have been done on analysing curriculum policy documents (Gresnigt et al., 2014; Izci, 2017; Rohaan & van Keulen, 2011).

The rationale behind the implementation of an integrated curriculum sought to take advantage of how knowledge across disciplines is interrelated in the real world, as opposed to separate subjects which is said to narrow learners' perspectives, and is insufficient in the learning process (Harell, 2010). Scholars such as Harell (2010), argue for an integrated curriculum, noting that through interaction with multifaceted knowledge, the student is able to grow and develop as an individual. Harell (2010) further explains the rationale behind an integrated curriculum was to allow for the learner to integrate knowledge thereby enhancing learning. The focus in literature appears to lean more towards learners and how they learn through an integrated curriculum, and appears limited in examining teachers' experiences (Park, 2008).

Arguably, the integration of subjects is seen as the capacity to integrate knowledge of two or more disciplines to enhance cognitive abilities in ways that are not possible through single subject (Spelt, Biemans, Tobi, Luning & Mulder, 2009). The aim here is to set forth the complexities that teachers face when there is a massive transformation to the school curriculum. An integrated curriculum, such as the one offered by CAPS, is one way in which curriculum developers sought to expand and modify the curriculum to better suit South African classroom contexts. CAPS sought to draw attention to the fact that the content learned in Natural Science or Technology should not exist in isolation (Department of Basic Education, 2011). The emergence of NSTech meant that the barriers existing between these two subjects

as separate entities, were broken down for the Intermediate Phase. Natural Science aims to understand the needs of the world and the people who live in it, whereas Technology communicates these needs and solves problems that prevail in society (Department of Basic Education, 2011).

The abovementioned research by Spelt et al. (2009) is in line with theorists such as Beane (1995), who advocated integrated forms of curriculum in earlier years. An integrated curriculum pertains to teaching multiple areas of subject matter that fall within the same area of instruction (Bloom, 2006). However, the challenge falls upon teachers who attempt to put this theory of an integrated curriculum into practice (Loepp, 1999). Curriculum can also take on the description of experiences that allow for personal and social growth (Tanner & Tanner, 1975). It can be observed that curriculum has evolved in its definition over the years, and it demonstrates a more integrated approach that leads us to our present curriculum (CAPS) implemented at schools.

Research done on an integrated Science and Technology curriculum found it to be beneficial as it allows teachers and learners to develop 21st century skills (Turiman et al., 2011). Teachers are equipped with adequate knowledge through classroom practices that allow for integration of subjects such as Maths, Science and Technology (Sen & Ay, 2017). Curriculum integration has come to the fore in recent years and it is important to note that, even under-resourced schools have the potential to integrate Science and Technology through problem or project-based, practical methods of teaching (Johnston et al., 2014; Sheikh Abdullah, 2016). Kelly (2004) expounds that educational change is imminent in society, just as everything else has changed around us in recent years, so should education. An integrated Science and Technology curriculum can be advantageous if properly implemented (Kelly, 2010).

Subject discipline-based curriculum has resulted in a disconnect between teachers' experiences and students' experiences, resulting in the need for an integrated approach (Zhou & Kim, 2010). A study conducted in China found that the aim of an integrated Science and Technology curriculum in the senior phase (grade 7 to 9) was to solely raise scientific literacy which in turn neglected Technology (Wei, 2009). There has been much acknowledgement that the integration of Science and Technology, especially in the higher grades, diminishes the coverage of the knowledge of the two subjects. This suggests that when Science and Technology are integrated, there is not enough coverage of content and adequate understanding on the part of learners and teachers. However, integrating Science and

Technology in the lower grades may be effective as it only introduces the subjects content knowledge, and is therefore, manageable and does not leave learners confused and overwhelmed (Nampota, 2008). In policy, an integrated curriculum such as CAPS, further ascertains the effectiveness of integration in the Intermediate Phase (Ramatlapana & Makonye, 2012).

2.3 Implementing an integrated Natural Science and Technology Curriculum: A South African context

The previous section explicated the rationale behind integrating NSTech. This section discusses how an integrated curriculum is implemented within a South African context. The pedagogy of teachers is an integral part of integrating the curriculum or subjects (Chicgona, 2010). Research such as Gömleksiz's (2012) focuses on how an integrated curriculum promotes student learning and develops their abilities and attitudes for the future. Notwithstanding, the success of an integrated curriculum depends largely on the learners' ability to integrate their knowledge. While the role of a learner is very important, the teacher's role in understanding and facilitating an integrated curriculum is arguably crucial for proper implementation of curriculum integration and consequently, the outcome of learning (Park, 2008). One cannot focus solely on learners' ability to learn using an integrated curriculum, as the experiences of teachers when implementing an integrated curriculum are equally important and parallel to learners' success (Park, 2008).

Other research on the process of curriculum integration shares particular emphasis on international perspectives of Science and Technology as an integrated subject (Gresnigt et al., 2014; Rohaan & van Keulen, 2011; Wei, 2009). Moreover, the literature explores teachers' experiences on curriculum integration and attempts to justify its ability to succeed or fail based on learners' success (Gresnigt et al., 2014; Park, 2008; Zhou & Kim, 2010). The aforementioned studies provide an inadequate understanding of teachers' experiences when implementing an integrated Natural Science and Technology curriculum in South African schools.

According to Grayson (2010), learners in South African schools perform poorly in Science, Maths and Technology benchmark tests. Learners' poor performance may, in turn, discourage them and reduce their affinity to pursue Science and Technology in the future, leaving teachers with a low morale about teaching Science and Technology. Additionally, Science education reforms ask Science teachers to integrate Technology into their teaching as this will equip and

prepare learners with 21st century skills (Guzey & Roehrig, 2009). In contrast to this view, Science and Technology are treated as separate entities in both the Senior Phase as well as Further Education and Training Phase (Department of Education, 2011). Teachers are often faced with various challenges such as lack of time, resources, pedagogical content knowledge and skills (Guzey & Roehrig, 2009). Curriculum may not be aligned with classroom practices, making the dissemination of an integrated curriculum rather difficult (Izci, 2017). Nampota (2008) explains that an integrated Science and Technology curriculum may not achieve the goal of giving a sound foundation for tertiary education. This may be so, because an integrated curriculum encompasses two subjects whose philosophies are rather different. However, Science and Technology are seen as critical inputs in tertiary education and form the foundation of day to day life (Nampota, 2008).

The quality of a curriculum and its implementation are often questioned. Teachers in South Africa and other countries across the globe, struggle with how best to educate the youth through an integrated curriculum to keep up with global education standards, despite the diverse contexts we face as a country (Umalusi, 2014). Most countries still promote an education system that addresses the needs of the past and neglects those of the present, which may be detrimental to subjects such as NSTech, due to its nature of promoting present day skills using Science and Technology (Sane, 1999).

A teacher's role is key to effective curriculum development and implementation (Kelly, 2004). Pedagogical approach of teachers may vary, which, in turn affects teaching and learning in schools (Kelly, 2004). Further, South African research, carried out with pre-service teachers in the Foundation Phase, suggest the need for enhanced practices at universities for proper implementation of an integrated curriculum (Kok & van Schoor, 2014). Pre-service teachers must be well prepared for teaching Science and Technology concepts using an integrated approach, and universities are at the forefront of imparting such skills to future teachers. Moreover, research alludes to the large number of teachers who lack sufficient content knowledge and effective classroom practices (Kok & Van Schoor, 2014). It is further argued that an integrated curriculum can only be properly implemented if teachers impart it in a meaningful way (Yildiz-Dubun, 2014). To do this, teachers themselves need to be familiar with everything that an integrated curriculum stands for, in both theory and practice, and be provided with the necessary resources to facilitate sound instruction of NSTech (Yildiz-Dubun, 2014).

The experiences of teachers established from the interviews and questionnaires will therefore provide invaluable feedback on teachers' experience implementing an integrated NSTech curriculum within a South African classroom. There have been few studies, if any, conducted in South Africa regarding teachers' experiences of implementing an integrated NSTech curriculum, which further provides motivation for this study. It is also imperative that international classroom contexts, which is discussed in the next section, be considered, to understand the notion of integration on a global scale.

2.4 Implementing an integrated Natural Science and Technology Curriculum: An international context

This component of the research explores the implementation of an integrated curriculum internationally. With countries such as Netherlands and France implementing Science and Technology as an integrated subject, literature alludes to the necessity of an integrated curriculum in the 21st century, arguing its contribution to learner's holistic development of life skills rather than isolated parts if subjects are taught separately (Costley, 2015; Jonsdottir, 1995; Rohaan & van Keulen, 2011; Yildiz-Dubun, 2014). Despite the global call for integration, studies conducted in U.S.A and England found that Science, Technology and all other subjects within the curriculum are still taught as separate subjects despite the acknowledgement of the benefits of integration (Gresnigt et al., 2014).

Integration of Science and other subjects in secondary schools in the United Kingdom was developed to bring together Science knowledge and learners' everyday knowledge (Frost, 1999). There are, however, major concerns of teachers' expertise and time allocation in newly integrated subjects, which one may view as hindrances to the implementation of an integrated curriculum (Frost, 1999). Further, international studies that focus on integration revealed that curriculum integration was exercised by teachers in a very limited way due to the pressure imposed upon them, especially to acquire content knowledge and expertise in two subjects as opposed to one (Frost, 1999). Successful implementation of an integrated curriculum became apparant when focus was placed on motivating teachers in their teaching rather than prescribing an unfamiliar curriculum for teachers to implement by themselves (Ferguson-Patrick, Reynolds & Macqueen, 2018). It is worth noting that the above studies focus solely on Science integration in the higher grades, and general curriculum integration, neglecting the integration of Science and Technology.

The implementation of an integrated Science and Technology curriculum in Turkey was met with mixed experiences from teachers. Some teachers feel that there were positive elements such as the ability of such a curriculum to support the scientific and technological understanding of learners, and relate the knowledge acquired to learners' daily lives (Yidiz-Dubun, 2014). More importantly, these teachers emphasise the difficulty of the level of content, lack of in-service and pre-service training, overcrowding and lack of proper facilities, thus rendering the implementation of NSTech problematic. If teachers face the abovementioned challenges, it leads to their inability to successfully implement an integrated NSTech curriculum on a personal and professional level (Yildiz-Dubun, 2014).

The teacher has a central role in the success of instructional practices of an integrated curriculum (Gecer & Ozel, 2012). Teachers have new roles and responsibilities in an integrated curriculum, very different to those in traditional curriculum with separate subjects (Gecer & Ozel, 2012). Teachers are expected to guide and facilitate learning, rather than to simply transmit knowledge, in keeping with the integrated approach to curriculum (Gecer & Ozel, 2012). Despite the new integrated approach that schools in Turkey offer, teachers still face the same challenges that were experienced in traditional classrooms such as overcrowding, lack of equipment, and insufficient time (Gecer & Ozel, 2012; Guzey & Roehrig, 2009). Additionally, a Canadian study kept track of the implementation of an integrated curriculum by pre-service teachers before and after integration (Lowe, 2012). The study shows that there was little to no training offered to teachers, leading to their confusion and anxiety when implementing an integrated curriculum (Lowe, 2017). In light of the issues highlighting the problematic nature of implementing an integrated curriculum at schools internationally, the following section discusses the factors influencing the implementation of an integrated curriculum.

2.5 Factors influencing the implementation of an integrated curriculum

Various factors influencing the implementation of an integrated curriculum emanate from the literature reviewed. The first factor eminent factor is the notion that integration of subjects draws attention to one subject more than the other (Wei, 2009). This in turn leads to a disconnect in the way an integrated curriculum is implemented. The propensity towards one subject is arguably one of the most conflicting aspects of curriculum implementation for teachers trying to implement a curriculum without leaning towards the subject they are more comfortable teaching (Kelly, 2010). Van den Akker (2010) explicates two important levels of

curriculum implementation. The higher levels which is the macro curriculum (vision of policy documents - CAPS) which directly affects and influences the lower levels which is the Meso curriculum (teachers' experience through their pedagogy in their classrooms) (van den Akker, 2010). This study focuses on these two levels to understand how they relate to each other when implementing an integrated curriculum, and how they may vary in their extent to offer curricular freedom for teachers in their classrooms.

The second factor that presented itself was the inadequate support and training given to teachers who implement an integrated curriculum. Gresnigt et al. (2014); Rohaan and van Keulen (2011) and Wei (2009) note that primary school teachers are usually generalists and teach all subjects. Being generalists leads to an overloaded curriculum and the avoidance of teaching Science due to either limited subject knowledge, inadequate understanding of the skills necessary to teach such a subject, or low self-efficacy on the part of teachers. This suggests that there is a problem with an integrated curriculum as teachers are now required to teach a combination of more than one subject requiring a whole new set of teaching skills and subject knowledge that teachers have no training for (Gresnigt et al., 2014; Rohaan & van Keulen, 2011; Wei, 2009).

The goal of education is to develop curricula that is on par with those of leading countries, and implementation is a key factor in ensuring a successful outcome (Oloruntegbe, 2013). The third factor expounds that teachers experiences directly influence curriculum implementation (Oloruntegbe, 2013). Teachers are often reluctant to implement a new curriculum due to pedagogical impediments such as inadequate training and an overloaded curriculum due to the compression of two subjects, while retaining the vast amounts of content (Oloruntegbe, 2013). As a result, the goal of providing quality education for the child will be a mirage. Additionally, with teachers being generalists within the Intermediate Phase, there is inclination towards their preferred subjects due to lack of proper training and facilitation. Teachers should be informed, trained and involved in the process of curriculum development as it enhances their productivity (Oloruntegbe, 2013). The following section discusses studies that were done on the experiences of teachers when implementing an integrated curriculum both locally and internationally.

2.6 Teachers' experiences in implementing an integrated curriculum

Teachers play a key role in the successful implementation of any learning approach (Comas-Quinn, 2011). Considerably, teacher's pivotal role in the classroom is significantly based on their experiences which could be found in the conceptualisation of learning, teaching

and training by both teachers and the school (Comas-Quinn, 2011). The reason for experiences being placed at the forefront of teaching and learning is owed to the notion that "teachers are active, thinking decision-makers who make instructional choices by drawing on complex, practically-oriented, personalised, and context-sensitive networks of knowledge, thoughts, and beliefs" (Borg, 2003, p. 81). The previous statement suggests the vital nature of teachers experiences in day to day teaching and learning, emphasising the influence that schools' unique contextual factors have on teachers' experiences.

Likewise, Roth and Jornet (2013), note that experience is one of the most commonly used terms in education, and it is recognised as being directly related to learning. Until now, what experience is and how it is related to learning, particularly in an integrated curriculum such as NSTech remains an unexplored area. Experience is a category of thinking, that includes people, their characteristics, material, social environment, and their interactions amongst one another (Roth & Jornet, 2013). Moreover, experience is not simply an encounter that teachers have, rather experience represents connections in, and across space and time with complex interactions between the teacher and their teaching environment (Roth & Jornet, 2013). It is difficult to predict the impact of curriculum change on teachers as they try to change their practice accordingly to suit the needs of the new curriculum (Scholtz et al., 2004). Teachers need more than just to be told what to do. They need support in adapting to innovative curriculum practices so that they can meet the needs of the contexts in which they work (Scholtz et al., 2004).

Teachers' experiences of implementing the curriculum, both locally and internationally, have become a major focus in understanding how an integrated curriculum works. A study in Netherlands show teachers who express a general dislike of an integrated curriculum as it imposes restrictions on the freedom and flexibility upon which topics are taught, and the depth with which subject content is covered (Shankar, 2014). Further, curriculum integration is seen as a challenge for teachers who try to implement it in the classroom as it involves constant changes in how knowledge, teaching strategies and the organisation of assessment practices (Shankar, 2014). Moreover, the school curriculum places increasing pressure on teachers' ability to implement an integrated curriculum which in turn, filters into the way teachers implement the curriculum and the outcome of learning (Fishman et al., 2001). Fishman et al. (2001) argue that curriculum shapes the professional development of teachers and is shaped by the results of professional development. This implies that if teachers acquire proper training to implement an integrated curriculum, it can be imparted and accepted by teachers and learners'

in a positive way. Studies show that teacher experiences are intertwined in the process of curriculum change, thereby affecting the way teachers implement an integrated curriculum. Due to the impact teachers' experiences have on the teaching and learning process, the main focus of this study is to explore NSTech teachers' experiences in implementing an integrated NSTech curriculum within the Intermediate Phase.

Although an integrated curriculum is appropriate for the Intermediate Phase, there is much speculation that it may be problematic as teachers lack sufficient practical guidance to allow them to implement it in their classrooms (Dowden, 2014). Despite teachers' best intentions to implement an integrated curriculum, it is most often insufficient as they are inadequately prepared for its implementation, resulting in lack of organisational skills and understanding when teaching (Dowden, 2014). This may stifle the integrated curriculum model (Dowden, 2007). Arguably, teachers need to be well informed about curriculum integration designs since most teachers lack the practical and personal knowledge to approach a newly integrated curriculum (Jonsdottir, 1995).

Teachers expressed difficulty when attempting to improve their teaching strategies as they have not been trained to improve their content knowledge and skills in an integrated curriculum (Chicgona, 2010). Within South African schools, teachers note the possible benefits from the Department of Education in addressing the lack of professional development and providing solutions to teachers' limited content knowledge, and the development of conducive teaching and learning environments (Chigona, 2010; Stott, 2013). The support offered to teachers above could improve their experiences, and ultimately the implementation of an integrated curriculum such as NSTech. Lake (1994) found that enthusiasm and meaningful experiences were at the forefront of teaching integrated subjects rather than separate subjects, and that teachers with constructive experiences were positive when implementing an integrated curriculum (Lake, 1994).

Despite curriculum integration being part of CAPS, some teachers in South African schools do not consider the option of an integrated curriculum, and still teach subjects separately (Costley, 2015). This research is parallel to research in American schools which notes low levels of integration (Weber, 2008). Teachers teach outside their subject specialisations leaving lessons dominated by non-practical, information-rich lessons. This challenged teachers' pedagogical-content knowledge which ultimately leads to the struggle being more about coping when teaching an integrated subject rather than implementing an integrated curriculum and

allowing for social transformation through integration (Department of Education, 2011; Weber, 2008). Teachers feel threatened when implementing an integrated curriculum as they are inadequately equipped with the pedagogical skills to effectively integrate subjects such as Science and Technology (Chigona, 2010). Teachers display a low morale of teaching when integrating subjects, especially if the school does not cater for the needs of an integrated curriculum, through provision of resources, infrastructure such as laboratories, as well as the development of teachers' expertise (Chigona, 2010).

Despite the apparent diversity and flexibility in decision making regarding curriculum, the integrated curriculum has the same intensity and heightened expectations as the traditional curriculum (Weber, 2008). Present day curriculum demands increased accountability and administrative workload; diversification of subject matter knowledge; subject expertise; and more time due to an increased workload on the part of the teacher (Park, 2008; Weber, 2008). Research has shown that, even the professional development training offered by the school or education district office in the form of workshops, is generic in nature, and covers assessment, safety and changes in policy, practice and planning (Harrell, 2010). This suggests that the workshops do not offer adequate professional development for teachers, nor do they offer guidance on how curriculum integration is to be successfully implemented.

Harell (2010) notes that for an integrated curriculum to be successfully implemented, adequate preparation of teachers is imperative. However, teachers in the Intermediate Phase of schools are assigned to teach subjects that they are not qualified to teach, which further hinders the success of an integrated curriculum (Harrell, 2010). Another constraint is the fact that teachers themselves have not experienced the benefit of learning through an integrated curriculum at school, and universities still offer single subject disciplines to pre-service teachers (Harrell, 2010). A study at a New York university highlights that pre-service teachers indicate inadequate preparation for the implementation of an integrated curriculum, but once they were prepared, became more forthcoming and had a positive attitude towards an integrated curriculum (Zhou & Kim, 2010). Some authors argue that teachers see Science activities as more appealing when they are part of an integrated curriculum rather than discipline-based curriculum (Gresnigt et al., 2014; Rohaan & van Keulen, 2011; Wei, 2009). Park (2008) notes the crucial role of teachers in understanding an integrated curriculum and its correlation to the proper implementation and positive experiences of such a curriculum.

Park (2008) attributes the confusing nature of implementing the newly integrated curriculum to teachers being insufficiently informed of such a curriculum, which leads them to consider it to be a method of teaching, rather than the creation and reconstruction of knowledge in an innovative way (Park, 2008). It is for this reason that teachers were found to be more comfortable when explicit connections between content were given, rather than forcing the process of curriculum integration upon teachers without properly equipping them to teach using this kind of curriculum (Park, 2008). Studies done in Nigerian schools expound that teachers are often involved in curriculum implementation in the classroom but are rarely involved in the development of these reforms (Oloruntegbe, 2013). Teachers are yet to embrace the new methods of classroom teaching, and often show resistance to implementing curriculum reforms since they are seldom involved in the development of newer curriculum (Oloruntegbe, 2013).

Consequently, the role of the teacher is emphasised, pointing out the gap between the curriculum (theory) and its implementation (practice), and further recommending the adoption of grassroots approach to curriculum development involving all stakeholders, including teachers, who will be implementing the curriculum (Oloruntegbe, 2013). This study sought to address the gap that exists in the literature, whose focus is more on general curriculum integration as opposed to the integration of NS and Technology as implemented by Intermediate Phase South African curriculum. This study explores teachers' experiences when implementing an integrated NSTech curriculum in the Intermediate Phase. The following section discusses Bernstein's theory of Classification and Framing within the NSTech curriculum.

2.7 Bernstein's theory of Classification and Framing

Bernstein's (1971) theory of Classification and Framing knowledge within the curriculum is used as a lens to guide this research study. In terms of discourse, this theory demonstrates the relationship between and within the different subject areas, as well as school knowledge and everyday knowledge (Hoadley, 2006). This theory is used to analyse and classify teachers' experiences of implementing an integrated NSTech curriculum, drawing relationships from their experiences. In so doing, this framework is used to understand what teachers' experiences are when implementing an integrated curriculum, and what their previous experiences were in implementing NS and Technology previously as two separate subjects. The framework draws on the relationships that exists between Bernstein's theory and teachers' experiences.

Bernstein's views on symbolic boundaries and the control of knowledge are explored in the context of curriculum integration in the Intermediate Phase of education in three South African schools (Spelt et al., 2009). The use of Bernstein's theory to analyse teacher discourse in an integrated curriculum is supported by Short, Singh, Yarrow and Millwater (2000) who note that the framework is useful, especially when analysing teacher discourse.

2.7.1 Classification and Framing of an Integrated Curriculum

Classification is the strength of boundaries between subjects (Nyambe, 2008). Classification refers to the content, where weak Classification indicates the subject boundaries are weak and not clearly separated (NSTech) and strong Classification refers to strong subject boundaries where the subjects are clearly separated (Natural Science and Technology).

Framing refers to control; and where Framing is strong, control lies within the transmitter (teacher) whereas weak Framing is when control lies with the acquirer (learner) (Nyambe, 2008). In the integrated curriculum, there is minimal boundaries between the subjects, therefore, reference is usually made to other subjects when teaching (Hoadley & Jansen, 2000). Traditional or separate subjects make no reference to other subjects when teaching; and even if a reference can be made, the boundaries are strong (Hoadley & Jansen, 2000).

Framing refers to the pedagogy of teachers and identifies how teachers and learners' pedagogic identities are distinguished (Bernstein, 1996). Framing makes the roles of teaching and learning in an integrated curriculum clear, by identifying whether the learner or teacher controls the content, how the content is organised, how this kind of curriculum is sequenced (specific order and time) and how it is implemented (taught) (Hoadley & Jansen, 2000). A strong frame would therefore, mean that specific content is taught within a specific time and order. Weak Framing results in content being selected and organised according to the learner's development. Framing supports Classification and creates the possibilities for a shift in the boundaries that exist between subjects, discourse and relations (Hoadley, 2006).

2.7.2 Classification and Framing of NSTech

In keeping with an integrated curriculum such as CAPS, Young (1971) elucidates the distinction between Classification and Framing of knowledge. Young (1971) explains that Classification does not solely refer to content, but also to the relationships between the different subjects. Framing refers to the strength of boundaries between what might be transmitted and

what might not be transmitted (Young, 1971). Therefore, Framing may actually refer to the options available to the teacher and the control over what is transmitted and received in the pedagogical relationship between the teacher and the learner. Within the NSTech classroom, a strong frame may place greater control in the hands of the teacher through strong power and knowledge in the classroom. Within NSTech, the Framing is strong as teachers impart the curriculum in a way they are comfortable with. This suggests that teachers may lean towards either NS or Technology, depending on their content knowledge.

Bernstein's 1971 theory highlights the importance of social structure when implementing an integrated curriculum, and notes that curriculum change is imminent depending on the way in which society changes and evolves. In a South African context, CAPS was designed with the intention of bringing about social and political change through the integration of knowledge from different learning areas. This would therefore, mean a weaker implementation of Framing and Classification of knowledge between subjects, hence an integrated NSTech curriculum where the boundaries between the different subjects become vague.

Gultig, Hoadley and Jansen (2002) note that Bernstein's theory of Classification and Framing outlines how curriculum integration might be successful. Curriculum integration must be clear, ideas and content must be clear and systematic, and control over the process must be sensitive to teachers' needs (Gultig et al., 2002). In an attempt to understand teachers' experiences of an integrated NSTech curriculum in the Intermediate Phase, this study carefully considered whether or not the criteria above were being adhered to in South African schools, with specific regard to CAPS, teachers' experiences, and their pedagogic practice in an integrated curriculum.

In this study, Bernstein's (1971) theory serves as a guide for the production and analysis of data. The research opines that for effective curriculum integration to take place, teachers need to have a more informed understanding of what makes up an integrated curriculum, because the teacher must now be able to change their approach from simply imparting information to learners, to one where they analyse information and integrate the new knowledge to the knowledge acquired previously. This necessitates ample preparation from the teacher, which has major implications for teacher development and training. Before teachers assist learners in recognising, realising and moving towards multiple discourses of schooling, they need to be well informed of these discourses themselves (Bernstein, 1996).

The concepts of Bernstein's theory of Classification and Framing provide a useful descriptive analysis of the relevant policy documents and pedagogic practices of teachers, as they capture the key issues, necessitating a broader qualitative analysis. In an attempt to explore teachers' experiences of implementing an integrated NSTech curriculum within the Intermediate Phase, this interpretivist research study pays careful attention to whether the above theory of Classification and Framing was adhered to within the South African context of curriculum design and implementation. Through teachers' experiences, Bernstein's theory of Classification and Framing allows the researcher to understand how strong or weak the implementation of an integrated NSTech curriculum really is. Moreover, it is useful in understanding the professional identities of NSTech teachers and what an integrated code means for these teachers.

2.8 Conclusion

This literature review explored scholarly articles relating to the rationale behind an integrated NSTech curriculum and how a curriculum such as this is implemented. It also explored the factors influencing the implementation of an integrated NSTech curriculum and the experiences of teachers when implementing an integrated curriculum. The focus was not to explore what an integrated curriculum is or how it works. However, the research pointed towards the experiences of teachers who implement an integrated curriculum within a South African context and around the world.

The integral role that teachers play in curriculum integration was emphasised and linked to the success of curriculum integration, and ultimately to the outcome of learning. This chapter noted curriculum reforms that led to the rationale and development of NSTech. It was noted that due to the imminent change in society, integration can be advantageous if properly implemented. Additionally, international and national studies showed that Science and Technology are still being taught as separate subjects in some schools, with teachers implementing information rich and non-practical lessons. Teachers felt overburdened with official and administrative duties, the lack of developmental workshops, little teacher expertise, as well as lack of time and facilities to properly implement an integrated curriculum. More so, concerns of overloaded content, lack of in-service training and overcrowding, all led to low self-efficacy on the part of teachers. The following chapter focuses on the research design and methodology employed in this study examining teachers' experiences when implementing an integrated curriculum in South African classrooms.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter discussed the literature review which explored the experiences of teachers implementing an integrated curriculum, both locally and internationally. The literature extended the rationale behind integrating Natural Science and Technology; implementing an integrated NSTech curriculum within a South African context and internationally; factors that influence the implementation of an integrated curriculum; teachers' experiences in implementing an integrated curriculum; and Bernstein's theory of Classification and Framing within a curriculum. This chapter of the research study explains the scope, relevance and limitations of the methodology used by, firstly focusing on the approach and paradigm. Thereafter, the study presents the location of the research sites, sampling methods, data generation tools and data analysis methods. Later, the concerns of trustworthiness, ethical considerations and limitations to this study are discussed.

The research methodology was necessitated by the need to effectively answer the two critical research questions below:

1. What are teachers' experiences of implementing an integrated Natural Science and Technology curriculum in the Intermediate Phase?

2. What are the factors contributing to teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?

In this qualitative study, data generation strategies as well as analysis techniques were employed with the intention of exploring teachers' experiences when implementing an integrated NSTech curriculum. To achieve this aim, this research study explored primary data in a particular setting. On this presumption, the research is an interpretive study guided within a qualitative research paradigm, whilst taking on and valuing the tenets of case study research. This interpretivist study explored teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase. The researcher explored the complexities of participants' views and experiences by gathering information about their lived experiences (Moustakas, 1994). This qualitative research study, therefore, made use of a case study that aimed to provide a unique example of real people (Intermediate Phase teachers) in real

situations (implementing an integrated NSTech curriculum) enabling a clearer understanding for the reader (Cohen et al., 2007). The qualitative approach to data generation suggests that data was generated within the participants' natural setting and the researcher analysed this data and drew themes from them (Moustakas 1994; Stake 1995).

3.2 An interpretivist paradigm

A research paradigm includes common beliefs shared by researchers regarding how problems are understood and addressed (Lincoln & Guba, 1985). This view is a specific way of exploring and understanding the world and shapes how one seeks answers to the research questions in a study. Consequently, a research paradigm is mainly characterised by its ontological and epistemological philosophies (Lincoln & Guba, 1985). Ontology is concerned with teachers' experiences and notes that reality is subjective with multiple experiences as seen by participants of the study (Lincoln & Guba, 1988). This research study included participants exact quotes thereby showing multiple experiences. Epistemology on the other hand is the process of uncovering knowledge about experiences and learning about it, in order to create a world view (Denzin & Lincoln, 2005). Being an insider to the research study, the researcher makes sense of the situation by spending increased amounts of time in the field (Lincoln & Guba, 1988). In this study, epistemology is, therefore, the researchers view of teachers' experiences based on what was learned.

Qualitative research allowed the researcher to interpret what was seen, heard or understood as these interpretations cannot be separated from the researcher's own context, background and understandings. Denzin and Lincoln (2005), echoing Creswell (2007), explain that a qualitative approach at this level, is situated research that is interpretive in nature, which seeks to locate the observer in the world. These interpretations continue well after the research report is completed, leaving the readers and participants to create other interpretations of the study, depicting how multiple views of the problem can surface.

A central aim of the interpretive paradigm was therefore, to understand from within, the subjective world of human experience through the small-scale study of the individual (Cohen et al., 2007). In this study, the interpretive paradigm is used as a lens to understand the experience of Intermediate Phase teachers who implemented an integrated NSTech curriculum.

3.3 A qualitative approach

In the world of research approaches, one scholar explains that a qualitative approach to research can be understood as

> …an intricate fabric composed of minute threads, many colours, different textures, and various blends of material. This fabric is not explained easily or simply. Like the loom on which fabric is woven, general worldviews and perspectives hold qualitative research together (Creswell, 2007, p. 51).

The qualitative field comprises many different individuals, including the researcher and participants who have different perspectives and are on their own looms, creating the fabric with their lived experiences under the lens of qualitative research. This qualitative study was shaped by participants' world views which held the threads of this study together and allowed an in-depth and holistic understanding of the central phenomenon of teachers' experiences when implementing an integrated NSTech curriculum.

Qualitative researchers study events and individuals in their natural settings, in an attempt to interpret the phenomena in relation to the ascribed meanings people bring to them (Denzin & Lincoln, 2005). This study utilised a qualitative approach to the research, with the data being gathered in participants' natural setting whilst ensuring sensitivity to the research sites and the participants under study (Denzin & Lincoln, 2005). Researcher reflexivity includes reflection on the researchers' personal experience of the fieldwork (Lincoln & Guba, 1988). A case study is a result of the interaction between the researcher and the research site, and this interaction is rooted in the researchers' character and their experiences (Lincoln & Guba, 1988). The researcher has an obligation to explore, question, challenge, critically reflect and correct themselves (Lincoln & Guba 1988; Yin, 2011). Any case study should, therefore, reflect these deeply personal processes on the part of the researcher. This research report included the voices of participants through the use of direct quotations. A thorough description and clarification of the problem, together with the literature, put forward a call for action (Tobin & Begley, 2004).

In keeping with the standpoints of qualitative research, this study explored the experiences of six Intermediate Phase teachers who implemented an integrated NSTech curriculum. The study viewed teachers' experiences as the central phenomenon which necessitated in-depth

understanding and exploration of implementing an integrated NSTech curriculum. This interpretive, qualitative case study included the purpose statement which focused on the phenomenon being researched, the critical research questions which the study sought to answer, and literature which supported and refuted the research.

In this study, the researcher acquired multiple sources of data through instruments such as semi-structured questionnaires and semi-structured interviews (Lincoln & Guba, 1985; Merriam, 1988). Once data was generated, the analysis commenced, in which the researcher analysed participants spoken words form the interview transcripts. In keeping with qualitative research, participants were asked a series of questions which allowed for their individual responses (Tobin & Begley, 2004). From a methodological standpoint, the research study made use of inductive data analysis by building patterns between themes which emerged and were shaped from the generation and analysis of the data (Lincoln & Guba, 1985; Marshall & Rossman, 2006). Once the analysis of data was complete, the report on the findings of the study with recommendations for future and further research was developed.

This qualitative study used supporting literature to locate the context of the study, and Bernstein's theory of Classification and Framing was used as a theoretical lens for the study.

3.4 Case study design

As defined by Stake (1995), case studies are unique examples of 'real people in real situations' (p. 272). A case study consists of an in-depth inquiry into a specific and complex phenomenon (the case), set within its real-world context (Merriam, 1988; Yin, 2013). This research study employed a case study design as it embraced a real-world context which includes an in-depth exploration of Intermediate Phase teachers' experiences of implementing an integrated NSTech curriculum. This case study is suggestive of the interpretive paradigm of research as it produces an in-depth description of a single situation. To provide this in-depth understanding, case studies necessitates only a few cases be studied, to give time to exploring the depths of a single case (Adelman, Kemmis & Jenkins, 1980; Robson, 2002; Stake, 1995).

Case studies are products of the interaction between the research site and researcher (Lincoln & Guba, 1988). The present case study is anchored in real life experiences of Intermediate Phase teachers as they implement an integrated NSTech curriculum, allowing the reader to see the situation through the eyes of the participants. Further, one of the strengths of using case studies, as seen in this research study, is that, they allow for the use of interviews

and questionnaires in order to provide a rich, holistic description of the phenomenon; which is the experiences of Intermediate Phase NSTech teachers who implement an integrated curriculum. In a systematic and rigorous manner, this case study attempts to portray an in-depth analysis of the data, generated through thick description rather than generalisations, thereby allowing for wholeness and integrity of the study (Yin, 2013). The boundaries of this case study are confined to three primary schools located in KwaZulu-Natal. Although this case study is not generalisable, it may provide an insight into similar situations thereby assisting with interpretation of these situations (Adelman et al., 1980; Stake, 1995). As with this research study, hallmarks of case studies are that they encompass rich descriptions, with particular focus on understanding individuals' experiences of events to portray the depth of the case (Hitchcock & Hughes, 1995).

3.5 Location of the study and research sites

The boundaries of data generation were located within three primary schools in the North of Kwa-Zulu Natal, in the areas known as Groutville (School A), Tongaat (School B) and Phoenix (School C). These schools were chosen because they offered an integrated Natural Science and Technology (NSTech) curriculum.

The maps (Figure 3.1 and Figure 3.2) highlight the province Kwa Zulu-Natal in South Africa and the towns in which the three different schools are located. Figure 3.1 locates South Africa at the southernmost tip of the African continent and shows the location of KwaZulu-Natal, a coastal province within the country of South Africa. Figure 3.2 on the following page, locates the towns in which the three schools are located, Groutville, Tongaat and Phoenix. The three research sites are located within South Africa's largest city, Durban. It comprises of mixed population groups and approximately 577 schools in the Durban area.

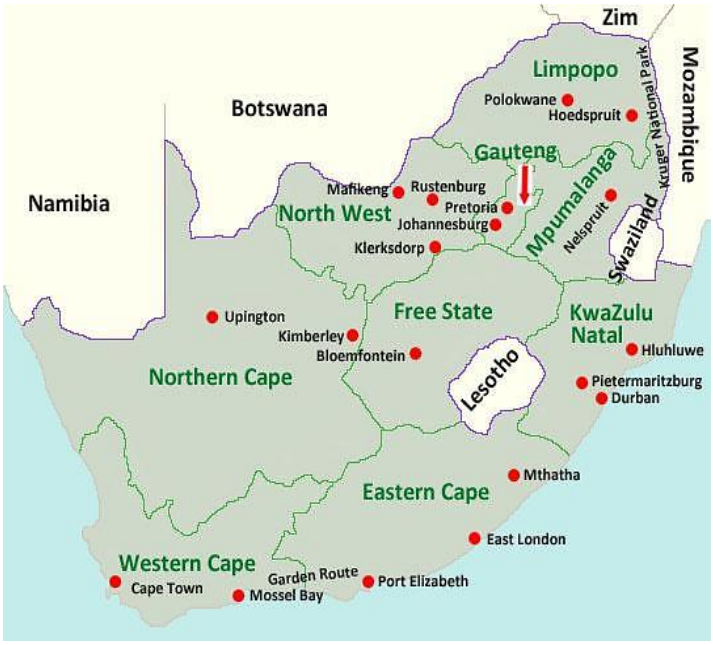

Figure 3.1: Map of South Africa locating the Kwa Zulu-Natal province

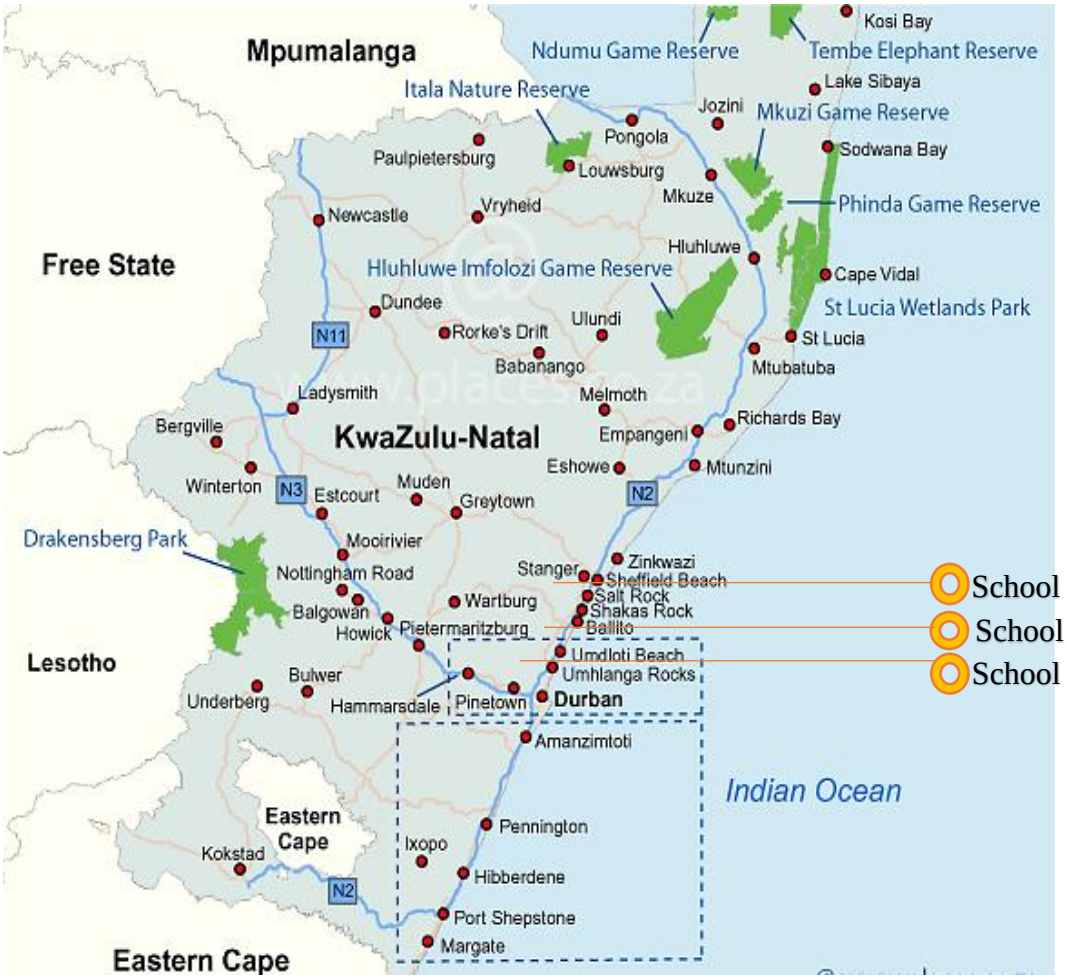

Figure 3.2: Map locating the research sites in KwaZulu-Natal, South Africa

(represents location of schools)

Each of the three schools had an approximate enrolment of 1200 learners and between 30 and 40 teachers. School A is an unconventional building that was established over a century ago. It has only essential furniture in the classrooms such as a chalkboard, desks and chairs. There is no Science or Technology lab. However, there are specialist NSTech teachers and equipment to conduct NSTech lessons is available. With less than 20 classrooms, space poses the biggest problem for teaching and learning.

School B is a semi-resourced school with adequate infrastructure and classrooms. School B is 33 years old and has recently accommodated a neighbouring school in the area by combining the learner population of both schools. The school provides teachers with the equipment to teach NSTech, and a specialised laboratory for conducting these lessons.

School C is a well-resourced school with a host of amenities as well as a Science laboratory and adequate equipment and qualified NSTech teachers for the facilitation of NSTech lessons. The Science laboratory, however, is not used for teaching Science lessons but rather as a classroom to accommodate the large number of learners at the school.

Figure 3.3 on the following page, was included as part of the Annual Performance Plan (2015), shows the statistics of schools' educators and learners in public schools in KwaZulu-Natal. The Annual Performance Plan (2015) is a strategic improvement plan put in place by the KwaZulu-Natal Department of Basic Education for the period of 2015/16 to 2019/20. The figure notes that the iLembe and Pinetown district consists of approximately 40 schools each, with the Pinetown district having almost double the number of teachers and leaners when compared to iLembe district.

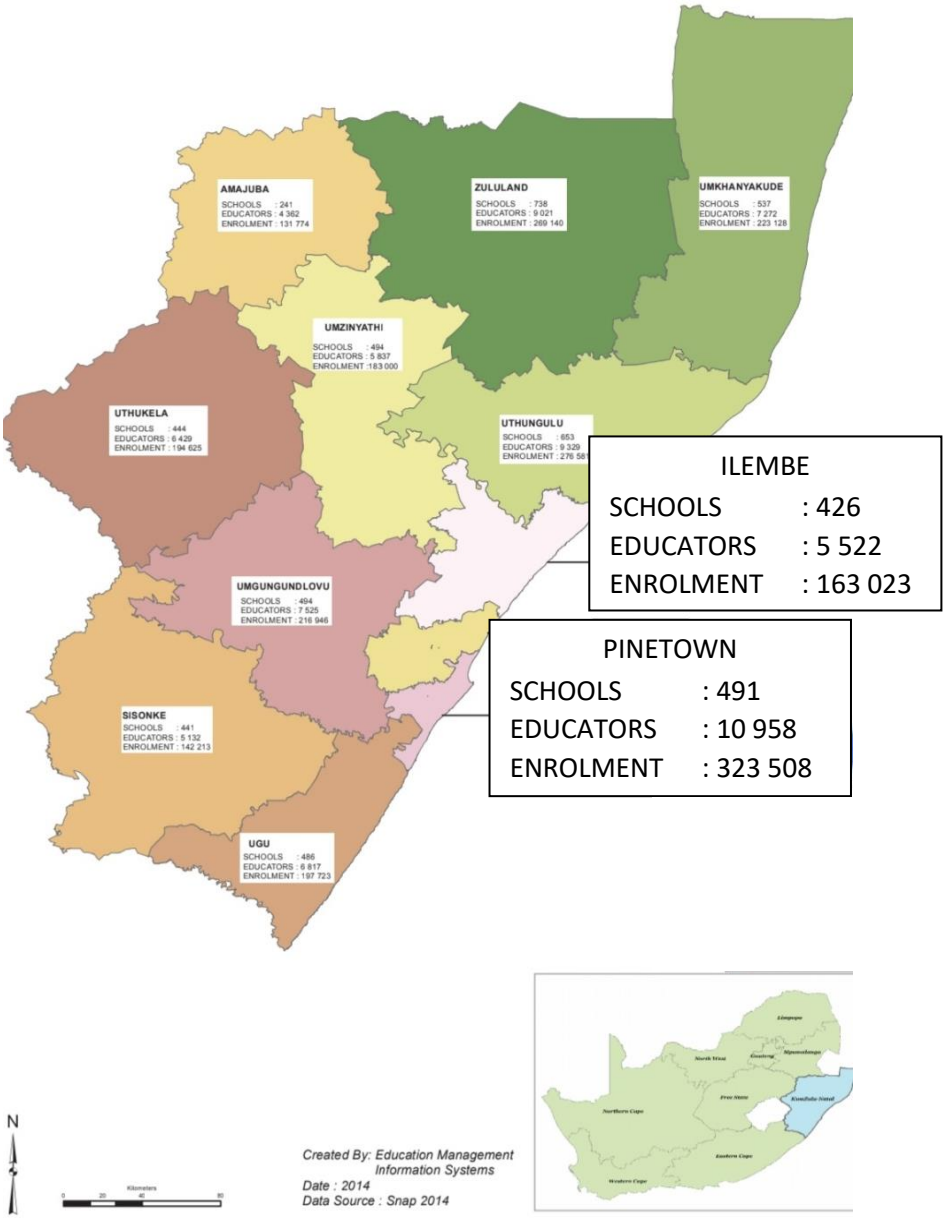

Figure 3.3: Statistics on schools' educators and learners: Public ordinary schools. (Department of Education, 2015)

3.6 Sampling

Sampling defines a selection from the population on which the research will focus (Patton, 1990; Yin, 2011). The sampling strategy considered the purpose and time constraints of the research study, the data generation methods, as well as the research methodology. The sampling strategy was governed by the criterion of 'fitness for purpose' which means the suitability and choice of the participant in relation to the phenomenon of the study was considered (Cohen et al., 2007, p. 136). The sample size for this study consisted of six Intermediate Phase NSTech teachers. The six participants constituted 2 teachers from each of

the three schools. The sample size was small, in keeping with qualitative research. This ensured greater reliability and accuracy through the ability to generate in-depth, rich data. Access to the sample population was obtained through informed consent from the participants and approval from the relevant gatekeepers of the three schools and the university. In this case, participants and sites were intentionally selected to learn about and further understand the study's central phenomenon (Patton, 1990).

In keeping with a qualitative case study, the strategy employed for this study was purposive sampling, as the researcher deliberately selected the participants to include in the sample, with full-knowledge that it would not represent the wider population, but simply represents itself. The sampling method was in keeping with small scale case study research where there is no attempt made to generalise the results of the research study (Patton, 1990; 2002). Purposive sampling was used in this study to 'access knowledgeable people', in this case, Intermediate Phase teachers who have in depth knowledge and experience with the implementation of implementing an integrated NSTech curriculum (Cohen et al., 2007, p. 134).

Additionally, participants were selected according to the following criteria: firstly, they had to be teachers who are currently teaching NSTech as integrated subject; secondly, the teachers would have taught either Natural Science or Technology prior to CAPS when these were treated as two separate subjects, and lastly, they should have taught for more than a period of five years. The following table presents the background of the six participants in order to link the participants with the data they provided and offer an insight into their lives and experiences.

Table 3.1: Biographical details of participants

Participants names (pseudonyms)	Gender	Current Grade teaching NSTech	Age group	Home language	Post	Qualification	Years of teaching experience	Years of experience teaching NSTech
1. Gwen	Female	4	30-39	Isizulu	Level 1	Diploma / *ACE	8	4
2. Simon	Male	5	40-49	Isizulu	HOD	ABET / NPDE	23	5
3. Monica	Female	5	50-59	English	Level 1	SPED / BA Degree	33	6
4. Kerri	Female	4-6	20-29	English	Level 1	B.Ed Degree	4	4
5. Ivy	Female	6	40-49	English	Level 1	B. Ed Honours	12	5
6. Nancy	Female	4-5	40-49	English	Level 1	M+4	19	3

Table 3.1 provides critical aspects relating to the biographies of participants. With the exception of Kerri and Gwen, most participants were senior teachers and had a number of years of teaching experience. Aside from Simon, who was an HOD, all other participants held level 1 teaching posts. Furthermore, the gender of the participants did not pose a problem in the selection criteria as there was a combination of male and female participants. All participants were Intermediate Phase NSTech teachers with a range of qualifications. Although Gwen and Simon indicated that Isizulu was their home language, the language of instruction for NSTech in the Intermediate Phase of all three schools was English. These biographies were drawn from the data generated. Data generation methods are discussed further in the section below.

3.7 Data generation

Face to face semi-structured interviews using open ended questions were employed in this study (Baxter & Jack, 2008). Additionally, a semi-structured questionnaire with open and closed ended questions was also used to gather data. This allowed participants to solicit and interpret information freely (Yin, 2011). The semi-structured interviews and questionnaires were used to gain knowledge, values, preferences, attitudes and beliefs about NSTech as an integrated subject (Creswell, 2009). In addition, the questionnaire was used to generate biographical data of the participants, which supported and added value to the data generated from the semi-structured interviews. With full consent from participants, qualitative audio material, such as a tape recorder, was used as a way of enhancing the instruments for data generation methods above.

The data was then analysed according to the transcripts from the semi-structured interviews and semi-structured questionnaires as well as audio recordings from the interviews. These methods with all their advantages, including an in-depth understanding of the phenomenon, were carefully aligned to qualitative research (Patton, 2002; Yin, 2011). The instruments for data generation were used as a means for gathering information, having a direct connection to the research objectives and providing the implications of the research thereof. The semi-structured interviews further assisted the researcher to delve deeper and gather information and validate data obtained from the semi-structured questionnaire.

3.7.1 Semi-structured questionnaires

This study made use of semi-structured questionnaires which were administered by the researcher. This allowed the researcher to be present throughout the process and permitted

uncertainties and queries to be addressed immediately without placing undue pressure on participants in any way. Due to the exploratory nature of the study, the semi-structured questionnaire included both open and closed ended questions which allowed participants to respond freely.

Semi-structured questionnaires by their very nature, are an intrusion into the lives of the participants (Cohen et al., 2007). However, in this study, the participants were furnished with an informed consent letter to indicate their acceptance and willingness to participate in this study, guaranteeing them their anonymity and confidentiality. The letter of informed consent ensured participants were knowledgeable of the intentions of the research study and allowed participants to withdraw from the study at any given time. A covering letter for the semi-structured questionnaire indicated to participants, the aim and importance of the study, and ensured confidentiality through data generation. Participants were informed about the purpose of the study and its contribution to the body of knowledge, the potential and beneficence the research had in understanding their current situation, as well as the guarantee that the study ascertained non-maleficence since it did not pose harm to the participants. The avoidance of bias in the semi-structured questionnaire addressed issues of reliability and trustworthiness of the data generation instruments. Technical and ethical issues were addressed through methodological rigour, which is discussed at a later point (Tobin & Begley, 2004).

3.7.2 Semi-structured interviews

Interviews are a flexible tool in generating data, and an exchange of views between the researcher and the participant on a topic of common interest (Cohen et al., 2007). One-on-one semi-structured interviews allowed the use of various sensory channels; verbal, non-verbal, spoken and auditory. Additionally, the nature of the semi-structured questions allowed the researcher to probe for complete responses from participants about complex issues, making it a powerful instrument for researcher (Kothari, 2004). The researcher was cognisant of time, ensuring the interviews were scheduled at the participants' convenience without imposing upon them. Researcher bias was avoided when conducting the interviews by encouraging participants' subjectivity in their responses.

Qualitative research seeks depth, as qualitative researchers are relatively close to their participants and the research sites resulting from the time spent at the research sites (Pandey & Patnaik, 2014). The researcher had previously taught at one of the schools where

the research took place and is currently teaching at one of the other schools involved in the research study. Due to the researcher being an insider to the study and displaying familiarity of the research setting and participants of the study, the researcher was sure to take on a neutral role when conducting the research (Dwyer & Buckle, 2009). The researcher ensured openness, authenticity, honesty and commitment to accurately represent participants' experiences through the use of spoken words when analysing the data (Dwyer & Buckle, 2009). The objective nature of the researcher did not result in participants' responses not being influenced in any way.

The questions for the semi-structured interviews were open-ended and developed in advance, in a predetermined order, and were the same for all participants, which allowed for increasing comparability as the study progressed. There was, however, minimal flexibility for participants to relate to the interview as the wording of questions were standardised and therefore, limited the relevance and naturalness of questions and responses. Nonetheless, a key feature of qualitative study was seen where participants were able to voice their experiences, unconstrained by past findings or any perspectives of the researcher, further adding to the subjective nature of the research study (Dwyer & Buckle, 2009). Questions used in the semi-structured interview catered for in-depth responsive and subjective explanations whilst capturing uniqueness, particularly valuing quality and individuality of the participants' responses.

The purpose of the study, which sought to gain an understanding of Intermediate Phase teachers experiences when implementing an integrated NSTech curriculum, determined the structure of the interview. The interview process enabled participants to respond freely and have openness, richness and originality in their experiences. Further, the semi-structured interviews were audio recorded for access in the transcription stage of the data analysis process.

Ethical issues pertaining to the semi-structured interviews were addressed through the provision of a typed, informed consent letter that was provided for each participant, by the researcher. Additionally, informed consent assured participants that they would not be harmed in any way. The assurance of confidentiality and anonymity was attained through the use of pseudonyms in place of participants' names and the fact that the data obtained could not be generalised to other populations other than those that formed part of the sample population. In this study, the interview covering letter stated the exploratory nature, the aim and the consequence, as well as possible beneficence of the research to the relevant stakeholders.

The semi-structured interviews were conducted at participants' own working environments and, in this way, catered for a non-stressful and relaxed environment for the interview process. The interview recordings, as well as the transcripts, would be kept in a secure location for a period of no longer than five years before they are discarded responsibly. These records were accessible by the supervisor and participants throughout the study. Once the research study is completed, participants will be furnished with a copy of the completed report. The process used to analyse data is presented in the table below and will be discussed further in the following section.

3.8 Data analysis

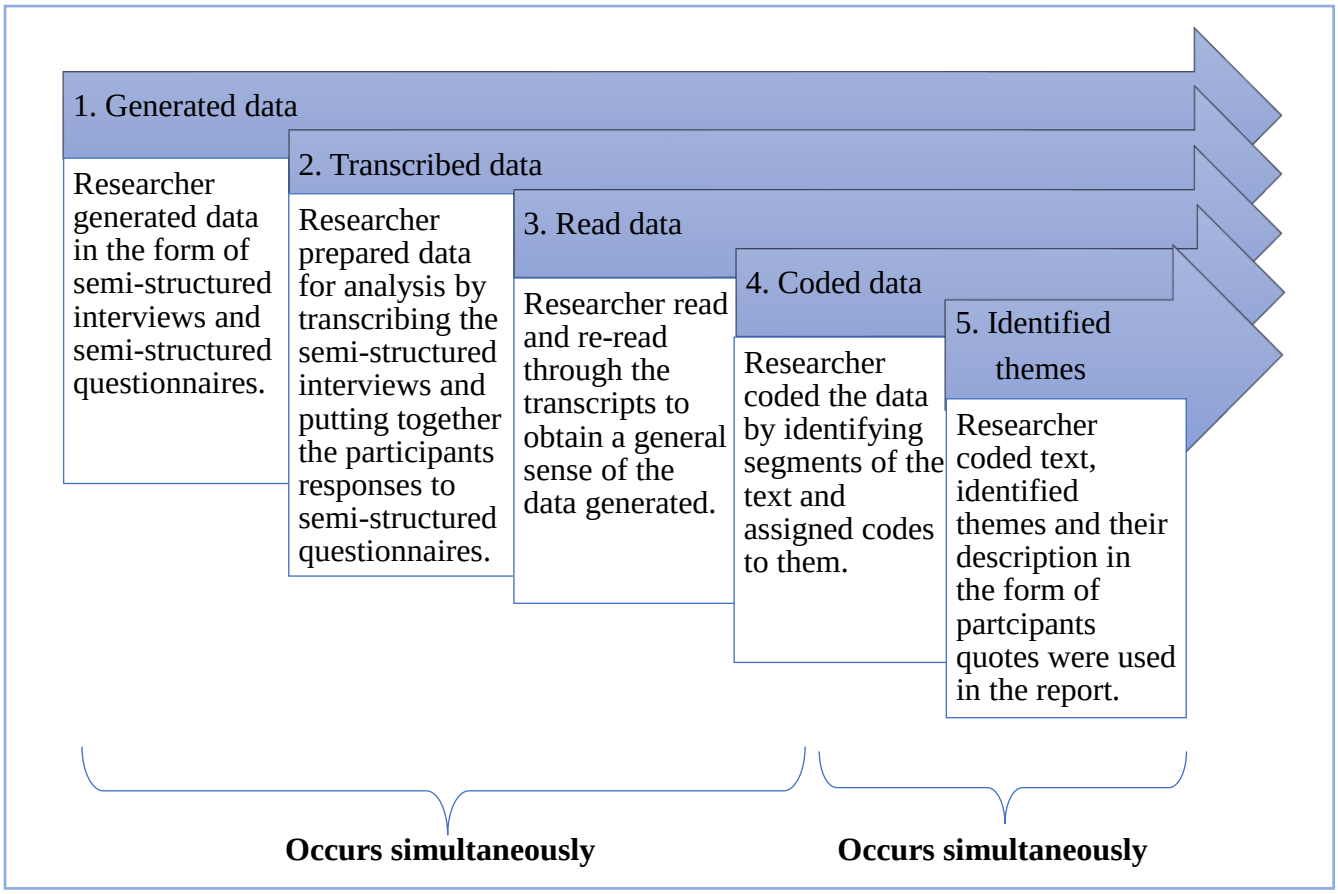

Figure 4.1: The qualitative process of data analysis (adapted from Creswell, 2012)

Qualitative data analysis necessitates making sense of participants' views and experiences of the situation by indicating 'patterns, themes, categories and regularities' (Cohen et al., 2007, p. 480). Qualitative data is inductive as it moves from detailed data (interviews) to the general codes and themes (transcriptions) (Creswell, 2012). The qualitative process of data analysis in figure 4.1, provides a detailed description of the data analysis

process that took place in this study. Data was generated, transcribed, read, coded and themes identified. The phase of qualitative data analysis is a simultaneous back and forth, iterative process of analysis, while the researcher generates data (Baxter & Jack, 2008). It is important to note that the first four steps were done simultaneously and thereafter, the fourth and fifth steps were performed simultaneously. The researcher saw the need to retain the original data by using participants' verbatim quotes. This ensured richness, detail and quality of the data (Rolfe, 2006).

Transcription of interviews involved a process of converting the audiotaped recordings into detailed text data under each of the research questions (Creswell, 2012). Qualitative data analysis subsequently involved reading the transcriptions several times whist carrying out an analysis at each stage of reading (Baxter & Jack, 2008). Each time transcripts were read, it developed a deeper understanding about the information supplied by the participants. Once transcribed verbatim, the transcripts were analysed by coding through the ascription of a category label to selected pieces of data. Thereafter, the researcher categorised data into interrelated themes which was used to find patterns and draw conclusions. Creswell (2014) notes that the above step is key in the process of qualitative data analysis. Subjectivity on the part of the researcher was assured through data reduction, which involved elimination of the researchers' interpretations and placed emphasis on the unique experiences of the teachers who were interviewed, in an attempt to fully understand what the participant was saying.

Qualitative research is interpretive research, which requires making a personal assessment or description that fits the situation or themes and capture the findings (Lincoln and Guba, 1985). This means that the researcher brought their own perspective according to their interpretation of the findings. This was in keeping with qualitative research as it did not allow for the study to be generalised to other research settings or participants. Because qualitative research emphasises that researchers' views cannot be separated from their interpretations, in this qualitative study the researcher viewed the research findings collectively and objectively, to gain a larger meaning about the teachers' experiences in comparison to reviewed literature.

Data was further analysed according to Bernstein's (1971) theory of Classification and Framing knowledge within a curriculum as part of the theoretical framework. The components of the theoretical framework were used as a lens under which the findings were interpreted. Lastly, this study put forward the implications of the results for the population studied or for future research.

3.9 Trustworthiness

This interpretive, qualitative study incorporated validity, reliability and rigor into the research (Yin, 2011). Validity is a strength of qualitative research and ensures findings are accurate from the standpoint of the researcher, the participant and reader (Rolfe, 2006). Participants were provided with information pertaining to the aims and nature of the study as was appropriate. However, it was important for the researcher not to disclose further information on the study that would prejudice the results (Lincoln & Guba, 1985). In qualitative methodologies, reliability refers to real life situations and in-depth responses (Tobin & Begley, 2004). In this qualitative study, reliability is replaced with the following terms: dependability, transferability, credibility and conformability (Lincoln & Guba, 1985).

Credibility can be observed in the focus of the research. The research addressed the focus and phenomenon that was set out by capturing the multiple realities of the participants under study. Credibility was further ascertained through methodological triangulation where the study made use of multiple tools for the generating data in the form of semi-structured interviews and semi-structured questionnaires. Qualitative studies triangulate amongst various data sources to ensure accuracy of the research study in the form of methodological rigor. By definition, triangulation involves corroboration of data from the different individuals, the instruments or methods of data, by attempting to fully explain the complexities of participants' behaviour through studying it from multiple standpoints (Yin, 2011). Triangulation assists the researcher to generate reliable data. Methodological triangulation addressed the issue of validity in this study and enhanced trustworthiness of the research study through multiple data generation tools, namely semi-structured interviews and semi-structured questionnaires (Creswell & Miller, 2000; Glaser 1996). Credibility for this study was heightened using audio-recording during interviews (Bertram & Christiansen, 2014). This ensured the accuracy of transcriptions as opposed to the researcher merely writing down notes. With participants consent, the semi-structured interviews were audio recorded to enhance the data generation process and ensure that the findings were credible.

A case study design enhanced the depth of qualitative data from the six participants. Participants were also allowed to verify responses to questions and would be furnished with a copy of the final report with the hope that the research may be beneficial to the participant and the school. Furthermore, the researcher explored each information source to support a theme.

Accuracy of the findings was established as the data drew on multiple sources of information, individuals, and processes (Rolfe, 2006).

Dependability ensured reliability through methodological triangulation, as findings using the same research methods, could be replicated if research was repeated in the same contexts using the same participants. This allowed for transferability and consistency in the findings. Semi-structured interviews, using open ended questions, allowed for reliability in the data generation process of this study. Generalisation of the study was not applicable, implying that the findings of the research study could not be generalised to a wider population other than the teachers being studied. Addressing the issue of generalisibility above, allowed for external validity.

Subjectivity was ensured through the researchers' ability to remain neutral and avoid researcher bias. The researcher taught at one of the schools where research was conducted and has also taught at the other schools that formed part of the study. The researcher was, therefore, careful to remain objective throughout the study and not let their position influence the findings of the study. Confirmability was ensured through the selection of all participants using the same criteria thereby allowing for neutrality. Moreover, the terminology used in the study was explained, which enhanced understanding and eliminated any misconceptions or ambiguity. The afore-mentioned confirmability further enhanced the overall quality of data generation and ensured reliability by indicating that the researcher's approach boasted consistency of the research study (Yin, 2011).

3.10 Ethical considerations

The ethical considerations pervaded the process of research. Gatekeepers are individuals at research sites who provide access to the site and permit a qualitative research study to be undertaken (Morrison, 2006). Informed consent was achieved through the approval and acceptance from the University's research department to conduct the research study. Thereafter, permission and approval were sought and granted from the Department of Education and the principals of the three schools where research was conducted. The approval to conduct the research study allowed the researcher to gain access to participants of the study through informed consent in the form of a written letter. Consent from participants and the research sites duly prepared the researcher for the next stage of the research study which was the generation of data once permission from the University and the Department of Education was granted.

The participants were provided with a formal letter of intent and informed consent by the researcher. Informed consent declared participants' willingness to participate and assured them of confidentiality. Assurance of confidentiality suggested that, though the researcher was able to identify participants from the information given, they would in no way, make the relationship known publicly, thereby protecting the boundaries surrounding the information generated (Morrison, 2006). Participants were furnished with informed consent letters in which they chose whether to participate in the study once they were informed of the facts that were likely to influence their decisions. Participants were duly informed of their competence for the study, their voluntarism to participate in the study, and the risks involved. Additionally, participants were fully informed about the study in order to comprehend the situation they were putting themselves into.

In considering the afore-mentioned aspects, the researcher ensured that participants rights were carefully and appropriately considered (Cohen et al., 2007). This was achieved through guarantees of anonymity and confidentiality by using pseudonyms for the names of participants. Disassociation of names during the data generation and analysis ensured anonymity of participants and research sites. Dissemination of findings will be negotiated with relative openness, sensitivity, honesty and accuracy (Hitchcock & Hughes, 1989).

In keeping with qualitative research, trustworthiness was ensured through the use of multiple sources of data and the thick description when analysing data (Shenton, 2004). Furthermore, the findings would not be generalised to a wider population as they only represented the population being sampled. Beneficence is a result of non-maleficence (Cohen et al., 2007). Non-maleficence protects the values held by society and was carefully adhered to as the study allowed the pursuit of 'truth and knowledge' ensuring no harm or indignity was posed to participants and research sites. Participants were not undermined, betrayed, treated unfairly, and their privacy not invaded.

3.11 Limitations of the study

Gatekeepers' access is of vital importance in a research study as the researcher requires permission from the participants and relevant authorities of the institutions where the research will take place (Marshall & Rossman, 2006). Obtaining gatekeepers' access required additional time for approval to be granted. To counter the malfunctioning of the recording device, an additional device was carried to the interviews, to ensure the process was a smooth one. It was

time consuming to find participants who met the needs of the sampling criteria as participants had to possess all specific attributes in line with the criteria mentioned in purposive sampling.

It was problematic to interview participants from the second and third school as this required time away from work, and the appointments with participants had to suit the schools schedule. Since the researcher had taught at both schools, this could possibly have shaped the interpretations of the data and posed as an ethical issue. To address the issue of subjectivity, the researcher avoided bias when generating and analysing the data. Moreover, reflexivity was ensured by the researchers' ability to reflect on their role in the study without advancing researcher bias. Furthermore, researcher was unambiguous and explicit about how their experiences could have possibly shaped their interpretations.

This study compared an integrated curriculum in the three schools, which is difficult not to generalise certain aspects of the research if needed. However, generalisation in qualitative research is a term that is used in a rather limited sense, since the intent of qualitative inquiry is not to generalise findings to individuals, sites, or places outside of those under study (Yin, 2003).

3.12 Conclusion

This chapter discussed the suitability of the research methodology and design that was utilised in this study. The characteristics of an interpretive, qualitative case study, data generation tools and strategies were explored. Further, the sampling strategy, and ethical issues that this study adhered to, and limitations of the study concluded this chapter. The subsequent chapter explores Intermediate Phase teachers' responses with particular focus on their experiences when implementing an integrated NSTech curriculum. Chapter four forms the core of the study as it analyses and presents the discussion of findings for the study.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 Introduction

In the previous chapter, focus was on the research design and methodology used in this study. This chapter focuses on the presentation and analysis of qualitative data gathered using semi-structured interviews and semi-structured questionnaires, which explored the experiences of six Intermediate Phase teachers implementing an integrated NSTech curriculum. This chapter unfolds by presenting biographical data obtained from the semi-structured questionnaires of the participants, as well as the introductory questions from their semi-structured interviews. The presentation of biographical data shed light on the participants' uniqueness and similarities with particular focus on their professional qualifications and experiences as NSTech teachers. The presentation and analysis of the results obtained from the research study follows the presentation of biographical data of participants.

Data generated through the semi-structured interviews was transcribed and subjected to rigorous thematic analysis to assist in finding common themes across the data. Thematic analysis of data assured insight and trustworthiness of the findings (Nowell, Norris, White & Moules, 2017). Thematic analysis is seen as the translator of qualitative research, and is a method that was used to analyse, organise, and describe the themes found within the data (Braun & Clark, 2006). Themes emerged through coding and Classification of the data, which highlighted participants' views and experiences as accurately as possible. Additionally, the researcher included direct quotations, in italics, from the data generated in the semi-structured interviews, to capture the findings obtained from participants spoken words. The sections below discuss the experiences of Intermediate Phase teachers as they implemented an integrated NSTech curriculum. The discussions depicted how they dealt with their experiences in the classroom and showed the impact that their experiences had on their pedagogy.

The findings presented in this chapter responded to the research questions:

1. What are teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?
2. What are the factors contributing to teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?

Being a teacher at one of the three schools and having previously taught at another one of the schools, the researcher was cognisant of participants' academic and professional backgrounds; the qualifications they held, their school and classroom situations, their home language and language of instruction, and the number of years of experience teaching NSTech. For this study, two participants from each school were chosen in terms of the specific criteria mentioned in the sampling strategies in chapter three. This study specifically focused on teachers who were teaching NSTech in the Intermediate Phase, as they were able to provide rich data as required by the researcher.

In this section, the terms 'participants' and 'teachers' are used interchangeably to describe the six NSTech teachers who participated in the study. The subsequent information is intentionally highlighted for the purposes of this chapter. Importantly, pseudonyms were used in place of participants' names, in order to protect their identity and ensure anonymity. The selected teachers differed in their teaching experience in terms of the number of years teaching. Teachers varied from seasoned to novice in terms of their experience; with Monica, Simon and Nancy being more senior teachers, whilst Gwen, Kerri and Ivy were newly appointed teachers. Similarities were also drawn from the fact that all participants taught NSTech between three and six years due to NSTech only having been implemented since the inception of CAPS in 2012. The teachers also differed in their educational background which manifested in their ability to teach a subject like NSTech. The more senior teachers taught NS and Technology in the OBE and RNCS curriculum when these were separate subjects. With the implementation of CAPS, the senior teachers were required to homogenise their teaching, accommodating the integration of NS and Technology into NSTech. Despite the differences in school environments, teaching experience and educational backgrounds, all the participants were teaching NSTech using the integrated approach, as stipulated in the CAPS document, and recommended by the Department of Basic Education.

The subsequent section depicts the personal responses and opinions of the six teachers who were interviewed. Teachers responses highlighted their own experiences in implementing the integrated approach to teaching NSTech using the present CAPS curriculum. Teachers' responses further reported on the effectiveness of their teaching methods and the reasons behind these experiences. There was a multiplicity of experiences emerging from the data, which are discussed under the first research question: What are teachers' experience of implementing an integrated NSTech curriculum in the Intermediate Phase?

4.2 A multiplicity of experiences when implementing the NSTech curriculum

From participants' responses, it was clear that a multiplicity of experiences existed when teachers implemented the NSTech curriculum. Numerous situations arose on the part of the teachers and the learners which came to light in participants' responses, put forward as themes in figure 4.2 below. The following themes emerged: inclination towards their preferred subject; A disjuncture in teaching NSTech as a combined subject, A lack of support and training from pre-service to in-service, intricacies of teaching NSTech in large under resourced classrooms, and 'working against the clock'. Lastly the subthemes led to a vision for the future of teaching NSTech as an integrated subject. The themes are further explored and explained as this chapter progresses.

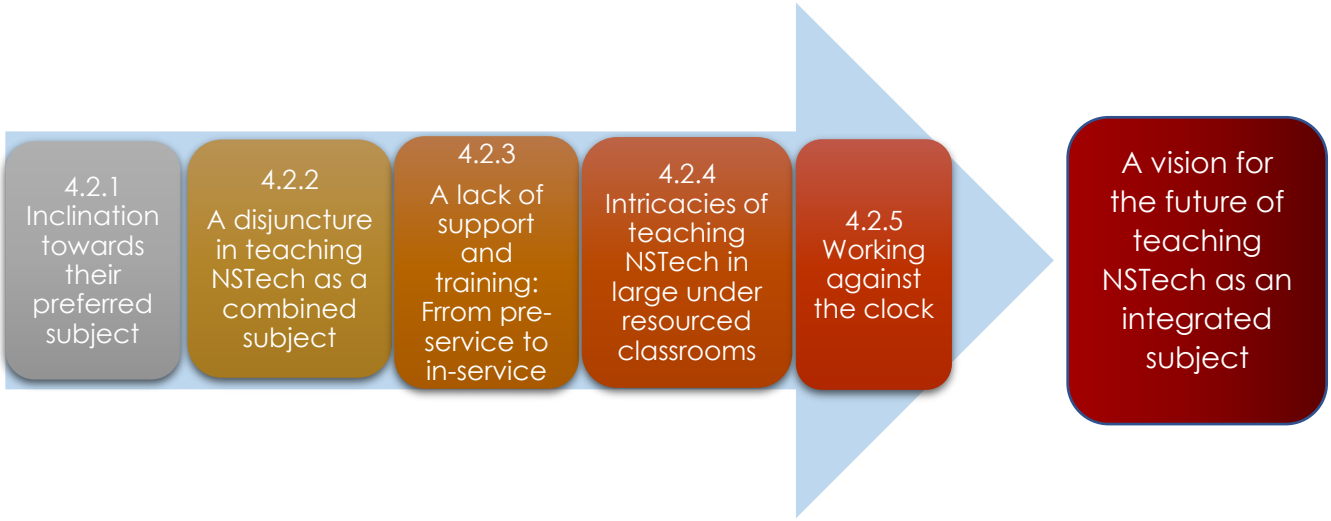

Figure 4.2: Emerging themes from the data generated

4.2.1 Inclination towards their preferred subject

Through the analysis of teachers' experiences when implementing an NSTech curriculum, it was evident that most NSTech teachers found themselves inclined towards the subject they were most familiar with. This meant that teachers either leaned more towards Natural Science or Technology when teaching NSTech. Simon and Gwen revealed that they preferred teaching the part of NSTech that advanced Technology aspects. Gwen's inclination towards Technology was expressed by her familiarity of the subject, "*I prefer Technology because that's the one that I started with.*". Teachers experiences varied, with some placing more emphasis on NS whilst other teachers placed more emphasis on Technology. Notwithstanding, this propensity

was motivated by teachers' experiences as well as their academic qualification, as many did not have a choice in teaching NSTech and were not prepared for an integrated curriculum.

Kerri, Ivy and Nancy preferred NS, since their experience demonstrated that learners related better to it and in this way, they were able to teach it more easily. Ivy mentioned that "*you get lots of weak learners in the class. They don't grasp the idea of Technology"*. This statement highlights participant feeling that weaker learners related better to NS and teachers therefore, felt a closeness when teaching NS because learners understood better. Nancy shared similar sentiments in her response where she noted, "*I prefer Natural Science. Learners can relate to it easily. They are fascinated when you give them facts about how we survive and how we are linked to nature"*.

Teachers unanimously leaned more towards the subject that they were familiar with or the one *"learners grasped better"* (Ivy). One teacher explained that she simply taught the additional integrated subject because it was *"foisted"* upon them (Monica). Ivy expressed her inclination towards Science,

> *"I lean more towards Science because Science is a little easier to understand and as a teacher you have to take into account that there are a lot of weak learners. With Science, it is much easier to relate to the weaker learners."* (Ivy)

This propensity was also claimed by Gwen as she remarked that it was the subject she was trained in teaching and therefore, preferred; *"obviously Technology because I am more familiar with it, but I do NS because I have to teach it"*. Likewise, Simon added that he was comfortable with *"aspects that speak to Technology"*. Aside from having a personal preference to teach one of the subjects, the general experience of teachers was that they leaned towards the part that covered Science, because there was more content to cover. Similarly, one participant provided her reasoning that supported her inclination towards Natural Science,

> *"There is more content in the Natural Science aspect as opposed to the Technology part of the subject. Like, for the year, we do more Natural Science practical's and I think for Technology we just had to make a circuit board which we have been doing since grade 3."* (Kerri)

Kerri was overwhelmed with the amount of content in Natural Science which meant that she had very little choice in which subject she leaned towards. Teachers' experiences showed that the dynamics of the school and the curriculum itself focused more on Natural Science than Technology. This further added to teachers' focus being directed towards Natural Science. Nancy supported Kerri with the following statement,

> *"I spend more time with NS as opposed to Technology because, with Technology, there's not much that needs to be covered in terms of syllabus content, so as a result, more time goes to NS…during science lessons, discipline is not even a problem because of the interest that's aroused in learners."* (Nancy)

Monica further noted that this inclination towards either one of the subjects in NSTech was unintentional,

> *"When we (teachers) taught it as Science, it was very focused. You knew that you are teaching the content and you are doing the practical. It was very focused and the kids (learners) could grasp that knowledge very easily…It's not because there's a personal preference that there's a leaning…it's simply because, er, there's more content in the science part, so you have to teach that content before you apply it, and we are following and relying heavily on the textbooks, so, the way the textbook is designed is, they have a whole lot of content and then they have that last section that shows the application of that content for technology itself."* (Monica)

From the above excerpts, it was evident that teachers leaned towards either Natural Science or Technology when teaching, depending on their experiences implementing NSTech. Most teachers noted that the structure of the NSTech curriculum favoured Natural Science because of the increased time and content allocated to Natural Science. Further, it was clear that the emergence of teachers' experiences alluded to the fact that teachers did not always lean towards a subject because of familiarity or preference, but also because the NSTech curriculum suited or covered Science more than Technology, and for this reason, it became prioritised by some teachers.

Literature, based on an international study in China, found that teachers' experiences depicted the aim of an integrated curriculum in the Senior Phase (grade 7 to 9), to raise scientific literacy, which neglected Technology (Wei, 2009). Raising scientific literacy makes the preference quite apparent, as emphasis is placed on Science, not only on a local scale, but also internationally. Consequently, this predominance of Science could possibly affect the way in which teachers experience teaching NSTech as a combined subject. Despite the problematic nature of an integrated curriculum in schools. Kelly (2004) highlighted the fact that educational change is imminent in society just as everything else is changing around us in recent years. Therefore, an integrated Science and Technology curriculum can prove to be advantageous if properly implemented, especially in the earlier grades (1 to 3) (Kelly, 2010). The disjuncture experienced by teachers implementing NSTech in the Intermediate Phase became apparent from the data and is explored more closely in the following section.

4.2.2 A disjuncture in teaching NSTech as a combined subject

A variety of teachers' understandings came to light regarding an integrated NSTech curriculum and how it is implemented using the guidelines stipulated by CAPS, as opposed to teaching NS and Technology separately as it was with RNCS. These experiences shed light on the disjuncture or disconnect between teaching Natural Science and Technology together or separately. The disjuncture meant that teachers were having difficulty teaching NSTech as an integrated subject and experienced a disconnect as there was insufficient time and an overload of content in NSTech. Teachers had to compromise the content by reducing or omitting certain topics due to the lack of allocated time to NSTech, and the interference of daily school activities that cut into notional teaching time. Moreover, teachers expressed that they taught NS and Technology separately for most of the lesson and drew on the links between the two subjects at a later stage in the lesson. As a result, teaching, learning, content and time was being compromised when implementing NSTech as an integrated subject.

Gwen stated that subjects are still being taught separately even though NSTech is an integrated subject in the present curriculum. Gwen responded with the following statement when asked about her experience of implementing an integrated curriculum, *"most of the time we teach NS and then Technology"*. Furthermore, subjects were being implemented in isolation as Monica mentioned that *"when you are teaching Technology, the main focus is Technology. It was kind of a bit isolated and you draw your links later"*. This was a teaching strategy that was in keeping with the RNCS curriculum where the two subjects were taught separately. Teachers had a difficult time drawing the links between the two subjects, leading to a lack of understanding for learners, who were not learning NSTech as an integrated subject. In an integrated subject such as NSTech, teachers found that they had to balance the content between Natural Science and Technology.

Kerri noted that learners also had difficulty in balancing the integration and it became difficult for teachers to clear learners' confusion and draw a link between the two subjects,

> *"It was a bit difficult, especially to explain to the children. For example, if we are doing energy and how the plant gets energy, then suddenly you have to teach them about electrical energy and learners start questioning, 'but mam you are talking to us about energy in the plant so how is it related to electrical energy?'. Then you (teacher) have to go about explaining the, the, definition of energy and how it is used by plants and how it is different from electrical energy. That was a little bit of a challenge. Er, explaining it for them (learners) to understand was a little bit difficult… because they*

know energy is like when body needs energy to do stuff and they wonder why you can't just use the same energy in electrical appliances, why do you need electricity?" (Kerri)

Monica tried to balance the two subjects by alternating their assessments as she stated, *"In one term, I do a project for Technology and in the next term we do an experiment that is part of Science, to try to balance the two subjects"*. From the quotation above, it was evident that although Kerri was a newly appointed teacher, she attempted to adapt to an integrated curriculum because she was not exposed to teaching NS and Technology as separate subjects in RNCS. However, there were still stumbling blocks. These stumbling blocks included cramming syllabus, leading to an overload of content being imparted on learners, which concerned Kerri. There are two subthemes that emerged from the data, under the disjuncture in teaching NSTech as a combined subject. The subthemes are discussed further in the section below. The first sub-theme: Killing two birds with one stone, discusses the idea that NSTech constitutes an overload of content, limited time and resources, and half the amount of 'manpower' to implement NSTech. The second sub-theme:Teaching an integrated curriculum: the effects on learners, discusses the experiences teachers have when implementing NSTech and the effects an integrated curriculum has on learners.

4.2.2.1 Killing two birds with one stone?

The intention of NSTech as an integrated curriculum was to combine the knowledge systems of NS and Technology by drawing on their interconnectedness. NS and Technology complement each other in the goals, focus, processes and evaluation method that each of the subjects uses. The complementary nature led to the integration of NSTech in the Intermediate Phase. At grade 7, however, NS and Technology are separated to prepare learners for the Senior Phase, and for them to become subject specialists and gain in depth knowledge. Teachers had difficulty in drawing the links between NS and Technology as learners were often confused about the overlap of content. The difficulty in implementing NSTech was supported by Kerri in the following statement,

"I have adapted to it and I am able to teach it because I have to, but the content is a lot and we are unable to finish it every single term. When it comes to the latter part of the term, we end up just throwing information on these learners and we(teachers) end up focusing on parts that were already done so that we can get learners ready for the exam. So, the end part of the actual syllabus, we can't really finish it. We have to make worksheets for them because there's no time to take down notes, and so forth." (Kerri)

It was clear that the content in an integrated curriculum such as NSTech was often compromised, because of contextual factors such as time. The problem of an overloaded curriculum had a chain reaction. Now that NS and Technology were integrated, this meant one teacher was teaching two in-depth subjects in half the amount of time. Arguably, the use of one teacher to teach a combination of two subjects which are heavily content driven suggests that the aim of an integrated curriculum was to possibly kill two birds with one stone, addressing two issues using a single means. In the RNCS curriculum, when NS and Technology were separated, it allowed for more in-depth coverage and understanding on the part of the learners and teachers. Simon concurred that NSTech now reduced the number of teachers. Instead of having two teachers if the subjects were taught separately, NSTech now only required one teacher with an added disadvantage of reduced time. According to Simon,

> *"it's like killing two birds with one stone. It saves time because one teacher will teach those two subjects in one class. So, it saves manpower for the department. Before, it was me with Science and another teacher with Technology. Now, I will be there alone… If I could squeeze myself in that three and a half hours per week, it suffices for both the learners and I."* (Simon)

Teachers felt that there was now a demand for a single teacher to implement an integrated subject which consisted of two different subjects put together. Teaching two subjects as a single subject with the same vast amount of content, meant teachers had to almost squeeze themselves into teaching NSTech. This added to the challenge when teaching NSTech, as teachers were unclear where to place themselves and what to teach. Simon highlighted the fact that, "*Technology, is consumed by Science or Science consumed by Technology. You need to strike a balance between the two."* However, not all teachers were able to strike this balance, and some found it difficult, thereby teaching NSTech as though they were teaching separate subjects.

The challenge when implementing NSTech as an integrated subject suggested that teachers were still unfamiliar with exactly what was required on their part. Some teachers were *"not familiar with RNCS"*. Nancy shared sentiments that she was equally unfamiliar with RNCS and therefore, was content with NSTech, favouring its integration.

Even the teachers that had taught NS and Technology as separate subjects prior to CAPS expressed mixed feelings when teaching the two subjects as an integrated subject. "*It is difficult teaching it together but as you sit down and look at the CAPS document, it explains everything" (Gwen).* Contrary to Gwen's statement, Ivy noted, *"CAPS is good in the sense that it covers a*

lot of the aspects, but if you have to compare it to the older one (RNCS), as much as I like CAPS and its easily outlined, with RNCS, it differentiates science and Technology." Ivy therefore, suggested that the separation of Science and Technology was preferable.

4.2.2.2 Teaching an integrated curriculum: The effects on learners

Teachers noted that teaching NSTech did not cater for the needs of all the learners in the class and especially the weaker learners who struggled to grasp content that was imparted on them at a rather alarming rate. Teachers focussed on the preparation for the examination which was a priority for curriculum coverage and schooling, and crammed content in a limited time. Ivy further shared her experiences and echoed Kerri's previous statement,

> *"With Technology, like if we (teacher) have to teach them (learners), we show them drawings and measurements and it gives time for the weaker learners to come on par, whereas when its integrated, we don't concentrate too much on that. So, although we touch on it, it's not enough time for the weaker learners. The weaker learners need more time*." (Ivy)

From the participants' experiences, it was clear that NSTech teachers were concerned about the needs of the learner. However, there was not much that teachers could do to assist learners since policy and schooling contexts confined the teaching of NSTech to allocated time and content. If a learner does not grasp what is being taught and performs poorly in tests and examinations, it is ultimately a poor reflection on the teacher as the aim of teaching and learning has not been achieved.

The difficulty of implementing an integrated curriculum was apparent for most teachers. Although teachers relied on CAPS to explain what to do, they rarely mentioned whether or not it assisted in the implementation or understanding of what an integrated curriculum was. There was almost a haze that pervaded the teaching of NSTech. Most teachers experienced difficulties in teaching NSTech and expressed their disappointment in trying to do justice to both subjects in a single lesson. This clearly emphasised a challenge in the experiences of teachers.

Monica was another participant who did not prefer NSTech as an integrated subject. She highlighted the fact that there were difficulties when the subjects were taught separately, and this had a direct impact on the way in which NSTech is taught presently. These difficulties resulted from lack of experience in teaching either of the subjects that were now integrated.

Monica explained that with the integration,

> *"Sometimes there were activities that I felt were a little beyond the age level of the children. Like, I know it was to design a bridge…other teachers used to complain about it. When you give a teacher a subject that they have no experience in, it's a huge stumbling block. Technology was foisted upon every Intermediate Phase teacher because nobody had any prior knowledge or experience. CAPS is prescriptive in a way. It outlines the curriculum which is helpful, I'm not saying it's not helpful because we (teachers) complained previously that the curriculum didn't tell us what to do, now it tells us what to do but they (curriculum) are telling us too much. It needs to be scaled down a bit because, obviously when you look at our, er, socio-economic background, it's too much for these kids to handle."* (Monica)

From the above quote, there was no absolute when it came to teachers' experiences of teaching NSTech as an integrated subject. Teachers' experiences varied with some in favour of the subjects being taught separately and others in favour of its integration. The challenge was exemplified with the prescriptive nature of CAPS and the level of integration for teaching and learning. Imposing the implementation of combined subjects, irrespective of teachers' expertise, is doing a disservice to both teachers and learners. It is worth noting that the teachers who were not in favour of the integration felt that they could have been able to perform better if the subjects were separate. Conversely, if subjects were to be integrated, proper and adequate training for teachers was required. To justify the need for an integrated curriculum, the reviewed literature, argued that discipline-based curriculum resulted in a disconnect between teachers' experiences and students' experiences, which resulted in the need for an integrated approach (Zhou & Kim, 2010).

The disjuncture that existed in teaching NSTech as an integrated subject, further emphasised teachers' experiences which found that curriculum is not aligned with classroom practices, thereby making the dissemination of an integrated curriculum rather difficult (Izci, 2017). Nampota (2008) explains that an integrated Science and Technology curriculum in primary school may not achieve the goal of giving a sound foundation for secondary or tertiary education. This may be so, because an integrated curriculum encompasses two subjects whose philosophies are different. Science and Technology are seen as critical inputs for a better quality of life, making the discussion of successful implementation or integration a critical one (Nampota, 2008). Although there has been much deliberation on the integration of Science and Technology, especially in the higher grades, due to its nature of diminishing the knowledge covered in the two subjects, it has been observed that integrating Science and Technology in grades 1 to 3 within the Foundation Phase of schools, can be effective (Nampota, 2008).

Curriculum such as CAPS which favours integration ascribes to this view (Ramatlapana & Makonye, 2012).

Findings highlight the challenge that teachers experience in implementing NSTech, and the difficulty in finding a balance between the overloaded content and the lack of time to impart this content onto learners. Teachers articulated that NSTech, as an integrated subject, merges the two subjects into a single subject with a single teacher and reduced amount of time. Moreover, teachers stated that they inclined towards the subject they were more confident in teaching. This negatively impacts on learning, as learners are unable to draw on the links between NS and Technology. Teachers expressed that added support and training on how to properly implement NSTech could possibly enhance their pedagogy and ultimately learning.

4.2.3 A lack of support and training: From pre-service to in-service

International and local literature supports the view that an integrated curriculum can only be properly implemented if teachers impart it in a meaningful way (Yildiz-Dubun, 2014). This suggests that teachers themselves need to be familiar with the content, knowledge, resources and skills necessary to facilitate the implementation of an integrated curriculum (Yildiz-Dubun, 2014). With the lack of proper workshops and the absence of support material and guidance from the Department of Education, teachers emphasised that they had become heavily reliant on the CAPS document. The above-mentioned nature of NSTech has led teachers to implement NSTech without proper facilitation and training and heavily reliant on their fellow colleagues for advice and support. The sub-themes below: A means to an end: Support structures for NSTech teachers, and uncertainty in implementing NSTech as an integrated subject, discuss the lack of support and training offered to teachers.

4.2.3.1 A means to an end: Support structures for NSTech teachers

Participants in this study indicated that greater support structures, such as proper training and facilitation, were needed for the implementation of NSTech, in a positive and meaningful way (Yildiz-dubun). Monica expressed,

> *"It's important that you train teachers properly for those things (the integration). You can't just send them (teachers) to a workshop for a day and then say okay, they are ready to teach the subject now. It just doesn't do justice."* (Monica)

There was much emphasis placed upon proper and adequate training. Simon and Monica agreed that collaboration and assistance from the various stakeholders were key factors in ensuring "*fruitful*" (Simon) teaching of any subject. Mixed responses came to light when teachers were asked about the type and extent of assistance that teachers were provided with, for teaching NSTech. Monica was rather hesitant in her response. With a long pause, she expressed that there is "*not much"* assistance from the school. Monica was, however, adamant and explicit in her response that the school did not play a significant part in providing teachers with the support or training to implement actual NSTech lessons. Monica went on to express that,

> *"They (school) are not equipped to help us with NSTech specifically. The school itself, no! I can't say that they are equipped to help us with that. They are involved, if you look at outside organisations, not the teaching of Science but things related to Science, then management will liaise with anyone that contacts school with regards to sponsorships and donations but not actually teaching of lessons as such."* (Monica)

There was a lack of proper assistance and guidance from schools and the Department of Education, in the implementation of NSTech. Monica, Simon, Gwen and Kerri, all agreed that they received more assistance from their fellow teachers than from their school or Department of Education. Gwen mentioned, *"If I don't understand, I would just go to my fellow NSTech colleagues*". Likewise, Simon said in his response, *"we all meet as NSTech teachers to chant a way forward with them, and also whatever we have individually acquired, we will be able to share it together".* Kerri noted that fellow NSTech teachers ensured an amicable solution to almost any problem encountered,

> *"With regards to assistance from teachers, we have one other NSTech teacher, she is very helpful. If I need to know anything, then we both sit down and have a short discussion, and we are able to come up with solutions that are learner friendly." (Kerri)*

In-service teachers sought assistance from more knowledgeable and experienced colleagues to cope with their lack of knowledge of an integrated curriculum. Only Ivy and Nancy explained that they engaged in *"team teaching"* (Ivy) and had subject committee meetings at their school to iron out any problems and ensure smooth instruction when teaching NSTech. That did not, however, rule out the lack of assistance offered by other key stakeholders such as the education district or Department of Education.

Teachers indicated the challenge they experienced when trying to follow Departmental policy documents such as CAPS, without adequate support and time for the implementation of NSTech. It is because of insufficient support, that Gwen still felt inadequately prepared asking

for the *"department to provide more resources and workshops"*. However, Gwen was thankful that *"CAPS tries to explain everything"*. It is worth noting the pedagogy and expertise of teachers is an integral part of integrating the curriculum or subjects (Chicgona, 2010). Moreover, teachers should be informed, trained and involved in the process of curriculum development as it could possibly enhance their productivity in the classroom and make them accountable for quality education (Oloruntegbe, 2013).

Contrary to Gwen's belief that additional workshops would assist in breaking down the divide of NSTech, Monica experienced quite the opposite saying,

> *"when I go to a workshop, I'm so revived and excited. Okay, I'm going to get some new ideas and information after teaching for so many years. When you go there, sometimes you end up coming back so disappointed, nothing new, nothing exciting."* (Monica).

Park (2008) emphasises the teacher's understanding of an integrated curriculum, their critical role in its proper implementation, and consequently in the outcome of learning. There is also lack of support on the part of the school as Nancy mentioned, that learners did not have access to facilities despite having a science lab. It was utilised as a classroom which was difficult as *"you need to carry equipment around…and swop classes" (Nancy)*. Similarly, Monica expressed that "*access to equipment is rather limited"*.

This lack of support and assistance from the various stakeholders such as the school management, circuit and district levels made teaching an integrated such as NSTech even more challenging for teachers who have had years of experiences teaching as well as novice NSTech teachers. The challenge of implementing NSTech as an integrated subject was supported by the teachers' responses of their experiences when teaching NSTech. Studies notes that even the most under-resourced schools have the potential to integrate Science and Technology through problem or project-based teaching (Johnston et al., 2014; Sheikh Abdullah, 2016). Therefore, the provision of proper facilities may enhance the success of implementing NSTech even further. Teachers need to be equipped with adequate knowledge through classroom practices that allow for the integration of subjects (Sen & Ay, 2017). Similarly, studies show that teachers in South African schools revealed that they could benefit from schools addressing professional development in terms of content knowledge and environments that support teaching and learning (Chigona, 2010; Stott, 2013).

Intermediate Phase teachers predominantly experienced little to no assistance offered by most schools and therefore, teachers became heavily reliant on their fellow NSTech teachers for

assistance when it came to any challenge associated with teaching NSTech. In addition to teachers' experiences, this lack of support and assistance stemmed from pre-service and continued all the way to in-service as described in the section below.

4.2.3.2 Uncertainty of implementing NSTech as an integrated subject

Only Kerri, expressed that she was adequately prepared as both a pre-service and in-service teacher, to enter the teaching fraternity, having been equipped with the necessary assistance and support to teach NSTech as an integrated subject. Kerri highlighted that she *"had two specialisations, which were Natural Science and Technology… so it was easy to teach it together"*. What added to Kerri's keenness for teaching NSTech is that she was based in the science lab which made resources easily accessible. Despite being more adequately prepared than the other participants, Kerri still preferred that Science and Technology be taught separately,

> *"I think if the subjects were taught separately, it would have been better because with Science, at least the teacher can focus solely on Science and if you are doing Technology then you can focus solely on Technology and I think learners would understand it bette."* (Kerri)

All other teachers opined that neither pre-service training nor in-service training adequately prepared them for teaching NSTech as an integrated subject. Responses from teachers also indicated that even workshops did not offer the assistance for the proper implementation of NSTech. Gwen expressed that she was not trained to teach NSTech as she started teaching in a high school and *"then it was very easy because it was not combined'.* Additionally, Gwen had an *"Advanced Certificate in Technology"*. Gwen did not fully grasp the concept of an integrated curriculum as was evident in the following response, *"when I'm teaching 'Earth', the learners need to also remember S.S. S.S also integrates with NSTech. Even mathematics integrates with other subjects…NSTech integrates with other subjects"*.

There was much confusion about what integration required from teachers. Gwen focussed on the integration of NSTech with all other subjects and could not explain her understanding of how NS integrated with Technology. Likewise, Simon explained his understanding of an integrated curriculum as *"a curriculum that would be able to be taught in another grade at a different level…bringing different sections together"*. This highlighted a vague understanding of an integrated curriculum from both Simon and Gwen.

Spelt et al. (2009) opine that an integrated curriculum is understood as the capacity to integrate knowledge of two or more disciplines, with the expectation of enhancing cognitive abilities in ways that would not have been possible through single subject means. Additionally, an integrated curriculum pertains to teaching multiple areas of subject matter that fall within the same area of instruction (Bloom, 2006). However, the challenge falls upon teachers like Simon and Gwen, who attempt to put this theory of an integrated curriculum into practice without having proper guidance or training as advocated in this study (Loepp, 1999).

In this section, the challenges that teachers experienced in the implementation of NSTech was discussed. It is imperative to note that although CAPS is prescriptive about what should be taught, the sequence, pace and time allocated for each topic, teachers expressed much difficulty due to the lack of support structures and inadequate time to properly implement NSTech. This section elucidated the critical role that teachers play in the successful implementation of NSTech as they are the transmitters of knowledge to learners. Schools need to offer support to teachers in the form of proper training, equip teachers with skills and provision of resources to properly implement NSTech which should begin in pre-service and continue to in-service teaching. The subsequent theme addresses the intricate nature of implementing NSTech as a result of unique contextual factors that prevail at schools.

4.2.4 Intricacies of teaching NSTech in large under resourced classrooms

> *"We have 95 learners in a class. It's not easy. There's no space to move around. It's very hard to do practical tasks. Even if you want to do practicals with your learners and take them out, it's very hard. You need to watch 95 learners. Even in class, you can't even move the desk around, there's no space so, it's very hard."* (Gwen)

When asked about the challenges that teachers experienced when implementing NSTech, Gwen responded with the above statement. Likewise, teachers unanimously experienced challenges when implementing NSTech in their classrooms since they were teaching learners about an unfamiliar subject, teaching large class sizes, having lack of resources which hindered teaching and learning. The challenges that teachers faced had a direct impact on how content was delivered, and the ability of learners to understand NSTech which was an unfamiliar subject.

Simon noted that in addition to large classes and limited resources, language was an added disadvantage,

> *"If CAPS tells me to do group work, I can't do group work in a congested classroom of 80 learners where I can't even move myself to the last learner in the last row. Language, floor space, overcrowding, for example, I can't do experiments or practical work. The last time I did the circuit, I had to bring the learners outside onto the netball court so that they could see it. I would get them to combine the circuit on their own in a wide-open space. With other experiments like combustion, I can't take learners outside because it will influence the flame…even in the classroom, for safety purposes, I can't do the experiment."* (Simon)

The quote above, depicts the language barrier that exists. Further to Simon and Gwen's responses above, it is worth noting that they taught in a school where English was a first additional language and not learners or teachers home language. Therefore, along with the issues of overcrowding, lack of floor space and resources, the language barrier experienced in some schools added to teacher's ability to successfully implement NSTech. This section explains the numerous intricacies when teaching NSTech as observed in classrooms that were overcrowded. Teachers were unable to move around and conduct practical tasks. Some practical tasks were not conducive to even the outdoor setting, teaching a practical subject such as NSTech, became a considerable task in some South African classrooms.

Monica explained that access to the equipment or resources was of utmost importance. If resources were unavailable or limited, it posed a challenge in moving teaching and learning forward. Monica said,

> *"We have limited equipment. We have some stuff and the fact that you are getting something to use was good but either the sponsors or principal-imposed limits. It had to be used in a laboratory and be locked away. Because of the lack of funds, it's hard to get some consumables. What I did is, I substituted. I use baby liners as filter paper and this is part of doing NSTech, its being resourceful and innovative, and that's what I do."* (Monica)

Despite the numerous challenges that could have inhibited the successful implementation of NSTech, such as the lack of space due to overcrowding, language barriers present in some schools and the limited resources available, teachers tried their level best to overcome them. However, some factors were beyond teachers control such as the lack of space and overloaded content. CAPS did not accommodate these challenges and teachers were unaware of what to do, leading to a compromise when teaching NSTech. Studies support the above view, noting the challenges of teaching NSTech and the reality that NS and Technology are treated as separate subjects. Identified challenges include lack of time, resources, pedagogical content knowledge and skills that prevail in the classroom (Guzey & Roehrig, 2009).

The literature reviewed, and the data generated, further emphasised the previous theme of the lack of adequate pre-service and in-service training and support. Even some of the affluent schools struggled, "*we've got lots of resources, but we don't have access to a science room, because of the large number of learners that we have at our school. We don't have a laboratory which would be ideal to teach NSTech" (Ivy).* This showed that even with the provision of ample resources, the prevalence of contextual factors such as the inability to access specialist rooms led to teachers having difficulty in implementing NSTech successfully. To cope with the challenges mentioned, Kerri explicated,

> *"We use our textbooks and the practical tasks…that encourage learners to work individually. We put learners into groups because of lack of resources, some groups have 4 learners per group…so you can work with them. I think learners learn better in that way."* (Kerri)

Despite the provision of resources in some schools, teachers such as Kerri and Ivy still maintained that these resources were not available for them to utilise during NSTech lessons. With the teaching environment not being suitable for the implementation of an integrated curriculum, it became a futile experience for teachers who attempted to implement NSTech. Therefore, it is worth considering the potential stumbling blocks experienced by teachers, of which space, overload of content and lack of available resources constitute significant hurdles for the proper implementation of NSTech. An added problem to the implementation of NSTech was inadequate time to complete content coverage. Teachers' experiences of working against the clock is discussed further in the subsequent theme.

4.2.5 Working against the clock

With the integration of NSTech, teachers felt that they now had to balance the content of NS and Technology in a reduced amount of time. This meant that there was too much of content and too little time to allow for content coverage, which hindered the implementation of NSTech as content of one subject was often compromised. Additionally, to cope with the integration and do justice to NSTech, teachers crammed content to complete content coverage.

Kerri noted the vastness of the NSTech content and the challenge of completing the content,

> *"The content is very vast. Grade fours have to do a bean plant and it takes just about a month and you have to observe every single step of the process. In the weekend, no one was at school to water it and it died off. So, I had to explain to the class what would have happened. Learners also have to do a moon assignment over a long period of time so children loose interest. Half the class didn't bring it back to me I have adapted to it*

> *(NSTech) now and I am able to teach it because I have to, but the content is a lot and we are unable to finish it every single term. When it comes to the latter part of the term, we just end up throwing information at these learners and we end up focusing on the parts that were already done so that we can get learners ready for the exam. So, the end of the actual syllabus, we can't really finish it." (Kerri)*

Since all assessments and activities are conducted in class, it became difficult for teachers to complete certain tasks. In addition, content was compromised with the integration of NSTech, and learners became unfamiliar with the distinction between NS and Technology, and how these were integrated, since work was rushed and crammed into lessons to prepare learners for the 'all important' assessments and examinations.

Simon favoured NS and Technology as separate subjects mentioning that there was a lot of overlapping, in-depth content taught, and not enough time for teachers to complete the content,

> *"The old RNCS, it was much more in-depth Science and Technology on its own. But now, having to, to teach both, uhm, at three and a half hours per week per section, and when there are two subjects you used to have 7 hours. Part of work is being consumed by another section so uhm… for example Technology, its consumed by Science or Science consumed by Technology, you need to strike a balance between the two. There's not enough time. Though, you are told that this (Science/ Technology) will be done and for how many hours. You may find yourself overlapping."* (Simon).

Teachers like Simon still showed their likelihood to implement NS and Technology as separate subjects. He emphasised that one of the subjects consumed the other leaving teachers with the complicated task of trying to balance the two and draw the link in topics taught in NSTech. In the attempt to balance content and do justice to both subjects, teachers often felt that they were repetitive in the content that was tested for examination.

In keeping with the problem of inadequate time for NSTech to be taught, Ivy expressed that there were a lot of assessments to cover, and because of the integration and the overload of content in NSTech cut into teaching time.

> *"CAPS is good in the sense that it covers a lot of the aspects, but if you have to compare it to the older one (RNCS, it differentiates Science and Technology and we put more focus on Science itself. We don't try and integrate it and time wise it's much better, they (learners) get more from it (NS and Technology separate). With CAPS we have to do a lot of assessments and a lot of our time goes into preparation of these assessments as well."* (Ivy).

Both, Ivy and Nancy expressed that the weaker learners struggled to grasp the content and *"needed more time*" as time was often taken by assessment which had to be completed in the

classroom during teaching time. Teachers felt that separate subjects allowed for more in-depth coverage and understanding. To further elaborate on what Ivy had mentioned about the disadvantage on the part of the learner, one participant noted "*you have to look at it from the child's (learner) perspective as well. We always say how important the child is and really, the child is overburdened"* (Monica). Apart from teachers noting the vast nature of the content, they felt that even learners are required to digest a lot of content as well. Studies found that primary school teachers are usually generalists and teach all subjects including Science, which leads to an overloaded curriculum and the avoidance of teaching subjects where they have limited content knowledge, inadequate understanding of the skills necessary to teach the subject, and ultimately, low self-efficacy (Gresnigt et al., 2014; Rohaan & van Keulen, 2011; Wei, 2009).

The focus of this research study was on teachers' experiences, notwithstanding that learner performance in a subject reflected directly on the teacher. For that reason, it was worth noting the impact that an overloaded curriculum had on the learner, and the effect that it had on teaching and learning. CAPS is very structured and therefore, the content is very structured and rigid with little room and time for expansion of content. However, some parts of the subject seemed to be prioritised according to the needs of the learner.

Simon expressed his disappointment in trying to do justice to both subjects in one lesson, mentioning that there was a lot of overlapping and "*not enough time"*. He further explained that NSTech has cut down the amount of time allocated to the subject, as well as the number of teachers, teaching NSTech but has not cut down the content as he often found that he had to *"squeeze himself into the allocated three and a half hours".* As a result, *"it saves time because one teacher will teach two subjects in one class, it saves man power.*" (Simon).

Ivy explained that assessments and the preparation for these tasks "*cut into teaching time" (Ivy).* With althe downsides to teaching NSTech, Nancy was the only participant who explained that an integrated curriculum worked for her, "*It has been working for me so there's not much that I can say about the problems that would arise. CAPS does allow time for Technology in the curriculum, so it has been working well. Learners seem to be coping".*

Except for Nancy, the majority of teachers expressed that time was a major factor that influenced the way in which an integrated NSTech curriculum is implemented. However, most of these factors such as time, overcrowding and lack of resources were out of teachers' control. This section explained the difficulty teachers experienced when teaching NSTech as an

integrated subject whilst trying to balance the vast content, and assessment within the specified time. Content coverage became problematic because content was almost doubled and the time halved. As a result, learners were at the receiving end of NSTechs' implementation.

The themes above highlighted the multiplicity of experiences when implementing NSTech. Considering the highlighted teachers' experiences, the subsequent section brings the researcher to the possible vision that this study has for teaching NSTech as an integrated subject.

4.2.6 A vision for teaching NSTech as an integrated subject

It is important to draw a link between teachers' experiences and how these could be used to enhance the implementation of NSTech as an integrated curriculum, especially in the Intermediate Phase. The lack of time to cover content and the language used in the textbooks were some issues highlighted by participants.

> *"For any lesson to be successful, you must have the time to teach the lesson. We need to have a slightly scaled down version in terms of content. If we reduce the content, then it can probably work out as a combined subject. Some of the language in the textbook as well needs to be toned down a little because there are learners who are Zulu speaking at home and they are learning in English, so it makes it difficult for them."* (Monica)

The issue of time was raised again, reflecting that teachers felt strongly about the need for increased amounts of time to cover content. Conversely, a scaled down version of the content, with age appropriate terminology used in NSTech textbooks, could be successfully implemented in an integrated curriculum. Simon added that if there was increased *"parental involvement"* and *"supervisors to visit schools"*, an integrated curriculum could be successful. The need for supervisors should not solely be to monitor teachers, but rather to offer teachers assistance to better deal with their challenges.

Kerri noted that more *"informative workshops"* were necessary together with an *"allocated science centre"* at schools. Additionally, one teacher expressed, *"we should have everything at our disposal"* (Ivy). Ivy further mentioned that NSTech *"should be prioritised just as much as English and Maths"*. Similarly, Gwen underscored the need for a Science laboratory, additional resources, and more workshops.

It is worth noting that all the themes in figure 4.2, which explained experiences of the teachers in this study, led to how they envisioned the NSTech curriculum and current practices that could be enhanced to ensure its success. Despite all the intricacies experienced, Simon still

favoured NSTech's integration saying, *"I don't think we should separate them".* Noting the challenges put forward, it became evident that teachers did not totally shun the idea of an integrated curriculum altogether but made recommendations of how it could possibly work for their own unique contexts.

Research question one alluded to the experiences that Intermediate Phase teachers had when implementing an integrated NSTech curriculum. To this point, four sub-themes were discussed under the main theme: A multiplicity of experiences when implementing NSTech as an integrated curriculum. These themes are as follows: An inclination towards their preferred subject; A disjuncture in teaching NSTech as a combined subject; Lack of support and training: From pre-service to in-service; Intricacies of teaching NSTech in large under-resourced classrooms; and working against the clock. From participants' responses in the data generated, it was evident that there was a multiplicity of experiences when teaching NSTech. These experiences led to a vision for teaching NSTech as an integrated subject. The following section depicts the personal responses of the participants and seeks to address the second research question: What are the factors contributing to teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?

4.3 Factors influencing teachers' experiences of implementing the NSTech curriculum.

Teachers had various reasons for their experiences when implementing the NSTech curriculum. Following the analysis of participants' responses to research question two, it became evident that certain factors influenced the implementation of the NSTech curriculum. The following factors were identified: Personal factors; Contextual factors; Political factors and Socio-economic factors. Significantly, the factors that emerged in the literature review, in chapter 2 are comparable with the aforementioned factors that emerged in the analysis of data. Notably, the inclination towards one of the subjects in an integrated curriculum can be suggestive of personal factors, the inadequate training and support is directly related to contextual and political factors and the influence that teachers' experiences have on implementation of an integrated curriculum is the result of contextual and political factors. The themes from the following section explored the factors which emanated from the data which influence the implementation of NSTech. Some factors were within the control of teachers (internal) and other factors were beyond their control (external). The factors are represented in figure 4.3 and will unfold in the discussion thereafter.

Bronfenbrenner's (1977) ecological systems model, was adapted in figure 4.3 below, and is used as an analytical framework in this part of the data analysis. The ecological model mentioned how the individual and their interaction with their immediate and extended environment influenced the growth and development of the individual (Hess & Schultz, 2008). Likewise, the factors that are explored, make it possible to understand how teachers' interaction with their immediate environment (internal factors) and extended environment (external factors) shaped the way NSTech is implemented in an integrated curriculum. Various contributing factors affected the way in which teachers experienced NSTech. The factors are discussed further below.

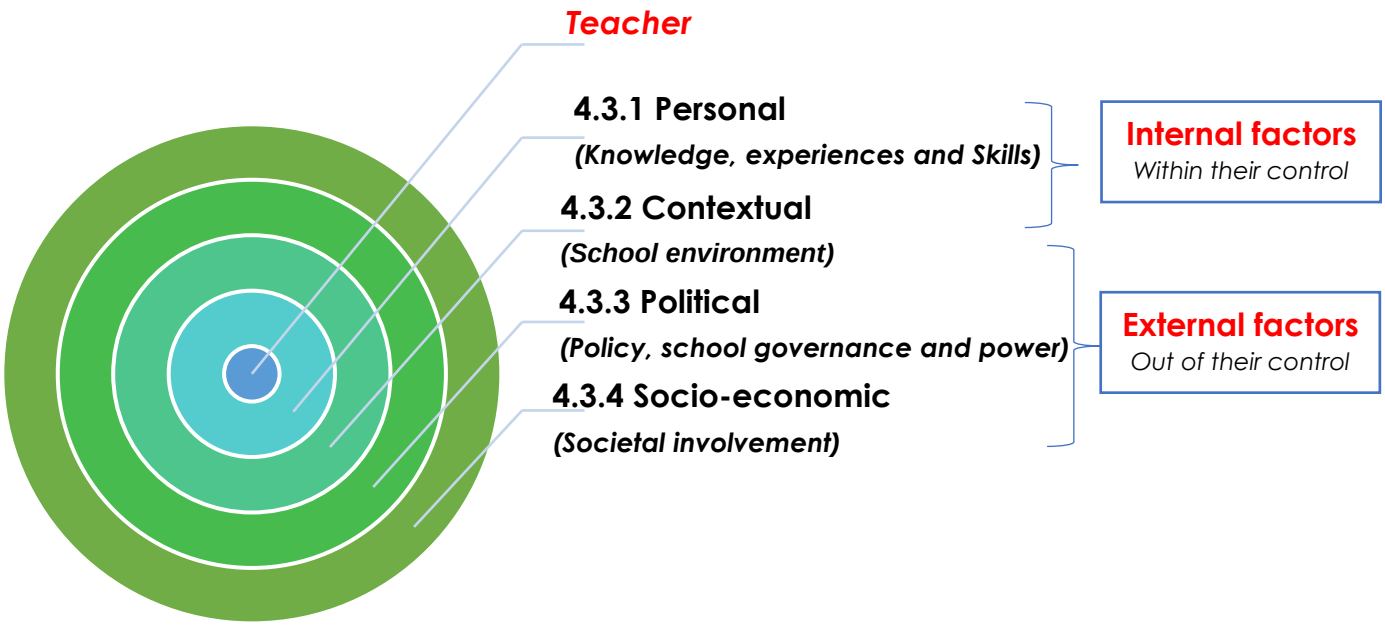

Figure 4.3: Factors influencing teachers' experiences of implementing the NSTech curriculum.

According to teachers' experiences, it appeared that the factors in figure 4.3 affected and influenced the way in which they experienced and implemented an integrated curriculum, and the way in which NSTech is taught. Literature points out that the experiences of teachers directly influence curriculum implementation (Oloruntegbe, 2013). These factors in figure 4.3 provide an insight into the themes discussed in research question one, by identifying and explaining the factors that contribute to teachers having these experiences. The factors aim to elucidate the reasons teachers had a multiplicity of experiences when implementing the NSTech curriculum. The internal factors (personal factors and contextual) were those factors

which were within teachers' control, and external factors (political and socio-economic) were those factors out of the teachers' control, which were filtered in by the Department of Education and the needs of society. The afore-mentioned factors are discussed further in the subsequent sections.

4.3.1 Personal Factors

NSTech teachers identified their qualification, experience, skills and knowledge in NSTech as some of the factors that played a vital role in how an integrated subject was implemented. It is worth mentioning the experiences that teachers had and how these experiences formed part of the factors that helped better understand how an integrated curriculum such as NSTech was implemented. From the literature reviewed, it was found that most teachers lacked the practical and personal knowledge to approach an integrated curriculum due to inadequate experience in the implementation process (Jonsdottir, 1995). Of paramount importance was the discovery that all participants did not have a choice to study NSTech as a combined subject at university, because the integrated NSTech curriculum (CAPS) was only introduced after all the participants were already teaching at schools. Some teachers felt that NSTech was imposed upon them,

> *"It wasn't my choice. I can't say I had a passion for it. They (university), had it in a set combination which was Natural Science and Physical Education. I did it because I had a Science background. In fact, nobody trained us for Technology. It was only Natural Science." (Monica).*

Another teacher had a similar experience to Monica as she mentioned, *"I was teaching Technology not NS. I was in a high school and that's where I've started. Then it was very easy because it was not combined"* (Gwen). Simon had taken on Natural Science in 2006 *"out of the love for Science.* Simon noted that his *'major is Technology"*. Ivy, not having specialised in Natural Science or Technology, remarked that *"the school needed a Natural Science and Technology teacher. I actually applied to the department and I got the post"* (Ivy). Similarly, Nancy noted that *"Natural Science and Technology was given to me to suit the needs of the school. There was a need for the teacher, so I took up the challenge"* (Nancy). Kerri was in the same situation as the other participants and her experience was that *"at university we did Natural Science and another subject, but when CAPS came about, it was my chance to do Technology."*

From the excerpts, it was observed that the personal circumstances, qualifications and the choice of subjects at university played an important role in teachers' abilities to implement the NSTech curriculum. Since it was evident that teachers lacked the expertise to teach NSTech as a combined subject and their choices to fulfil teaching posts was dictated by their circumstances, teachers lacked the skills to properly implement such a curriculum because of their limited knowledge of the subject.

One such study supported this view, noting that teachers who taught outside their subject specialisations leaned towards non-practical and information-rich lessons, which in turn challenged teachers' pedagogical-content knowledge, ultimately leading to the struggle being more about survival rather than social transformation using the curriculum (Weber, 2008). As a result, whilst attempting to link NS and Technology in NSTech, teachers often found themselves leaning towards either NS or Technology, thereby doing the other subject and the learners an injustice. This inclination resulted from teachers' familiarity with either of the two subjects that made up NSTech. Ivy asserted this and stated that she *"leans more towards Science"* and *"I spend more time with NS as opposed to Technology. I haven't taught NS or Technology in the RNCS curriculum, I've just started with CAPS."* (Nancy). Simon on the other hand leaned towards *"aspects that speak to Technology because I am confident when I teach it".*

Despite teachers' personal circumstances and outside influences, they maintained having taken up the challenge as part of their job description, and to suit the needs of the school. Teachers' ultimate outcome or goal was to assist with learners understanding of NSTech with the hopes of creating *"future scientists or Technologists"* (Simon), thereby *"understanding everything about Science and Technology"* (Gwen), whilst leaners were taught "*the skills and values"* (Monica) of life as well as drawing on the link between the two subjects "*to understand that Science and Technology are not worlds apart"* (Kerri)*"as they go hand in hand"* (Nancy) to ensure learners fitted into society and became responsible adults. Importantly, the above vision that emerges from teachers' excerpts, did not stray too far from the goals and objectives of an integrated NSTech curriculum as stipulated by CAPS. Aside from teachers' personal factors, there are various contextual factors within the school environment that teachers must deal with. The contextual factors are exemplified in the section that follows.

4.3.2 Contextual Factors

With regard to teachers' experiences, their contextual factors were another reason that had to be considered. Contextual factors formed part of both internal and external factors. Participants' contexts in which schools were located, the contexts of the classroom, and the contexts that surrounded the teachers and learners, were important reasons that had to be considered in ensuring the successful implementation of NSTech. Monica expressed disappointment that NSTech did not cater for her school's or learners' unique contexts. Additionally, Gwen irately replied that overcrowded classrooms due to the lack of space posed a challenge when teaching NSTech, *"There are 95 learners…Even in class you can't even move the desks. There's no space to move around, it's very hard to do practicals with learners, even if you want to"*. Another participant shared similar sentiments with an added disadvantage, *"language, floor space, overcrowding. I can't do experiments and practical work"* (Simon). The movement of equipment from one classroom to the next was a major challenge as one participant stated, *"we have very limited equipment"* (Monica). Teachers noted that time and the overload of content were contextual factors that inhibited the successful implementation of NSTech. *"The content is a lot and we are unable to finish it every single term…we end up throwing information on these learners"* (Kerri). Additionally, "*time goes into preparing for assessments…because remember it's all class based…so it cuts down more on the content being taught"* (Ivy).

In addition to teachers' personal factors which contributed heavily to NSTech's implementation, the contextual factors that presented themselves, posed as even greater hindrances to the implementation of NSTech. The problematic nature of the contexts in which teachers found themselves in, further added to the lack of proper implementation of NSTech. The lack of regular assistance in the form of developmental workshops offered to teachers from the various stakeholders also added to the other contextual factors. Due to the above reasons, some teachers relied heavily on their schools for assistance, noting their engagement in *"subject committee meetings"* (Ivy & Nancy). Kerri stated that she looked to fellow NSTech teachers to aid, *"we have one NSTech teacher who is very helpful"*. Other teachers received no assistance at all *"the school itself, they are not equipped to help us with NSTech"* (Monica).

Moreover, overcrowding led to problems in maintaining discipline because *"as we are doing practicals…we will take the first group and others are doing their own thing"* (Gwen). Further, to overcrowding, Gwen highlighted the fact that "*in grade 3, they learn everything in Zulu, so*

when they come to grade 4 it's when they start English so It's very hard for them". Some participants noted that outside activities proved to be a major contextual factor

> *"with the content being so vast and the practical's being so long, er, activities at school definitely affect the lesson. We have to cut back on the content that we are supposed to teach. We focus more on assessments because that is more important because you need to get the marks." (Kerri)*

Further,

> *"organisations that want to come to school…parents want to come…because you are worried about the child's progress, you leave your lesson and you are standing outside to talk…not giving your complete attention to that lesson so there's a lot of multitasking that impacts on how you can achieve that integration." (Nancy)*

Therefore, as mentioned earlier, the contextual factors that could be controlled by the teacher such as the improvisation of resources, teaching strategies within their classroom, and length of practical tasks were internal factors. The lack of space, shortage of time because of interference from school related activities, and overloaded content are external factors out of teachers' control. Despite contextual factors being out of teachers' control, teachers often attempted to offer solutions to the problems they faced. This emphasised what the teacher could do to counter these problems they experienced as part of contextual factors. Therefore, was mentioned before, contextual factors formed part of both internal and external factors.

In an attempt to successfully implement the NSTech curriculum, teachers improvised in their lessons. However, it was not always successful as observed. Despite, the apparent diversity and flexibility in an integrated curriculum, literature seemingly explicated an integrated curriculum still fostered the same intensification and heightened expectations of the traditional curriculum with increased accountability, administrative workload, diversification of subject matter knowledge and expertise as well as lack of time due to increased workload on the part of the teacher (Weber, 2008).

Park (2008) further highlights the lack of information offered to teachers about what an integrated curriculum is, the excessive official duties on the part of the teacher, lack of facilities to properly implement an integrated curriculum, and the lack of in-service training for curriculum integration. The following section discusses political factors such as policy and school governance issues that teachers are faced with on a daily basis which affect the implementation of NSTech.

4.3.3 Political Factors

From the factors in the previous theme, it may be observed that policy surrounding NSTech has underestimated the personal and contextual factors linked to teachers implementing NSTech. Participants emphasised that, not enough time was allocated to NSTech which was already a subject overloaded with content due to the integration of NS and Technology. Additionally, participants highlighted that policy does not specify what teachers should do in under resourced or overcrowded schools, noting the assistance offered to NSTech teachers was little to none. Below, the research presents the experiences that surrounded political factors linked to NSTech and the CAPS document.

Teachers experiences highlighted that NSTech had been imposed upon them to *"suit the needs of the school"* (Nancy) or the Department of Education. As such, teachers were inadequately prepared to teach such a subject *"I was teaching Technology not NS. It was difficult teaching it together"* (Gwen). *"The school needed a NSTech teacher"* (Ivy*), "Nobody trained us for Technology, it was only Natural Science"* (Monica). In addition, limited assistance was offered by schools and the Department of Education in the form of *"subject committee meetings" (Nancy)* and *"workshops" (Monica)* for teachers to cope with teaching NSTech. Park (2008) underscores the crucial role of teachers understanding an integrated curriculum and its correlation to its proper implementation.

Importantly, NSTech was dictated by CAPS and the creation of policy was out of teachers' control. The lack of involvement of teachers left the power of creating policy solely with the heads of the school or Department of Education. Teachers noted that,

> *"If you look at the way the weeks are designed in our planning (CAPS), there is less time allocated for Technology. Sometimes, there were activities that I felt were a little beyond the level of the learners"* (Monica).

The design of policy did not consider the standpoint of teachers who directly experienced NSTech. CAPS was dictated by rigid guidelines and content which teachers experienced as unfavourable. However, it is in fact the teacher who should have the ultimate 'power' when selecting content and deciding whether or not an integrated subject can be implemented as they are teaching the NSTech curriculum in the classroom. Teachers stated that they were *"following and relying heavily on textbooks"* (Monica) and learning was facilitated through the use of *"group work"* in order to cope with contextual factors such as overcrowding and

lack of resources when implementing NSTech. Resultantly, if teachers are unfamiliar with how to implement an integrated curriculum, it cannot be imparted to learners, and its integration becomes futile. *"When you give a teacher a subject that they have no experience in, it's a huge stumbling block and Technology was foisted upon every Intermediate Phase teacher because nobody had any prior knowledge or experience"* (Monica). Harrell (2010) supports the view that teachers themselves have not experienced the benefit of learning through an integrated curriculum, as universities still offer single subject disciplines. It is therefore, not possible to demand a positive outcome from such a curriculum in the absence of rigorous training.

Another teacher stated, *"I'm not familiar with RNCS, I started teaching with CAPS"* (Nancy). Further, Gwen stated that *"most of the time we teach NS, not Technology because in the fifth, sixth and seventh week, we want to set exams"*. Time required for examinations is often neglected by policy makers as ample provision is not made for the development of teachers' assessment tasks, knowledge and skills to teach NSTech. Monica noted,

> *"It's important that you train teachers properly for the integration. You can't just send teachers to a workshop for a day and then say they are ready to teach a subject. It doesn't do justice. CAPS is prescriptive. It outlines the curriculum which is helpful. It needs to be scaled down a bit, even when subject advisors come around, they look at NSTech under microscope, you can't do that. You have to look at the fact that you are functioning as an entire school." (Monica)*

The above extract relates to what was discussed earlier regarding the lack of training and support offered to pre-service and in-service teachers. The lack of training and support was a major contributing factor to understanding the experiences of NSTech teachers relating to policy, school governance and the role of power. Power in an integrated curriculum lies within the policy makers and heads of school. Power structures responsible for curriculum design should consider socio-economic factors such as the contexts of schools, teachers and learners which contribute significantly to the reasons for teachers' experiences when implementing NSTech. Socio-economic factors are discussed in the subsequent section.

4.3.4 Socio-economic factors

Some schools are located in areas where the socio-economic circumstances influence the way in which teachers are able to teach, thereby affecting the ways learners were able to learn. An example of this, as mentioned earlier, was the overcrowded classrooms which led to a lack of resources and space. In terms of overcrowding and the lack of space, Gwen mentioned, *"I stand in front of the class because there is no space"*. Socio-economic factors present in the

communities where these schools are located lead to limitations such as the lack of space which encroaches on teachers ability to teach and properly implement NSTech.

There was a lack of parental involvement when *"there are tasks that we give to learners as homework to do. Some of the parents are illiterate and find it difficult to help. The learners find themselves copying from others"* (Simon). Because of the socio-economic factors such as parents who had not attended school or a lack of knowledge of what was being taught, parents were unaware of how to assist their children. This led to a limited understanding on the part of the learner and added to the teachers' inability to implement the NSTech curriculum effectively. Teachers alluded to the notion that their aim of teaching NSTech was to create *"future scientists"* (Simon & Gwen) by *"teaching learners the skills and lessons of life"* (Monica) as this could possibly alleviate or improve learners' social and economic conditions.

Aside from those factors that affected the teacher in their personal capacity, socio-economic factors included those factors that affected learners. These adversities primarily affected the way in which an integrated curriculum was implemented because the way that a learner receives the curriculum is of vital importance to how the teacher structures their lessons and can effectively implement NSTech.

At this point, the researcher drew attention back to the internal and external factors in figure 4.3, which fundamentally influenced teachers' ability to implement an integrated NSTech curriculum. These were teachers' personal factors relating to their knowledge, experiences and skills; the contextual factors which relates to the unique school environment; political factors that explored policy, school governance and power associated with curriculum development and implementation; and socio-economic factors which explained the reasons teachers and learners' social contexts influenced the implementation of NSTech. All the factors directly and indirectly affected teachers' experiences and therefore, must be considered as a vital part of implementing NSTech. This chapter makes clear, the factors that place teachers at the core of the model, with each concentric circle nested within the next, to show the interrelationship between each factor. The adaptation of the ecological systems model in figure 4.3, showed the factors directly affecting the teacher being located closer to them and those that affected their experiences indirectly, located further away (Hess & Schultz, 2008). The next section of this chapter focuses on Bernstein's (1971; 1996) theory of Classification and Framing in relation to the data analysed and the findings presented in this chapter.

4.4 Bernstein's theory of Classification and Framing

This section explores Bernstein's (1971) theory of Classification and Framing of knowledge within the curriculum, which was used as a lens to guide the research study. Bernstein's theory was used to analyse and classify the experiences of six Intermediate Phase teachers who implemented an integrated NSTech curriculum.

Curriculum revision in South Africa in the past 20 years was meant to initiate socio-economic development through quality education for all (Ramatlapana & Makonye, 2012). In so doing, the transition from RNCS to CAPS was meant to address shortfalls left by NCS. CAPS is based on Bernstein's (1996) theory of Classification and Framing in the hope of making curricular knowledge visible and explicit to all. This may be viewed as restricting teacher autonomy in how NSTech is implemented (Ramatlapana & Makonye, 2012). Arguably, what has been neglected by CAPS was that the autonomy of teachers in curriculum implementation enhanced the effectiveness of schools, as teachers were able to think more freely in the interest of their learners (Ramatlapana & Makonye, 2012).

It is imperative to note the influence that school knowledge and everyday knowledge have on teacher's autonomy and ultimately their experience in terms of Classification and Framing. Teachers experiences play a vital role in the successful implementation of teaching and learning. Teachers role is based on their experiences of teaching, learning, training, their character, resources, social contexts and interactions with other individuals (Comas-Quinn, 2011). It is not simply a single encounter that determines teachers' experiences. Likewise, contextual factors such as the availability of resources, class sizes and classroom space play a key role in the implementation of an integrated curriculum and produce and are produced by different experiences (Roth & Jornet, 2013). These experiences are not always professional in nature occurring at the teaching and learning environments. Social contexts largely influence the experiences that teachers have, as these determine the teaching and learning environments which directly affect teachers' experiences (Roth & Jornet, 2013).

4.4.1 Classification and Framing

The theory of Classification and Framing was explored in chapter two. To summarise, Classification on one hand refers to the strength of boundaries in content. Strong Classification meant strong, distinct boundaries between subjects whereby NS and Technology were kept separate. Weak Classification displayed weak boundaries between subjects allowing them to

interlink. This is suggestive of an integrated curriculum such as NSTech. Classification, therefore refers to policy such as CAPS which incorporated the integrated NSTech curriculum.

Framing on the other hand refers to pedagogy which explores how content is taught and organised (Harley, 2010). A strong frame referred to a rigid curriculum, in a predetermined order that was to be completed within a specific time, whereas a weak frame is suggestive of the teacher in control of selecting and pacing content according to the level of the learner (Harley, 2010). Classification is therefore, associated with power whilst Framing is associated with control (Harley, 2010). In this study, teachers' experiences and pedagogy formed part of Framing. When NS and Technology were taught as separate subjects, teachers experienced a great amount of power over curriculum implementation which showed strong Classification and weak Framing. When NS and Technology collapsed into NSTech, this showed weak Classification where the amount of power and control of teachers' experiences were limited.

Strong Classification establishes strong educational identities, mastery of knowledge and the development of subject loyalty, leaving the teacher in control (Bernstein, 1971). Bernstein (1971) expounds that the pedagogy of weak Classification is more uniform as teachers of the same subject will have to work rather closely, leading to a more synchronised teaching approach. Although NSTech is suggestive of the weak Classification, most teachers in this study rarely had the time or facilities that allowed them to work together closely. Team teaching came to the fore in this study. However, this may lead to uncertainty with regards to teachers' identities as it is achieved through collaboration with fellow teachers (Harley, 2010). Uncertainty questions teacher expertise in teaching an integrated curriculum such as NSTech. This is rather different from the strong Classification where there is certainty in professional identities, meaning you teach either Science or Technology, and develop expertise in either field of knowledge.

To fully understand the theoretical framework of an integrated curriculum using the concepts of Classification and Framing, one can refer to Bernstein's view of the boundaries and control of knowledge within the context of an integrated NSTech curriculum. In the integrated type of curriculum, reference is made to other subjects as these are not taught in isolation (Gultig et al., 2002). The NSTech curriculum that is currently being taught at South African schools exhibits an integrated curriculum as it blends NS and Technology, while aiming to integrate concepts of knowledge that overlap, consequently displaying minimal boundaries. Classification, therefore refers to the relationship between the different subjects (Young, 1971).

The central idea is that the content of different subjects (in this instance, Science and Technology) is combined and now represent a complete new subject (NSTech). This suggests that the content taught within a curriculum is likely to be changed or modified in order to meet the needs (socio-political) of a particular society. Since Framing is associated with power and Classification is associated with control, the theory establishes the extent to which teachers' experiences influence these notions of power and control.

For Bernstein (1971), the curriculum operates as a form of control with the shift between strong and weak Classification, confusing power relationships and educational identities of teachers. Likewise, the move from RNCS to CAPS encouraged the distribution of power in the classroom with the main focus being on learners. Teachers experiences of power and control are neglected in the implementation of NSTech and limited to the implementation of policy rather than levels where policy is developed. Educational policy (CAPS) levels of social control, pedagogical identities and ramifications for teachers become questionable in NSTech. The discussion below attempts to locate the theory in relation to the findings, attaching meaning to participants' responses.

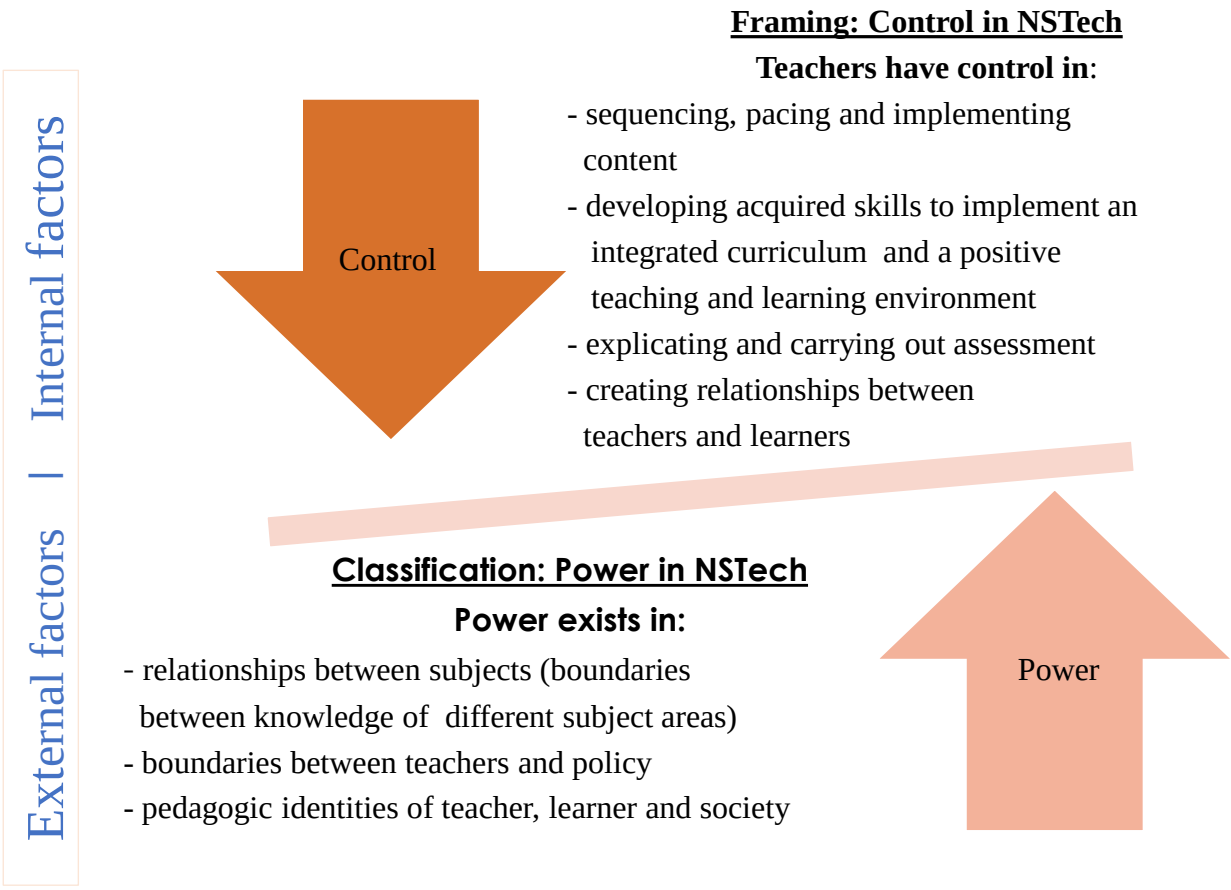

Figure 4.4: The imbalance in an integrated curriculum (adapted from Bernstein, 1971)

Figure 4.4 explicates the imbalance that was evident in an integrated NSTech curriculum. From the diagram (figure 4.4), the internal factors referred to Framing of how content was taught and organised. Teachers have control in sequencing, pacing and implementing content in NSTech. Additionally, once skills are acquired in the form of professional development training, teachers can thereafter, develop these skills further and enhance the implementation of NSTech. Teachers are also responsible for the implementation of assessment in NSTech and the creation of a positive environment between teachers and learners. Control in NSTech therefore, prevails in teachers' ability to implement NSTech responsibly within the boundaries specified by CAPS as an integrated subject.

The external factors highlight the role of power in NSTech and explicates that power exists in the boundaries between knowledge of subjects. The boundaries between subjects have already been identified by policies such as CAPS and therefore, power lies with the Department of Education. Power exists in the boundaries between teachers and their role in policy as they are rarely involved in the creation of policy. Power further exists in the roles and identities of teachers, learners and society. The factors from figure 4.4, that have been adapted from Bernstein (1971) and applied to this study, are discussed further regarding the imbalance when implementing NSTech.

According to Hoadley and Jansen (2012), Classification creates a container for NSTech to exist, meaning that it creates a special time and space for an integrated subject such as NSTech to be taught. Framing refers to how the teaching and learning of NSTech happens within this given time and space. As the data pointed, this was strongly influenced by the prescriptive nature of the policy document and teachers rarely had control in Framing of NSTech. The sequencing and pacing when teaching NSTech displayed weak Framing as the order in which NSTech occurs or how quickly learning proceeds, depended on the needs of the learners and the various contextual factors highlighted. This determined the selection and pace of the lesson. Weak Framing was evident from the responses by teachers in their multiplicity of experiences depending on their unique contexts, the disjuncture in teaching NSTech as an integrated subject and working against the clock.

The second part of the analysis presented the reasons for teachers having these experiences. Here, the factors that influenced the implementation of NSTech came to light. Personal factors such a knowledge of NSTech, teachers' qualifications and skills, were a major contributing factor to the way NSTech was implemented. Personal factors

emphasised strong Classification in that there was clear demarcation of the subjects Natural Science and Technology. Moreover, participants found themselves leaning towards their preferred subject and as a result, there was lack of integration between the two subjects and there were limited links drawn between NS and Technology. Contextual factors proved that Classification is weak in relation to space and time. Participants revealed that the sites for learning NSTech such specialist rooms are not clearly demarcated, and teachers must often move around from one classroom to another, inevitably into other teachers' space. This means that the subject being taught was not apparent from the arrangement of space, the display of the environment and the equipment being utilised. The vague learning environment created further confusion on the part of teaching and learning NSTech.

Time was clearly a factor that participants were dissatisfied about, due to the fact that time for teaching and learning was not clearly demarcated for a particular subject. Disruptions in the schooling environments such as extra, co-curricular and non-curricular activities usually being scheduled during teaching and learning time. Time for activities mentioned above was not allocated in policy documents, and often tolerated to a large extent by the school, making it difficult for teachers to properly implement NSTech.

Although Classification and Framing are concepts that have clear outlines as to how they fit together in terms of strong and weak Classification and Framing, and specific characteristics describe an integrated curriculum such as NSTech, it is important to note that after the analysis of data and presentation of findings, the researcher was able to use the experiences of teachers and the reasons behind these experiences, to specifically understand that pedagogies can in reality, encompass elements on both planes of the continuum. As a result, the study was able to specifically describe the way in which NSTech is classified and framed in relation to Bernstein's theory of Classification and Framing of the curriculum and the implications of teaching and learning thereof. It is important to note that the contextual environment, according to Bernstein (1971), plays a crucial role in the extent of Classification and Framing of the curriculum.

From teachers' experiences of an integrated curriculum, prevalence of the imbalance between Classification and Framing is suggestive of the need for this research study. The findings suggest that an integrated subject such as NSTech, is not beneficial for teachers and learners alike. Further, policy documents such as CAPS are created for 'ideal' teaching

environments and it is evident from the findings that each teaching environment varies in terms of its contextual factors which makes the extent of Classification and Framing debatable in each schooling environment. In this regard, good pedagogy comes from a balance between the two extremes of Classification and Framing.

4.5 Conclusion

Teachers had a multiplicity of experiences when implementing the NSTech curriculum. There was an inclination towards one of the subjects in an integrated NSTech curriculum due to teacher's familiarity with that subject. This led to a disjuncture in teaching NSTech as an integrated subject. Further, teachers were not offered proper initial and ongoing support and training on how an integrated curriculum such as NSTech should be implemented. Additionally, the NSTech curriculum did not account for the intricacies associated with the unique contextual factors of schools, such as the lack of resources and space. Despite these adversities, teachers used their experiences to put forward their vision for an integrated NSTech curriculum. This vision was one that considered the experiences of implementing an integrated curriculum as well as the personal, contextual, political and socio-economic factors that influenced these experiences.

Teachers need to understand and be fully informed about curriculum integration to allow them to change their approach from just imparting knowledge, to analysing the relationships between subjects. This means that teachers need to be trained adequately for an integrated curriculum themselves, which underscores the need for adequate preparation in the form of teacher training. To conclude this chapter, it must be noted that teachers are too often drafted into curriculum implementation in the classroom without being adequately informed and involved in the development of curriculum (Oloruntegbe, 2013). It is for this reason that teachers often show resistance to implementing curriculum reforms and to embrace the new methods of curriculum implementation such as NSTech.

CHAPTER FIVE

CONCLUDING DISCUSSIONS AND RECOMMENDATIONS

5.1 Introduction

The aim of this study was to better understand the experiences of Intermediate Phase teachers when implementing an integrated NSTech curriculum. The study also explored the factors contributing to teachers' experiences of implementing an integrated NSTech curriculum. The research was carried out at three schools within the Department of Education in northern Kwa Zulu-Natal. Chapter one provided an insight into the background and introduction to the study; chapter two reviewed the related literature and the theory that guided this study; chapter three explored the research methodology and design employed; and chapter four analysed and synthesised the data, as well as presented the findings of the study in relation to the research questions, literature review and the theoretical framework. In doing so, patterns, themes, inconsistencies and ambiguities were discovered. This allowed the researcher an opportunity to reflect thoroughly on the study's findings as well as the theoretical and practical implications thereof.

The intent of this chapter is to conclude this research through a brief overview of this study, thereafter, provide a summary of the key findings that were generated from the semi-structured questionnaires and semi-structured interviews conducted with NSTech teachers. This will lead to the recommendations for future research and areas for further research. Lastly the chapter will draw to an end with the concluding statements. This case study was informed by Bernstein's theory of '*Classification and Framing'* as it explored how teachers implemented an integrated NSTech curriculum in their daily teaching practices. This study responded to the research questions below:

1. What are teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?
2. What are the factors contributing to teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?

In relation to the research questions, the findings indicated that teacher experiences were of paramount importance to the successful implementation of an integrated curriculum and the promotion of NSTech. Data was compared in terms of similarities and distinctions, which were thereafter, reflected in the issues that came to the fore in the implementation of NSTech. The

results of the comparison between the similarities and differences contributed to a discussion of the main findings of this study below.

5.2 Summary of key findings

In contrast to the RNCS curriculum designed and implemented prior to CAPS, knowledge is now interconnected and complex, leading teachers and curriculum designers towards an integrated approach in most subjects in the Intermediate Phase. This means that most subjects are combined and no longer compartmentalised. In South Africa, such steps have already been taken towards an integrated approach to curriculum. The combination of Natural Science and Technology into what is now commonly known as NSTech, is one such example of integrated approach to curriculum implementation. However, teachers in the Intermediate Phase, specifically NSTech teachers, displayed a multiplicity of experiences when it came to the implementation of an integrated curriculum. The summary of the key findings that came to light is discussed under the two critical research questions. Lastly, Bernstein's theory of Classification and Framing in relation to NSTech is discussed.

Below, is a summary of the key findings that came to light under the first research question:

> **What are teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?**

There was a strong inclination towards either one of the subjects combined in NSTech. This often resulted from teachers' academic qualifications that advanced one aspect of NSTech more than the other. Additionally, teachers were not in a state of preparedness to teach a subject such as NSTech, which further motivated their indulgence towards one of the subjects. The findings also suggested that teachers did not like the idea of an integrated curriculum being 'foisted' upon them.

It was ascertained that the school curriculum focused more on aspects that favoured NS as it specifically catered for infrastructure such as a science lab and scientific equipment whilst neglecting the needs of Technology. The 21st century requires new and improved curriculum advancements such as integrated approaches. It was evident from the findings of the study that if NSTech was not properly implemented, the ideology of integration was futile. Another imperative point that surfaced was the implementation of NSTech in the earlier grades (1 to 3) as a way of moving learning forward by allowing for distributive work load and proper implementation on the part of teachers as opposed to the abrupt introduction of an integrated

NSTech curriculum in the Intermediate Phase. The introduction of NSTech as an integrated subject in grade 1 to 3 will allow for increased understanding on the part of the learner thereby enhancing teaching and learning in the Intermediate Phase.

Findings also shed light on teachers' understanding of an integrated curriculum showing that there is was a disjuncture in how NSTech was meant to be taught and how it was actually being taught as a combined subject. This disjuncture was a major contributing factor for teachers still teaching NSTech as separate subjects, isolating the Technology aspect from Natural Science, as they were unable to draw the links between the two subjects and leading to confusion about teaching NSTech. Teachers often attempted balancing the subjects, but this was overweighed by the increased content crammed into NSTech and the lack of time for implementation, further compromising the notion of integration.

A strong argument on the disadvantage of an integrated curriculum such as NSTech meant that the number of teachers and allocated time was now halved, whereas the quantity of content was now, in fact, almost doubled. The unfamiliarity of integration bred mixed feelings, disappointment and frustration as the challenge of trying to balance NS and Technology became apparent amongst teachers. Teachers were also unprepared and inexperienced to teach NSTech, and it was found that proper, adequate training was required. The lack of workshops and absence of support material and guidance from the school and departmental officials led teachers to become heavily reliant on policy documents. Fellow colleagues offered support to NSTech teachers as a means of coping. The lack of support and training stemmed from pre-service all the way to in-service training. Workshops did not adequately prepare teachers for the implementation of NSTech.

Another finding that supported the above statement was the fact that teachers had a vague understanding of curriculum integration due to the lack of training and support. This meant that teachers were unable to properly implement NSTech. If teachers are properly trained, this increases accountability and productivity. There was no point in increasing the number of workshops as the study found that teachers experienced no satisfaction or new knowledge from these. Although there was a specialist room to implement NSTech, the general experience was that these specialist classrooms could not be used to implement the integrated curriculum.

There were intricacies related to teaching NSTech, which were mainly contextual in nature. The challenge of teaching a subject they were not prepared to teach, and the problematic nature of large classrooms impacted on content delivery. Moreover, the study found that language was

a barrier to teaching and learning NSTech. Almost all these factors were beyond the teachers' control. Even the more resourced schools experienced similar challenges. The study also found that curriculum was not aligned with classroom practices which made the dissemination of NSTech futile. The uncertain nature of implementing NSTech questions the subject's ability to provide a firm foundation for learners specialising in such subjects. The findings also suggested that NSTech combined subjects whose philosophies were quite different. The ability of teachers to successfully implement NSTech was based on all facets above and not simply on their pedagogy.

Due to the workload stipulated by the CAPS document for NSTech, content was found to be rather vast and overloaded. This led to the compromise of NSTech being implemented as an integrated subject. The research found that the curriculum has taken advantage of teachers in primary schools' who were seen as generalists, having the ability to teach all subjects. Arguably, all subjects require a specialist approach for its proper implementation and a firm foundation for the learner. An ideology shared by all teachers was that the needs of learners were extensively neglected. Teachers were demotivated due to their lack of skills and proper training in such subjects. The study found the CAPS curriculum to be rather prescriptive and rigid in nature. The rigidity was detrimental as teachers sought to complete examinations and tests as early as the fifth week and prioritised their preparation whilst neglecting teaching strategies that could possibly enhance understanding. The majority of the factors were found to be out of the teachers' control.

The second research question highlighted the findings relating to the factors contributing to teachers' experiences from research question 1.

> **What are the factors contributing to teachers experiences of implementing an integrated NSTech curriculum in the Intermediate Phase?**

There were key emerging internal (within the teacher's control) and external factors (out of teachers control). These factors were personal factors which formed part of internal factors; contextual factors formed part of internal and external factors; political and socio-economic factors formed part of the external factors. These factors directly and indirectly influenced the way in which teachers implement NSTech.

The findings strongly alluded to the fact that teachers did not have any choice in the integration of NSTech curriculum at university since the integration of NSTech only came about in 2012, after all participants had completed their university education. Additionally, NSTech was still

not offered as an integrated subject at university. Therefore, most participants saw the integration of NS and Technology as a challenge. The findings further highlighted the state of unpreparedness and lack of expertise of teachers who implemented NSTech. Another concern was that lessons became information rich and non-practical in nature. In an attempt to integrate NS with Technology, teachers were increasingly falling to the side of the spectrum that favoured one of the subjects. Teachers ultimate goal was to spark interest in NSTech and create a passion for NSTech amongst the learners, thereby increasing their desire to pursue NS or Technology in higher grades.

Teachers raised numerous concerns of contextual factors that inhibited the implementation of NSTech. The contextual factors such as overcrowded classrooms led to a lack of space making teaching rather difficult. Language barriers that were experienced between the learners and teachers, as well as discipline issues on the part of learners, hindered teacher's ability to properly implement NSTech. Additionally, limited equipment and an overload of content did not allow teachers to implement the lessons fully and often content was left out because of lack of time. Class based assessments required additional time taken from allocated teaching time. The lack of in-depth developmental workshops and assistance from the Department of Education, to teach the NSTech curriculum was lacking, thereby making its implementation even more difficult. The study found that even the school itself was not in a position to assist teachers in the implementation of NSTech and the only available assistance came from fellow colleagues and subject committee meetings.

Teachers also emphasised that extra and co-curricular activities had a major impact in the implementation of NSTech as they ate into teaching time, and teachers had to often improvise in an attempt to solve the problem of insufficient time. In this way, the present NSTech curriculum was no different from RNCS, except with intensified expectations such as increased accountability, huge administrative workload, diverse subject matter and the requirement of diverse expertise, and less time. Teachers were inadequately informed about curriculum integration and how to integrate subjects, not to mention the suffocating amount of official and administrative work on the part of teachers, inadequate facilities in most of the schools and the lack of training offered to teachers. CAPS therefore, took for granted the issues of personal and contextual factors in the implementation of an integrated subject. Findings revealed that policy offered no solutions to the problems encountered in the implementation of NSTech.

Teachers relied heavily on textbooks to implement NSTech with content being above the level of most learners. Teachers emphasised that the creation of policy was out of their control, the content and suitability of the subject was not at the level of the learners it was designed for. Hence, the ripple effect of the factors above became evident. If contextual factors inhibit the implementation of NSTech, teachers cannot impart this knowledge meaningfully to learners. As a result, the implementation of an integrated curriculum such as NSTech becomes a futile experience.

Teachers noted that CAPS was helpful in outlining the curriculum, however, it needed to be scaled down in terms of the content coverage. Furthermore, there was a sense of disappointment from teachers' comments about the visits made by subject advisors and the amount of scrutiny involved in the teaching of NSTech. Teachers argued that a holistic view as opposed to a single visit from subject advisors was more applicable because of the factors present in schools.

Socio-economic factors involved society's influence in the contexts of schools. The socio-economic circumstances of the communities these schools were found in, led to overcrowding, lack of space, inadequate facilities and equipment. This made it difficult for teachers to implement NSTech. There was also a lack of parental involvement thereby making it even more difficult for teachers to assist in offering solutions to the problems learners encountered.

Teachers' motivation for teaching NStech was to improve and alleviate the current socio-economic circumstances learners found themselves in, affording them the ability to became future scientists and technologists. However, proper implementation is more than what meets the eye, and teachers need proper facilitation in order to properly implement NSTech. These socio-economic factors ultimately led to adversities in the classroom and affected the implementation of an integrated curriculum in the way lessons are structured. The internal and external factors impacted teachers' ability to implement the NSTech curriculum.

5.2.1 Key findings in relation to Bernstein's theory of Classification and Framing

In relation to Bernstein's (1996) theory of Classification and Framing, an integrated curriculum such as NSTech is seen as imposing restrictions upon teachers' autonomy, which affects free thinking of teachers and the effectiveness of teaching at schools. According to teachers' experiences of implementing an integrated subject within the CAPS curriculum, it was seen to have strong Framing because teachers were no longer firmly in control of the subject matter as

it was prescribed by CAPS and created around the learners needs. However, noteworthy, was the fact that, teachers' experiences revealed that Framing was in fact weak, because of the various contextual factors imposed upon teachers during the implementation of NSTech. Additionally, the inadequate knowledge, training, skills and preparation of teachers by the department and schools for an integrated subject, the content to be covered and the time frame for its completion further emphasised weak Framing. This sometimes meant that the pace of the lesson was slower, taking up more time because teaching took longer due to the factors mentioned above. Additionally, teachers reverted to strong Classification as they most often created strong boundaries between NS and Technology. This resulted from the factors discussed in chapter four and the propensity of teachers towards their preferred subjects due to their experiences.

The findings suggest that an integrated subject such as NSTech is not beneficial for teachers and learners alike if it cannot be extensively and properly implemented. Policy documents such as CAPS are created for 'ideal' teaching environments and it is evident from the findings that each teaching environment varies in terms of personal, contextual, political and socio-economic factors, which make the extent of Classification and Framing debatable in each schooling environment. In this regard, good pedagogy comes from a balance between the two extremes and allowing teachers the autonomy to create their teaching and learning environments based on these factors.

5.3 Recommendations

The recommendations for this study have been put forward in this section. The six Intermediate Phase teachers from the three schools within KwaZulu-Natal, noted the problematic nature of implementing the integrated NSTech curriculum through their responses based on their experiences in the classroom. The recommendations for this study were the necessity for: improved professional development; teachers being made part of the process of curriculum change and development; the ability of the NSTech curriculum to strike a balance between NS and Technology content and integrating NSTech into earlier grades; increased allocation of time for NSTech in the curriculum; an integrated NSTech venue and the provision of adequate resources to facilitate learning; and lastly, consideration of contextual factors when designing and implementing NSTech. The above-mentioned recommendations are explained further below as these require clarity and further elucidation.

The findings put forward in this study have significant consequences for policy. Policymakers often give focus and attention to the restructuring of curriculum but neglect the experiences of teachers when administering these changes. This research study shed light on teachers' experiences and the impact they have on teaching and learning holistically, with the possibility of deliberating changes in curriculum. This study also provides insight into the reasons such educational changes are not implemented the way they were intended.

Firstly, a greater degree of continuous professional development for teachers is required from the department and school in the form of informative workshops. Additionally, these workshops need to offer specific guidelines, occur more frequently, and be more practical to effectively grasp and implement curriculum integration. This could possibly encourage teachers not to lean towards one subject and allow them to implement NSTech as an integrated subject increasing their preparedness to teach. Additionally, workshops should not simply focus on assessment tasks and how to use the CAPS document as they presently do but should encompass meaningful methods on how to implement an integrated NSTech curriculum. Further, the Department of Education needs to come on board and avoid subject advisory visits as a once off measure, and rather schedule more frequent, informative visits to ensure the smooth sailing when teaching NSTech.

The experiences mentioned above argue for a more holistic approach to implementing NSTech. Moreover, many teachers relied heavily on collaboration with fellow teachers to allow them to cope with implementing NSTech. The department should allow for time during the school day to carry out additional workshops at school, just as it allows time in the school day for teachers to attend departmental workshops out of school. In their groups, teachers could engage in discussion and make sense of the integrated curriculum, subsequently implementing these changes, allowing for careful planning and development of teachers' skills of integration. This could possibly eradicate the frustration and confusion that teachers experience, and effective teaching could filter through to the classroom, encouraging adoption and engagement amongst learners in an integrated curriculum.

Secondly, it would be advisable that the department put in the time and effort in ensuring teachers are part of curriculum change by capacitating them to be knowledgeable about what an integrated curriculum is and how it can be implemented. Additionally, the department of education needs to provide support and guidance on how an integrated curriculum such as NSTech, should be implemented. Teachers may resultantly consider themselves part and parcel

of the process and be more accepting of the integrated approach. It was recommended by teachers in this study, that if one is passionate about the subject, they will bring it to life in the classroom, achieving the goals and objectives of NSTech. A recommendation for further studies is the exploration on how pre-service teacher training could enhance teaching and learning, allowing for teachers to be prepared to teach an integrated curriculum if universities offered NSTech as an integrated subject rather than separate subjects.

Thirdly, teachers' experiences noted the requirement for policymakers to strike a balance between the content coverage of the two, to minimise the propensity towards a single subject. Further, teachers recommended that NSTech must be implemented in earlier grades to build knowledge and skills and distribute the pressure that Intermediate Phase teachers and learners find themselves in. Therefore, the actual concept of integration needs to be revisited because of the limitations imposed upon Intermediate Phase teachers and their ability to implement NSTech effectively.

Fourth, the overload of content and inadequate time compromises the idea of integration. It was noted that the number of teachers was halved whilst the amount of content was doubled. Teachers recommended that content be cut down and practicals, which are also time consuming, be shortened. In keeping with limiting the overload of information, content should be slightly scaled down because of the limited time to implement NSTech. Teachers are left with even less time for curriculum coverage because of the additional activities that schools take on. Therefore, policy documents need to allocate time for extra and co-curricular activities which cut into teaching time.

Fifth, teachers were required to work with limited resources, infrastructure and facilities for teaching NSTech which elicited negative experiences. It is recommended that the Department of Education increase the budget for resources in schools so that resources can be provided for primary schools and not only high schools. Infrastructure of schools also cater more for NS in terms of the provision of science labs and equipment and not so much Technology specialist rooms. This further enhances the leaning towards one subject more than the other because of the overemphasis. An integrated platform in keeping with an integrated subject must be provided for NSTech to be properly implemented. The Department of Education must ensure teachers are provided with necessary resources so that NSTech can be implemented the way policy makers envision. This research study argues that NSTech should be prioritised just as much as English or Mathematics.

Sixth, the unique contextual factors of schools such as lack of space, overcrowding, lack of facilities and language barriers must be considered. In view of NSTech being a combination of subjects, teachers further recommended that the language used, be toned down as the language barriers that presented themselves in the classroom made teaching and learning difficult. All these factors mentioned were clearly evident in all three schools where research was conducted. Teachers explained that these factors hindered the implementation of NSTech as they could not move around freely to carry out the lesson and had to improvise for the facilities that were unavailable. CAPS is seen as catering for an ideal school environment and should take into consideration all the factors mentioned above. Contextual factors such as the schooling environment, infrastructure and resources as well as the suitability and expertise involved on the part of the teacher are factors that must be considered when the department polices suggest integration within the curriculum. It must be ensured that the school environment is conducive, with smaller class sizes for teaching and learning to allow for a successful outcome.

Socio-economic factors form part of the contextual factors and play a pivotal role in the way teachers are able to implement an integrated curriculum. This suggests that the society in which schools are located must be a guiding factor when an integrated curriculum is contrived. Increased parental involvement, departmental involvement and provisions, especially in the under resourced schools, are necessary to effectively teach NSTech. If teachers are to implement NSTech properly, they need to be well versed and well informed about subject integration. Once again, the argument for ample informative workshops advocates that in-service and pre-service training be compulsory and a stepping stone for teaching NSTech. Political factors such as school governance, policy makers and policy documents should involve teachers and start at grassroots level instead of the top-down approach evident presently. This will ensure better understanding and appropriately designed material for an integrated NSTech curriculum. Teachers will also be able to relate better and have an increased sense of accountability and confidence when teaching.

5.4 Recommendations for further research

The researcher has extensively analysed the experiences of NSTech teachers. It is with anticipation that the findings put forward in this study will provide worthy contribution to the area of research on teachers' experiences in ongoing curriculum changes. Noteworthy is the fact that this study is a new area of research within the South African context, and it is thus, recommended that the results lead the way for further studies. An in-depth exploration and

consideration of the findings of this study show that the field of teacher experiences is vast and open to further research.

This study explored the experiences of a small number of NSTech teachers. It would be interesting if in-depth research was carried out with an increased number of teachers who implement other integrated subjects such as Social Science and Life Skills. Additionally, the study could be extended to other provinces in South Africa.

The study touched on language barriers that some teachers experienced because of multilingual classrooms and the areas that these schools are situated in. Research could look at the implementation of integrated subjects such as NSTech in multilingual classrooms and the effect that they have on teachers implementing an integrated curriculum.

Teachers experiences often impact the way in which curriculum is implemented and will therefore, have an effect on curriculum changes. Additionally, a field of study to be undertaken could explore the teachers' qualifications and their number of years of experience and how this influences the implementation of NSTech as this study displayed a vast array of years of experiences of teachers. Although teachers were faced with unfamiliar experiences and changes in the curriculum, they attempted to cope with these experiences so that there were minimal disruptions to their teaching. Provisions were constantly made to cope with these changes.

The findings of this study have significant implications for policy. The changes in curriculum are foisted upon teachers with minimal consideration of how the changes affect teachers' experiences. Despite following CAPS closely, each teacher implemented NSTech within their own context which directly influenced their experiences. If teacher experiences are given the due regard and attention they require, it would allow for far greater understanding between policy makers and teachers. This implies that policy makers should consider investing more time and energy in ensuring that teachers become knowledgeable and adequately equipped with the skills and resources to effectively implement NSTech as policy envisions.

An amicable suggestion for further research should explore the effect that regular communication amongst teachers and policy makers have on minimising the challenges and difficulties that teachers experience when implementing NSTech. The suggestions above are made under the presumption that teachers experience of implementing an integrated curriculum

significantly affects the quality of education, therefore, advocating for practical solutions above, in an attempt to effectively implement policy changes and sustain curriculum reform.

5.5 Conclusion

This research study's primary focus was teachers' experiences of implementing an integrated NSTech curriculum in the Intermediate Phase. The study is expected to contribute to the increasing amount of knowledge on teacher experiences both locally and internationally. It is evident from the limited research studies conducted in South Africa that this is an area of research that required due attention. I anticipate that this study has depicted the exploration of teachers' experiences when implementing an integrated NSTech curriculum as a worthy area of research, noting that curriculum change is rooted in these experiences. It is relevant and necessary for the literature on curriculum integration and teachers' experiences to speak to each other since it has become evident that teachers' experiences are central to the proper implementation of NSTech.

This research study concludes that teachers' experiences are a vital part of the teaching and learning process and need to be carefully considered when creating and implementing policy. Teachers' experiences cannot be separated from the implementation of curriculum as they are inevitably bound to the implementation process. In curriculum reforms that implement changes in education, teachers' experiences cannot be ignored. This study is hopeful that teachers' experiences are recognised, so that the changes that present themselves in schooling environments will be accepted enthusiastically by teachers. Teachers in this study understood the significance of integration and what it aims to achieve. They explained the importance of teachers' experiences and the need to consider all facets and factors that could possibly affect the implementation of an integrated curriculum.

Experience is transformation and a moving force that promotes understanding (Roth & Jornet, 2013). Therefore, teachers' experiences in curriculum implementation cannot be ignored. It must be noted that these experiences are at the core of curriculum reform. Therefore, acknowledging the experiences of teachers when there are changes such as integration of the curriculum, allows for an increased chance of success in the implementation process, without which, one can anticipate minimal change in the classroom, where it ultimately matters.

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