

# UNIVERSITY OF ZULULAND



## **Exploring the Strategies used by Grade 6 Teachers in the teaching of Natural Sciences and Technology in the Ngwelezane Circuit Schools.**

**Submitted to the Faculty of Education, in the field of  
MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION  
(MSTE).**

**In fulfilment of the requirements for the degree of Master of  
Education (Natural Sciences),**

**By**

**BONITHEMBA WELLINGTON BUTHELEZI**

**Student Number: 201400001**

**Supervisor/ Co-Supervisor**

**DR R. PILLAY**

**DR R. MOSOLOANE**

**OCTOBER 2018**

## **DECLARATION**

I, **Bonithemba Wellington Buthelezi**, Student Number: **201400001** do hereby declare that this dissertation, tendered to the University of Zululand for the gradation of Master of Education, has not previously been put forward by me for any degree at some other University, and that the entire resources I have employed or cited have been specified and recognised by means of complete reference.

---

B. W. Buthelezi

**Student**

## ACKNOWLEDGEMENTS

My heartfelt sincere gratitude is extended to the Almighty God who facilitated my achievement. It was not through my energy, knowledge, might nor power, but His amazing grace and love towards me.

I appreciate the guidance, encouragement, motivation and understanding demonstrated by my supervisor Dr R. Pillay and my co-supervisor Dr R. Mosoloane who always ensured me that this is going to happen and I will make it. That unstinting encouragement has supported me in the accomplishment of my study.

My heartfelt gratefulness is directed to my father, Philemon Sidumo Buthelezi, and my siblings for their love, support and understanding. My very special appreciation goes to my significant other Thobile (My Wife) for her encouragement and support, love and affection, understanding, assistance, caring and encouragement throughout my hard work. Sthenjwa! Madlokovu, wena waseNgweni Owadlovula imifula, bethi imifula yenile! Ntusiyeinkomo!

Sphumelele Snethemba, Sphindokuhle Andisiwe and Aphelele Siwaphiwe my beautiful daughters, I thank you for your understanding and support. Family life changed from being normal to what you were not used to because of the pressure, it was due to this project. Your daddy loves you so much.

I also like to express special gratitude to the KZN DBE HOD for allowing me to conduct my research in the provincial public schools, the Principals of schools visited for various instruments and observations. I acknowledge the teachers whom I worked with. Thank you so much for your time and participation to this work. I recognise my Principals from my previous school (Mrs B. P. Ngwenya – Matshana Primary School) and my current one (Mrs L. Kunene – Kangikho Primary School) for your understanding in this regard. Thank you so much.

Lastly, my gratitude is conveyed to all my peers, for their support, encouragement, motivation, guidance and understanding throughout my studies. I value your great work conducted inputs and ideas were very much appreciated, your graft was extremely escalated. I am beholden to the Schools, Principals and teachers who contributed in this study; it is through their participation that this study reached its completion.

Thank you. May the Almighty God richly bless you all.

## **DEDICATION**

This thesis is dedicated to my late loving Mother Mirriam Ntombingani Buthelezi (MaShandu), who played a substantial role in my life. Illiterate but an extraordinary and remarkably mentor. I also dedicate it to my other half, my late twin brother Nkosikhona Wellington Buthelezi (uHluthu) whom I have just recently lost him. The rest of the work was done during hard times of trying to understand that he is no longer with us. This thesis is written in their memory, as they did not live to witness the achievement of my goal. May their souls rest in peace.

## ABSTRACT

Teaching strategies support learners in developing knowledge or skills. The teacher therefore needs to have the skills to develop the knowledge and skills of the learners (Killen, 2010). Hence CAPS states that NCS is based on principles including, inter alia, encouraging an Active and Critical approach to learning rather than rote learning and uncritical learning of given truths. Teaching strategies play a role in developing the love of the subject. South African Science teachers are struggling due to inadequate Science content knowledge, pedagogic skills and lack of confidence (Bantwini, 2010 and 2012; Centre for Development Enterprise, 2007 and 2014; DBE, 2013; Muwanga, 2003; Kriek and Grayson, 2009).

The study aimed to explore the teaching strategies that teachers used in Grade 6 in the teaching of Natural Sciences and Technology in the Ngwelezane Circuit schools. The objectives of the study were to identify the teaching strategies used by the Grade 6 Natural Sciences and Technology teachers in their teaching; to explore the views of teachers on the teaching strategies they use in teaching Natural Sciences and Technology in Grade 6 and, to determine the extent to which teaching strategies align to the principles and purposes of the CAPS as indicated in the problem statement. The study employed the Qualitative Research Methodology. The information was derived through the use of survey questionnaires, in-class observation, interviews and document analysis. The study sample comprised of five Intermediate Phase teachers per school.

The findings revealed that telling method, text book and question and answer are dominating in the classes as lessons were conducted, which does not align with CAPS requirements and is promoting passive learning. Teachers are aware of the teaching strategies developing Critical and Active learning as per the responses from the questionnaires and the interviews, but they are not used in class, used to a lesser extent, or not used at all. Lessons were more content based. Very few or no critical learning and problem solving, was developed in learners through active involvement in learning. No proper training was received towards teaching the subject. Other teachers having no background in the subject were mandated to teach the subject by management. The best teaching strategies are those which make the students active participants in the learning process through Active Learning where learners construct their own understanding and knowledge of the world through experience reflecting upon that experience than through rote learning (Harasim, 2012).

## LIST OF THE ABBREVIATIONS

AIDS	-	Acquired Immune Deficiency Syndrome
ACE	-	Advanced Certificate in Education
B. Ed	-	Bachelor of Education Degree
B. Sc	-	Bachelor of Science Degree
CAPS	-	Curriculum and Assessment Policy Statement
CCM	-	Constant Comparative Method
CNE	-	Christian National Education
C 2005	-	Curriculum 2005
CK	-	Content Knowledge
DBE	-	Department of Basic Education
DoE	-	Department of Education
DSG	-	Developmental Support Group
FAL	-	First Additional Language
FET	-	Further Education and Training
GET	-	General Education and Training
GEOG	-	Geography
GSI	-	Graduate Student Instructors
HET	-	Higher Education and Training
HIV	-	Human Immunodeficiency Virus
HIST	-	History
HL	-	Home Language
HOD	-	Head of Department
IQMS	-	Integrated Quality Management Systems
KZN	-	KwaZulu-Natal
LS	-	Life Skills
LTSM	-	Learning and Teaching Support Materials
MCQ's	-	Multiple Choice Questions
M. Ed	-	Master of Education Degree
NCS	-	National Curriculum Statement
NGSS	-	The Next Generation Science Standards
NPDE	-	National Professional Diploma in Education
NP	-	National Party

NQF	-	National Qualifications Framework
NSTECH	-	Natural Sciences and Technology
OBE	-	Outcomes Based Education
PCK	-	Pedagogical Content Knowledge
PK	-	Pedagogical Knowledge
QLSF	-	Quality Labour Force Surveys
QUAN	-	Quantitative Research Method
QUAL	-	Qualitative Research Method
REQV	-	Relative Education Qualification Value
RNCS	-	Revised National Curriculum Statement
SA	-	South Africa
SAQA	-	South African Qualifications Authority
SAQMEQ III	-	The South and Eastern African Consortium for Monitoring Educational Quality
SS	-	Social Sciences
TIMSS	-	Trend in International Mathematics and Science Study

## **REFERENCES**

## **APPENDICES**

Appendix A: Survey Questionnaire

Appendix B: The Teacher Profile

Appendix C: Interview Questions

Appendix D: Interview schedule

Appendix E: Request for permission to conduct research at School (Principals)

Appendix F: Request to participant for permission to conduct research

Appendix G: Informed concern declaration form

Appendix H: Research Questionnaires with responses

Appendix I: Document Analysis of the teacher per school observed

Appendix J: Teacher Profile – Detailed Analysis

Appendix K: Interview Transcript 1

Appendix L: Interview Transcript 2

Appendix M: Interview Transcript 3

Appendix N: Interview Transcript 4

Appendix O: Interview Transcript 5

Appendix P: Detailed Analysis of the Lesson Plans

Appendix Q: Detailed Analysis of Observations

Appendix R: Certificate of Language Editing

Appendix S: Turn it in Report

Appendix T: Analysis of Interviews

Appendix U: Permission to conduct research in KZN public institutions, letter from HOD.

Appendix V: Ethical Clearance Certificate

## TABLE OF CONTENTS

<b>No.</b>	<b>Content</b>	<b>Page</b>
1.	Declaration	i
2.	Acknowledgement	ii
3.	Dedication	iii
4.	Abstract	iv
5.	List of Abbreviations	v
6.	References	vi
7.	Appendices	vii
8.	Table of Contents	viii
	<b>Chapter 1- INTRODUCTION</b>	
1.1	Introduction	1 – 2
1.2	Problem Statement	2 – 5
1.3	Purpose and focus of the study	5
1.4	Research Questions	5 - 6
1.5	Objectives of the study	6
1.6	Intended contribution to the body of knowledge	6
1.7	Context of the study	7 – 8
1.8	Development of education in South Africa	8 – 11
1.9	Chapter Outline (What each chapter entails)	11 – 12
1.10	Concluding Remarks	12
	<b>Chapter 2 – LITERATURE REVIEW AND THEORETICAL FRAMEWORK</b>	
2.1	Introduction	13
2.2	Literature Review	13 – 17
2.2.1	Science and Mathematics and Teacher Education	18-19
2.2.2	Teacher Qualification	19
2.3	Teaching Strategies	19 - 25
2.3.1	Teacher-Centred Approach	25 – 27
2.3.2	Content-Centred Approach	27 – 29
2.3.3	Learner-Centred approach	29 – 33
2.4	Theoretical Framework	33 – 37
2.5	Concluding Remarks	38
	<b>Chapter 3 – RESEARCH METHODOLOGY</b>	
3.1	Introduction	39
3.2	Research Method and Design	39 – 47
3.3	Data Gathering Techniques or Instruments	47 – 52
3.4	Population Sampling	52
3.5	Data Collection	53
3.5.1	Observation	53
3.5.2	Interviews	54 – 56
3.5.3	Research Survey Questionnaire	56 – 57
3.5.4	Document Analysis	57 – 58
3.5.5	Data Analysis	58 – 59
3.6	Credibility and Trustworthiness	59 – 60
3.7	Ethical Issue	61 – 63

3.8	Concluding Remarks	64
	<b>Chapter 4 – DATA PRESENTATION, ANALYSIS AND DISCUSSION</b>	
4.1	Introduction	64
4.2	Data Analysis	64 - 68
4.3	Profile of the Participants	68 - 70
4.4	Data Presentation and Analysis	71
4.4.1	Research Question 1	71 – 78
4.4.2	Research Question 2	78 – 84
4.4.3	Research Question 3	84 – 90
4.5	Discussion	90 - 94
4.5	Concluding Remarks	94 - 95
	<b>Chapter 5 – SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION</b>	
5.1	Introduction	96
5.2	Summary of Research Findings	97 - 100
5.3	Recommendations	100 -102
5.4	Limitations of the study	102-103
5.5	Recommendations for further Research	103-104
5.6	Conclusion	104-105
5.7	References	106-120
5.8	Appendices	120-189
	Appendix A: Survey Questionnaire	122-123
	Appendix B: The Teacher Profile	124-125
	Appendix C: Interview Questions	126
	Appendix D: Interview Schedule	127
	Appendix E: Request for permission to conduct research at School	128
	Appendix F: Request to participant for permission to conduct research	129
	Appendix G: Informed Concern Declaration	130-131
	Appendix H: Research Questions with responses	132-137
	Appendix I: Document Analysis of the teacher per school observed	138-140
	Appendix J: Teacher Profile – Detailed Analysis	141-144
	Appendix K: Interview Transcript 1	145-149
	Appendix L: Interview Transcript 2	150-157
	Appendix M: Interview Transcript 3	158-161
	Appendix N: Interview Transcript 4	162-164
	Appendix O: Interview Transcript 5	165-167
	Appendix P: Detailed Analysis of Lesson Plans	168-170
	Appendix Q: Detailed Analysis of Observations	171-175
	Appendix R: Certificate of Language editing	176
	Appendix S: Turn-it-in Report	177
	Appendix T: Analysis of Interviews	178-187
	Appendix U: Permission to conduct research in KZN public Institutions letter from KZN DoE HOD.	188
	Appendix V: Ethical Clearance Certificate	189

## CHAPTER 1: INTRODUCTION

### 1.1 Introduction

Killen (2010) outlined that teaching strategies support learners in developing knowledge or skills; the teacher therefore needs to have the skills to develop the knowledge and skills of the learners. That is why it is important that in each and every teaching strategy used by the teacher, there should be the skills acquired by the learners for their future empowerment for life. Concurrently, it is imperative that teaching strategies cater for the political, economic, social and technological pressures so as to be more pertinent to learners' needs and more concerned about how well learners are prepared to assume future social roles. The Department of Basic Education (DBE) (2011), Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences and Technology Grades 4-6 (Intermediate Phase), stated that the National Curriculum Statement (NCS) is based on principles including, inter alia, encouraging an active and critical approach to learning, rather than rote learning and uncritical learning of given truths. The NCS aims to produce learners that are able to: Identify and solve problems and make decisions using critical and creative thinking. The document mentioned that Science and Technology complement each other. So the researcher looked at the Natural Sciences component in the same document.

According to the researcher, both the Active and Critical Learning terms intertwine. The researcher agrees with the definition by Beyer (1995) who defined Critical Thinking as making reasoned judgements on statements, new ideas, arguments, research, etc. Although this is an old reference, the definition still corresponds with current thinking, where Paul and Elder (2005) viewed Critical Thinking as the intellectually disciplined process of actively and skilfully conceptualising, applying, analysing, synthesising and evaluating information gathered from or generated by observation, experience, reflection, reasoning or communication as a guide to belief and action. These skills are mentioned in the CAPS document as being expected from learners. Piawa (2010) defined the Creative Thinking process as involving the ability to produce original ideas, to perceive new and unsuspected relationships, or to establish a unique and improved order among seemingly unrelated factors. He further on stated that, in Malaysian schools, teaching and learning strategies involving creative and Critical Thinking have been implemented. Kitchens, Barber and Barber (1991),

articulated that, without knowing student's thinking styles, it is difficult for the teacher to provide teaching strategies and materials that best accommodate learners' learning and thinking styles.

Teaching strategies need to be effective towards learning. An effective strategy is a successful one that brings valuable results in the learning process. It is therefore understandable that, in the active and/or critical learning strategy:

- Learners can explain a complex concept or a physical social phenomenon.
- Sketch a flow chart or circuit or free body diagram or plot a timeline or concept map.
- Solve a short problem or outline the solution of a longer problem.
- Predict or interpret the outcome of a scenario or experiment.
- Critique a report or proposal or design an article.
- Brainstorm a list or formulate a question.

Teachers need to be aware that using effective Teaching Strategies is not an easy job. According to Goodman and Lehman (2010), any strategy can be the "right strategy" depending on the application and the conditions enveloping the lesson. Examples of teaching methods include debates, demonstrations, academic games, listening to oral reports, and use of individual learning. It is therefore vitally important that teachers are made aware of numerous strategies perceived effective to the teaching and learning, but that any strategy can be a 'right-strategy' according to Goodman and Lehman (2010). This makes things seem varied and lively in the classroom. It is therefore essential to explore the teaching strategies used by teachers teaching and learning processes. An effective teaching strategy can be perceived through the outcomes observed through the way learners produce quality results in their exit classes, and the way they perform in the society and or the world of work.

The researcher's experience in teaching Natural Sciences and Technology, the love of the subject, and what the researcher has observed happening in the field, has led to the motivation to conduct this study. The study investigated the effectiveness of the teaching strategies that teachers apply in schools when teaching Natural Sciences and Technology in Intermediate Phase Schools in the Ngwelezane Circuit. The strategies to be used in the teaching of Natural Sciences and Technology must be observed and the learners must test

some ideas and these ideas need to be proven and must also cater for cultural diversity from the community. This means that the strategy used by the teachers must observe the learners and test the ideas. Teachers therefore need to make sure that they cover these aspects in their teaching. This implies that the techniques and approaches used in teaching the subject must promote the search to understand the world, which strategies need to promote. This section, therefore, includes background, the purpose and focus of the study, assumptions of the study, objectives, research questions and the rationale of the study. The location of the study and the structure of the theses were briefly discussed.

## **1.2 Problem Statement**

Bantwini (2010) spelled out that what is evident from most teachers was the lack of confidence in the curriculum reforms. He stated that the rapid and frequent restructuring of the education curriculum over a short period has caused uncertainty and anxiety among teachers, who are unsure about policy changes and which policy applies at a particular time. Teachers have attended many professional development activities (mostly during school time) to prepare them for the latest changes and this has led to loss in teaching time.

The new curriculum that has been tested in South Africa like Outcomes Based Education, known as Curriculum 2005 (C2005), may have negatively affected learners' knowledge - a situation caused by teachers struggling to understand the new outcomes-based approach and teaching using unfamiliar teaching materials. In the teaching and learning process, the teacher is central in creating a supportive environment for learning Science and Mathematics (Reddy, 2006). The other factor that plays a role in underperformance of learners in schools, especially in science subjects has to do with strategies that science teachers use to teach Physical Sciences (Makgato and Mji 2006: 254). They further mentioned that many teachers use traditional teaching practices like instructional practices and lack basic content knowledge. Capps, Crawford and Constan (2012) addressed researchers who found that primary school teachers often have little or no formal science training, and they lack familiarity with the fundamentals of Science Inquiry.

Teaching strategies play a role in developing the love of the subject. If the teacher is presenting his or her lesson without considering the interest of the learners, learners will end

up not having a love for the subject. Lindahl (2003) found that interest in science is mainly formed during the primary school period and therefore the teacher's role is of great importance in laying out the background. This denotes that allocating teachers who have qualification in science, to teach science lessons in primary schools plays a pivotal role in the love and performance of the learners as the outcome of learning and teaching process. The researcher concurs with Adler and Reed (2002) who stated that content knowledge is not enough. There are studies showing that SA science teachers are struggling due to inadequate science content knowledge and pedagogical skills and lack of confidence (Bantwini 2010 and 2012; centre for Development Enterprise, 2007 and 2014; DBE, 2013; Muwanga, 2003, Kriek and Grayson, 2009).

Dhurumraj (2013) in a study on contributing factors to poor learner performance in Physical Sciences in KwaZulu-Natal province focusing on the Pinetown district, found that for the past five years, South Africa has seen a gradual decrease in the pass rate in National Senior Certificate results for the subject Physical Sciences. In 2011, 22, 4% of Grade 12 learners who passed Physical Sciences were admitted to institutions of higher learning (Department of Education: 2012b); a possible assumption for poor performance and low higher learning entrance is the way the subject was taught in the early grades in the Intermediate Phase. Adler, Slonimsky, and Reed (2002), debated that teachers need to know the subject matter they are teaching and, moreover, that they need to know how to present this clearly to learners.

The researcher strongly agrees with Kriek and Grayson (2009), insisting that teachers need development along three dimensions simultaneously; content knowledge, teaching approaches and professional attitudes. The researcher believes that the way the subject is taught in the lower grades might have an impact on the performance trend. That is why the researcher sees a need to carry out research focusing on the teaching strategies used in teaching Natural Sciences and Technology in the Intermediate Phase. So this study is to pursue what teaching strategies are used, why they are used and how they are used. The discipline of science is based on content knowledge, methodology and relevant pedagogic theory, (Kriek and Grayson, 2009). They also highlighted that strengthening science teachers' content knowledge should be an essential component of any professional development programme. There are studies showing that SA science teachers are struggling due to

inadequate science content knowledge and pedagogical skills and lack of confidence (Bantwini 2010 and 2012; Centre for Development Enterprise, 2007 and 2014; DBE, 2013; Muwanga, 2003). Kriek and Grayson (2009) call attention to the fact that teachers need to be confident in their knowledge of the subject that they are teaching, and teacher education programmes should be structured in ways that help teachers develop both subject and pedagogic knowledge or ask the Norms and Standards for Education to include it.

The researcher agrees with Adler and Reed (2002) that content knowledge is not enough, the issue is how to integrate further learning of the subject with learning about how learners in schools acquire subject knowledge. This study seeks to contribute to the “how learners in schools acquire subject knowledge” by focusing on the way material is presented by the teachers through their teaching strategies, more especially to gauge the alignment to the expectations of the CAPS curriculum of Active Learning.

### **1.3 Purpose and Focus of the Study**

The purpose of the study was to explore the teaching strategies employed by Grade 6 teachers when teaching the Natural Sciences and Technology in Intermediate Schools in the Ngwelezane Circuit. Van der Westhuizen & Mosoge. Nieuwoudt, Steyn, Legotlo, Maaga, & Sebege, (2002), elucidated that, when there is inadequate preparation on the part of the teacher and a limited academic background, the result is poor teaching and learning in schools. The study also explored why teachers use these strategies and whether the teaching strategies that are aligned to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Basic Education will assist Natural Sciences and Technology teachers in making the teaching of the subject fun and interesting. This will lead to the learners being inspired and that, in turn, will make them become interested in the subject and improve results.

### **1.4 Research Questions**

The study intended to answer the following research questions:

- (1) What teaching strategies are used by Grade 6 Natural Sciences and Technology teachers in their teaching in the Ngwelezane Circuit?

- (2) What are the views of the Grade 6 Natural Sciences and Technology teachers on the teaching strategies they use in teaching the subject?
- (3) To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?

### **1.5 Objectives of the study**

The objectives of this study were to:

- Identify the teaching strategies used by Grade 6 Natural Sciences and Technology teachers in their teaching in the Ngwelezane Circuit.
- Explore views of teachers on the teaching strategies they use in teaching the Natural Sciences and Technology in Grade 6.
- Determine the extent to which teaching strategies align to the principles and purposes of the CAPS as indicated in the problem statement.

### **1.6 Intended contribution to the body of knowledge**

The study will contribute to the body of knowledge by identifying the strategies that teachers can use when teaching the subject in schools, how the teachers view the use of the teaching strategies and why they use those strategies. This will be done after the study has been published and made available to libraries and the Department of Education as the copies will be sent to it. The copies will also be issued to the institutions through libraries and will be critically read by learners in contributing to the body of knowledge.

When the study has been completed, the material generated by the research will be published through the relevant media and libraries. Copies of the research will be given to the institutions that took part i.e. schools and the Department of Education. Should there be any academic conferences and workshops, through the assistance of the supervisor, the research will be presented for further additions and positive criticism. The research materials will also be published in the accredited journals which will be done through the help of the supervisor.

## 1.7 The Context of the Study

The South African National Curriculum (Grade R to 12) aims and serves to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives and for participation in society as citizens of a free country (Department of Basic Education, 2011). Therefore, Natural Sciences and Technology teachers have the responsibility to promote love for the subject to develop knowledge, skills, and positive attitudes and bring out values in learners. This could be done through the use of effective teaching strategies. The following are the aims of teaching Natural Sciences and Technology in Grades 4-6 as per the Curriculum Statement for Intermediate Phase p. 10 - 11 issued to the teachers as a resource for teaching:

(i) Doing science and technology

To achieve this, the teachers must use methods that allow the learners to practically plan and undertake simple investigations and solve problems. Learners essentially should be able to analyse the problems and use practical processes and skills in designing and evaluating the solutions.

(ii) Understanding and connecting ideas

When teachers teach for the learners to achieve this specific aim, the learners should be able to have a grasp of scientific, technological and environmental knowledge to apply in new contexts. Teachings should give support to learners to make correlations between the perceptions and concepts in their minds.

(iii) Science, Technology and society

The teaching method must make learners comprehend and appreciate the practical use of Natural Sciences and technology in society and the environment, and for them to absorb values as caring and creative citizens.

The Natural Sciences and Technology Curriculum and Assessment Policy Statement (CAPS) Document, Intermediate Phase Grades 4-6 (Department of Basic Education, 2011), stated that teaching of Natural Sciences and Technology has been shaped by the search to understand the natural world through (1) observation, (2) testing and (3) proving of ideas, and has become integral to the cultural heritage of all nations. Dhurumraj (2013) avows that Physical Sciences as a subject requires an Active Learning strategy instead of a passive learning. The study focused on Natural Sciences and Technology which include biological concepts, which was

not covered in his study. He further said that Active Learning involves learners and teachers; education becomes a two-way process with both the teacher and the child learning from each other. The study was based on the principle of Active and Critical Learning; encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths (DoE, 2011, p4). The strategies used need to be effective for learning and teaching. Effective in the sense that when the teacher has used the strategy he or she perceives as effective, the strategy must be able to produce learners that are able to:

- Work effectively as individuals (independently) and with others as members of a team.
- Collect, analyse, organise and critically evaluate information, and
- Communicate effectively using visual, symbolic and/or language skills in various modes (DoE, 2011: p5).

## **1.8 Development of Education in South Africa**

In history, our country has experienced various education systems like education that was provided in the past. Booysse and le Roux (2010), stated that it is the kind of education which used to take place in traditional societies, based on extended family or clan, forming the community. Children were taught to become useful members of the society, and this education system was gender specific. Because of modernisation and urbanisation, traditional education is becoming a thing of the past.

Landing in the Cape in 1652, the Dutch established a school where children were taught to read, write and to count in Dutch (le Roux, 2013). The Dutch created an idea of superiority of Europeans in the minds of the indigenous South African people. Le Roux also mentioned that the Dutch school was established in 1658 for young slave children and was not successful. The other one was established in 1663 for 12 colonist (white) children, four slave children and a Khoi (indigenous) child. The British ruled Cape Town from 1795 to 1803; they then established a separate education system in 1806 in the Cape Colony (le Roux, 2011). He mentioned that later the Cape Education Department was established and that separate primary and secondary schools were established. The education was formal in this kind of education system. From 1841 onwards, state aid was made available to mission schools on

condition that English was taught and the Education Department had the right to inspect them (le Roux, 2011)

The National Party (NP) came into power in 1948. They implemented an education system which invented the word 'apartheid'. The word 'apartheid' meant separation. Race was used to separate people according to groups in South Africa. In 1953 the Bantu Education Act of 1953 was endorsed by parliament, which made provision for formal education for Black people, Indians and Coloured people. Since National Party rule in 1948, it was apparent that there is racial discrimination in South Africa. This continued until the subsiding of Apartheid in the 1990s, where apartheid was fought. In the year 1976, it prevailed as the beginning of a long period of resistance to 'Bantu education', where blacks were showing discontent with black education.

This resulted in strike combat and boycotts started in the early 19<sup>th</sup> century. The 1960s saw the birth of the Black Consciousness Movement. This movement aimed at uniting all the oppressed people of South Africa - African, Coloured and Indian - of all classes, in the struggle against white domination in all its forms, political, economic, social and psychological (le Roux, 2013). This led to Soweto uprising in 1976 where new Grade 8 pupils in classes in high schools found themselves in large classes, with teachers struggling to cope with both large numbers and twofold language policy. This led to protests extending from school to school. In June 1976 a mass demonstration against the use of Afrikaans and to stipulate the end of Bantu Education in South African schools. This brought to the abolishing of the 1986 provincial councils which had control on white education. The control of white education was centralised under the Department of Education and Culture, House of Assembly, which represented whites in Parliament. Coloured and Indian education fell under similar departments of Houses of Representatives and Delegates, respectively (Joubert and Prinsloo, 2009). Control of black education fell under any of the Departments of Education of the ten black homeland governments, or under the Department of Education and Training. This department had replaced the Department of Bantu Education in 1979 and controlled black education outside the black homelands (le Roux, 1993).

In 1990, the National Party government recognised unrest, violence, and foreign opposition, and they abandoned the policy of Apartheid. Negotiations resulted in the first fully

democratic election in South Africa, which is regulated by its Constitution, The Bill of Rights and The South African Schools Act, securing non-racial education in South Africa. All this brings us to education in the era of democracy which focuses on creating a system of high quality education for all country's learners (Joubert and Prinsloo, 2009). All the 18 different education departments in South Africa have been amalgamated into one National Department of Basic Education (DBE) and nine provincial departments (Department of Education, 2001). The South African Education system as a whole is guided by the National Qualification Framework (NQF) that "is a comprehensive system approved by the Minister for the classification, publication and articulation of quality-assured national qualifications (NQF Act 67 of 1998: p6). The structure of Basic Education (DBE) in South Africa comprises the Primary Schooling Phase (Foundation Phase Grade R to 3) and Intermediate Phase Grades 4 to 6), the Senior Phase which is Grades 5 to 9, which forms the General Education and Training Band (GET Band). After this Band is the Further Education and Training Band (FET), this is from Grades 10 to 12). The focus of the study was the Intermediate Phase, as the researcher is more experienced in teaching in the stated phase.

After all these changes, the country ended up having a new curriculum. The new curriculum was adopted in 1999. It was structured in accordance with the principles of Outcomes Based Education (OBE). This new curriculum was known as Curriculum 2005. It was intended to support teacher independence and Critical Thinking, and teachers were free to design and choose their own teaching content and the strategies to teach the content. Teachers were understandably struggling to implement the OBE curriculum, as described in the National Curriculum Statement (NCS), it was then revised and was adopted as Revised National Curriculum Statement (RNCS). This was revised to more stipulated syllabus content, however this, too, attested unsuitable, and another new curriculum was adopted in 2011. The new curriculum introduced in 2011 was titled the Curriculum and Assessment Policy Statement (CAPS). It is a skill-based curriculum rather than outcomes-based or the content curriculum. CAPS is fully prescribed and it prescribes what to teach and when to teach it. The content is given for every subject and every grade.

It also outlined an assessment programme and provides teachers with model examination papers and assessment tasks. One comprehensive CAPS document for each subject in a phase replaces the Subject Statements, Learning Programme Guidelines and Subject Assessment

Guidelines that made up the previous curriculum statements (of 2002 and 2009). This gives the overview of the education systems we had in South Africa before one reads about the strategies used by teachers when teaching Natural Sciences and Technology in Grade 6 in schools in Ngwelezane circuit. According to CAPS, in the Intermediate phase, the subjects are Home Language (HL IsiZulu), First Additional Language (FAL English), Mathematics, Life Skills (LS), Social Sciences divided into Geography and History Section (SS – HIST and GEOG) and the Natural Sciences and Technology (NSTECH). The researcher focused on the teaching of the Natural Sciences and Technology section of the learning programme. The researcher identified from the above literature review that the present study will address the existing gaps which are evident, since it is focused on the specified grade and/or phase in the teaching of Natural Sciences and Technology in Grade 6. The researcher will aim to investigate the extent to which teachers in Ngwelezane Circuit practice according to the required curriculum.

## **1.8 Chapter outline and what each chapter entails**

### **CHAPTER 1 – INTRODUCTION**

In this chapter, the researcher provides introduction to the study, and states the problem. The objectives and the research questions are also portrayed.

### **CHAPTER 2 – LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

In Chapter 2, appropriate literature is examined to provide conceptual and theoretical frameworks for the problem under examination. Different approaches in teaching are also displayed.

### **CHAPTER 3 – RESEARCH METHODOLOGY**

Chapter 3 discusses the research methodology and the research design that the researcher used in this study. Population and sampling used for data collection are discussed. The ways of collecting data and data interpretation techniques are discussed in the same chapter.

## **CHAPTER 4 – PRESENTATION OF DATA**

This chapter is about the central aim and objectives of the study as presented in Chapter 1 during data analysis and processing.

## **CHAPTER 5 – DATA ANALYSIS AND FINDINGS**

Chapter 5 presents the findings of the research project and makes some recommendations. Suggestions for further investigations around the same topics are also made.

### **1.9 Concluding Remarks**

The background on the necessity of the study had been brought to attention and outlined by the researcher. Active and Critical Learning are emphasised as essential skills in the current teaching and learning environment, by the teachers with competent pedagogy in the teaching of Natural Sciences and Technology especially in the Intermediate Phase, as the foundation for future Physical Sciences, with focus in Grade 6 as an exit class to Senior Phase. Teachers needing to make learners love the subject and teaching it with interest also looked at. The purpose of the study was elucidated with research questions, objectives of the study, intended contribution to the body of knowledge and its context and the chapters to follow were outlined

## **CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

### **2.1 Introduction**

Creswell (2012) described Literature Review as a written summary of journals, articles, books and other documents that describe the past and current state of information on the topic of your research study. In this chapter, the researcher wanted to accomplish what Creswell uttered. Literature was organised into subtopics and some documents were summarised. The researcher will support the findings as Creswell (2012) mentioned that researchers use the literature to support the findings. Literature contained both primary, which is literature reported by individuals who conducted research and originating ideas; and secondary, which is literature that summarises primary source materials (Creswell 2012; p83)

### **2.2 Literature Review**

Roche, Adiga and Nayak (2016) stated that Active Learning Strategy has many benefits for the learners (learners). They state that its aim is to enhance Active Learning, comprehension and Critical Thinking with a view to promoting horizontal and vertical integration between subjects. Hence Nelson and Crow (2014) explained Active Learning strategies as strategies that teach learners to think critically and must, therefore, be the type of activities that are designed to mentally stimulate and engage thinking in a relevant context. They furthermore show that learners can be physically and/or verbally active in a learning experience. Subsequently, Arslan, and Demirtas, (2016) endorsed that Critical Thinking is a self-regulated process of reasoning that is defined as an individual making a judgement of conclusions by questioning, affirmation, approval and correction in the process of cognitive activities focused on a special purpose.

Hence, Bean (2011) described Active Learning as exercising Active Learning exercises as strategies that make learners more powerful thinkers and better arguers. Whereas, Bhalli Sattar and Asif, explored Active Learning as a process whereby learners engage in activities like reading, writing, discussion or problem solving, problem analysis, syntheses and evaluation of educational content. They further stated that Active Learning can be promoted

by simulations, bedside teaching, clinical skills, demonstrations, tutorials, group discussions, problem-based learning, clinical scenarios, and class quizzes, multiple choice questions (MCQs) at the beginning or the end of a lecture. Although these Active Learning strategies are recommended for medical learners, the researcher saw them fit for the student teachers and the teachers in the teaching of Natural Sciences and Technology as it forms the basis of science required in medical career training. He furthermore stated that he recommends the use of case studies, role playing, small group work, and creative activities which stretch thinking skills that can be applied to appropriate situations. Moreover, according to Felder and Brent (2009), Active Learning is defined as anything course-related that all learners in a class session are called upon to do other than simply watching a lecturer and taking notes. They furthermore state that it includes answering questions in class, completing assignments and projects outside the class, carrying out laboratory experiments or anything else other than sitting passively in a classroom.

This means that teachers need to know the learners' thinking styles to accommodate them in their teaching. While Sanyin and Li-Fang (2017) focused on the thinking styles for deaf, hard of hearing and hearing learners in America, they defined thinking style as referring to people's preferred ways of dealing with tasks or using their abilities (Sternberg, 1988). Although this was an older definition, Zhang and Sternberg (2006) defined thinking style as the individual's preferred way of processing information and dealing with tasks. They further mentioned that it predicts various aspects of student development. Zhang (2002), classified 13 thinking skills into three types, Type I, Type II and Type III. He mentioned that Type I includes legislative, judicial, hierarchical, global and liberal thinking styles. These highlight creativity, evaluation and priority. Type II included executive, local, monarchic and conservative styles, which value established rules for performing tasks, paying attention to details, performing tasks sequentially and taking traditional approaches to tasks. Type III includes anarchic, oligarchic, internal and external thinking styles. It involves performing whatever task may come along and doing multiple tasks without regard to priority, while internally and externally focusing on independence and co-operation. Matching style to learning and thinking style will increase academic achievement and make the teaching and learning process an enjoyable experience.

“Science teachers are tasked with a set of challenges to make science lessons interesting; inspire learners with wonders and excitement; increase the flow of scientists, entrepreneurs and technicians for tomorrow; and ensure that citizens and consumers understand the risks and benefits of modern science”, Osborne and Dillon (2010: p7-8). There are other challenges associated with the teaching of Natural Sciences and Technology in South African schools where the challenge is proficiency in subject knowledge and teaching skills. One of the challenges in South African education is that rural schools are battling to retain appropriate teachers in teaching especially in primary schools.

Bertram, Mthiyane and Mukeredzi (2013) wrote that many rural schools in South Africa are struggling to find suitably qualified teachers. Hence Hugo, Jack, Wedekind and Wilson (2010) argued that rural schools, in particular, find it difficult to attract qualified teachers and thus there is a situation where unqualified teachers are in the classroom. This brings a concern on the quality of teaching and whether the strategies are effective in their teaching. (Bantwini (2010 and 2012) confirmed that there are studies that show that South African science teachers are struggling due to inadequate content knowledge, poor or inadequate pedagogical skills and lack of confidence. The difficulties in primary school Science education are exacerbated by the fact that the subject is mostly taught by teachers who did not specialise in it (Bantwini, 2010; DBE, 2013). They are allocated to the subject having not done it in their training for various reasons such as the shortage of appropriately trained teachers or teachers not having the subject in their qualifications, especially in the Primary schools, unlike in High Schools where the speciality is of utmost importance.

It is further confirmed by (Bantwini, 2010) that in the Primary schools in South Africa, science education has, for a while, been struggling to receive the attention currently enjoyed by the High School level. Grossman, Jones, Straker (2006) and Reed (2009) stated that there does seem to be some consensus amongst researchers that four key domains are Content Knowledge (CK is the knowledge of the subject content that needs to be taught); general Pedagogical Knowledge (PK is knowledge of different teaching strategies, classroom management strategies, assessment strategies, etc.); Context Knowledge (CK is knowing about the background of the learners and knowing the organisational culture of the school, etc.) and the Pedagogical Content Knowledge (PCK is the content-specific pedagogy that addresses how teachers make their specific subject content accessible to learners). The

researcher agreed with van der Sandt, Niewoudt (2003) and Taylor (2009) when articulating that there have been a number of studies reporting on South African teachers' poor content knowledge, particularly in maths and science. That is why it became a prerequisite for the researcher to accomplish this study to look at the strategies that can be effective to learners when teachers are teaching in schools.

Walan (2016) talked of the Inquiry-and-Context-Based Science Education strategy in primary schools, which he names it the IC-BaSE. The Next Generation Science Standards (NGSS) (2013) defined Inquiry Based teaching as a teaching strategy that involves engaging learners in using Critical Thinking skills. It also mentioned that these skills include asking questions, design, carrying out investigations, interpreting data as evidence, creating arguments, building models and communicating findings. This should deepen learners' understanding of using logic and evidence about the natural world. The study aimed to develop an understanding of primary school teachers' knowledge of inquiry and context based science education. He mentioned reasons for his study, one of which was the need for professional development in teaching those who teach Science in Primary Schools.

The other reason was stimulating learners' interest in teaching science. The study was both qualitative and quantitative in nature. The sample was 12 primary school teachers working with 10 – 12-year-old learners. Learners responded positively to IC-BaSE, and had fun. The study found that teachers need to move forward, not only to be “doing”, but also know why they are doing the activities and how to do them. Learners need to be interested in their learning, Walan (2016) further restated that inquiry-based or context-based teaching methods are instructional strategies as they stimulate learners' interest in learning science. Dewey (1938/2004) advocated what he called “Progressive Teaching”. This researcher perceives this strategy as a “Progressive” one because it is said that learners should be active learners instead of passive receptors.

Walan (2016) also stressed that teachers must consider and pay attention to what learners are interested in as these interests are possibilities for development. He further said that knowing about their interests may help the teacher in choosing teaching strategies and the materials to use. Dewey (1938/1998) reflected that the learning must be rooted in the conditions of experience and arouse an active request for information and new ideas. He further mentioned

that this must be grounded in the experiences of everyday life. Concurrently Fitzgerald, Dawson and Hackling (2013); Hofstein, Eilks and Bybee (2011); Holbrook (2003); Osborne and Dillon (2008), called it attention to difficulties when facts are taught in isolation from a context. This does not motivate learning. Many studies have shown that learners' interests and motivation in science education is low.

Reddy (2006) affirmed that mathematics and science teachers in South African schools are the least qualified when compared to international teachers, as opposed to the international teachers who mostly had at least a 4-year degree qualification. According to *eNCA.com* report on 5 September 2013, there were currently 7,076 unqualified teachers on the education department's payroll. These are teachers who have only a grade 12 qualification. There are also 2,642 under-qualified teachers in the country, who have completed matric and who only have one or two years of tertiary studies under their belts. This was revealed in a reply to a question posed to the National Council of Provinces in response to a query from Congress of the People (Cope) Member of Parliament, Swaphi Plaatjie.

Education analyst Graeme Bloch told *eNCA.com* that the number, as a portion of the total number of around half a million teachers, is not significant. However, Bloch said it was still important to ensure that teachers were appropriately qualified. "It is something we must worry about because we want our kids to get the best. But, at the same time, we must understand that it's 10,000 (unqualified or under qualified teachers) out of 400,000 teachers, so it's a small number, but it's still not a significant number." Bloch added that university qualifications were not enough to ensure good pass marks. "We've got a lot of bad teachers who have managed to get themselves university degrees. That's part of the problem. Our results at primary level are very poor despite the fact that teachers' qualifications have improved massively since 1994."

According to departmental figures, in December 2011 there were 4,786 under-qualified teachers. The department currently paid for bursaries which allowed teachers to finish their education training. "Of all the provinces, KwaZulu Natal (KZN) was the worst affected when it came to unqualified teachers. "What we are doing now, we are no longer saying be a teacher and then give you a bursary. We target you. If there is a best student in science, who qualifies for BSc, we give you a bursary to do an extra year to be an educator. So, as a country, we are getting highly qualified educators in the past three or five years" *eNCA*, so the teacher's qualifications are getting better.

### **2.2.1 Science and Mathematics and Teacher Education**

Reddy (2006) further stated that the performance of learners in mathematics and science in South Africa is very poor. In a speech delivered by the former Minister of Education (Pando, 2008), she identified the dismal performance of learners in Science and Mathematics as a major concern and a factor that contributes towards skills shortages impacting the country's economy. Whereas the Presidency (2011), in his National Development Plan Vision 2030, put emphasis that good science and technology education is crucial for South African future innovation and vital to development as they underpin economic advances, improvement in health systems and educational infrastructure. According to Shepherd (2013) she declared that, recently, the World Economic Forum ranked South Africa 137<sup>th</sup> out of 139 countries in terms of mathematics and science teaching.

Spaull (2013) mentioned the causes being poor teacher education as well as a broad nation concern over the poor state of teachers' knowledge, particularly their subject content knowledge. Spaull (2013) expressed that the teaching of mathematics in South African schools is amongst the worst in the world. He further state that, in 2011, the Trends in International Mathematics and Science Study (TIMSS) showed that South African learners had the lowest performance among all 21 middle-income countries that participated. This confirmed that there is a challenge in the learning and effective teaching of Natural Sciences and Technology in South African schools. "In 2004, only 48 percent of teachers met the minimum requirement qualification of REQV 14. REQV stands for Relative Education Qualification Value, which is the current minimum professional qualification for educators (Government Gazette, volume 596, no. 38487).

### **2.2.2 Teacher Qualifications**

The document states that for REQV 10 it was when the teachers had Standard 8 or 10. Adding a certificate in education brought the teacher to REQV 11 state. If the teacher qualifies to National Diploma in Education Part 1 (NPDE), they have achieved REQV 12. Having completed Advanced Certificate in Education (ACE) or Bachelor of Education (B.Ed.), the teacher qualifies for REQV 14. When the teacher acquires an Honours Degree (B.Ed. Honours), she or he reaches the REQV 15 level. A Master's Degree (M. Ed) is REQV

16 and Doctor of education is REQV 17. The minimum level expected for school teachers is REQV 14. According to the Quality Labour Force Surveys (QLSF), Statistics South Africa of 2010, the proportion of secondary and primary school teachers with REQV 14 and higher was 78,9 and 36,0 percent respectively (68,7 percent together). A further 18 percent are adequately qualified at an REQV 13 level. This implies that, in 2010, 13.3 percent, or approximately 55 000, Basic Education teachers remained under qualified even by the more lenient requirements that applied in 2000” (Shepherd 2013: 2). According to Trends in International Mathematics and Science Study (TIMSS, 1995, 1999, 2002, 2011), science education has been receiving some but insufficient attention from various stakeholders due to learners’ poor performance in TIMSS assessment in grades in the Intermediate and the Senior Phases.

### **2.3 Teaching Strategies**

According to Bhalli, Sattar and Asif (2016), teaching strategies refer to the methods, techniques and procedures a teacher uses during instruction to achieve desired learning objectives. They mentioned that best teaching strategies are those that make the learners active participants in the learning process. This means that teachers need to make sure that their teaching strategies involve the learners because learners learn better if they are actively involved in the educational content they are being taught. It is therefore important to understand the way learners learn as it helps in the selection of the teaching strategies best suited to them. Killen (2010) expressed that teachers can help learners develop knowledge or skills, but no single teaching strategy is effective all the time for all the learners. It calls for the teacher to be flexible and be equipped with various strategies in teaching whilst training in order to use them in their teaching field. That is why Borich and Tombari (1997) stated that learners are individuals, so a “one-size-fits-all” lesson will not give equal learning opportunities to all the learners. They further mentioned that learning is a social or cultural experience, so it is necessary to create opportunities for appropriate interactions between learners.

The researcher agrees with Borich and Tombari (1997) that if teachers want quality learning to occur in their classrooms, they must deliberately teach in ways that will enable and encourage learners to engage in the intellectual activities that promote quality learning. They

stated that learning is most effective when learners have opportunities to think and reason and debate their understanding. It is necessary to deliberately create these opportunities by employing appropriate teaching strategies. The researcher viewed different teaching strategies that the teachers can use in the teaching of Natural Sciences and Technology. There are a number of teaching strategies suitable for the teaching of Natural Sciences and Technology which the teachers can choose from for effective teaching and learning, that caters for Active and Critical Learning. They are discussed as follows:

- (a) **Direct instruction** - Borich and Tombari (1997) defined this as a teaching strategy where learners are guided as they work with information. Teachers help learners to find information, remember it, understand it, organise it, apply it, evaluate it and think creatively.
- (b) **Discussion** - according to Borich and Tombari (1997), it is an appropriate teaching strategy. This is a strategy in teaching where a class discusses or talks about something, in this case something scientific, to create a decision to exchange ideas. It is used to organise and control the classroom. Discussions can also use small groups.
- (c) **Co-operative learning** - is working together to achieve shared goals. It is an instructional technique in which learners work together in small groups to help one another achieve a common learning goal. It is based on the belief that learners can achieve more working collaboratively than by working alone or by passively receiving information from a teacher (Borich and Tombari (1997, p.215). Hence Majumalon (2015) described it as instructional use of small groups through which learners work together to maximise their own and each other's learning. He mentioned that each member has a valued role in the learning process and everyone is responsible for each other's learning. There are benefits that Majumalon (2015) stated when this strategy is employed. He said the learners are able to acquire positive interdependence, individual accountability, and that all have equal participation and simultaneous interaction.
- (d) **Problem solving** - is defined by Borich and Tombari (1997), as the learning that takes place in order to solve the real problem to show that the learners have understood the information. Sale (2001) mentioned that problem solving promotes creative or divergent thinking and critical or convergent thinking in learners. Loyens and Gijbels (2008) conveyed that problem solving develops Critical Thinking skills and prepares the learners for the professional work environment. Hence, in teaching and learning

where no problem solving is exercised, the learners will not be able to acquire the creative and Critical Thinking skills needed in Natural Sciences and Technology teaching.

- (e) Sale (2001) talked about **learner research as a teaching strategy**. He mentioned that this strategy helps learners to understand and work through each of the stages to learn how to investigate experiment, evaluate information and draw logical conclusions. The researcher strongly agrees with the use of this strategy by teachers in their teaching of Natural Sciences since it promotes these skills that are needed in the teaching of the subject.
- (f) **Role-playing** - is also one of the teaching strategies. Sale (2001) explained it as a strategy with learning activities in which one or more learners are required to “act” a part, for example in the learning of how the earth rotates and revolves around the sun, the teacher can let them role play after he or she has explained the process. He also enlightened it as “performance activities”. It may be formal (a scripted play), structured (like debating), free flowing (role-play) or mixture of structure and freedom (simulation games). He further mentioned that it could be used from whole-class activities to small group work. Majumalon (2015) described it as role-playing and simulation where he explained it as a strategy used to dramatise the situation. He stated that pupils are placed in a situation that models a real life phenomenon. The researcher concurred with the use of this strategy by teachers when teaching Natural Sciences and Technology, but it needs to be implemented with care as the learners might end up playing the whole period if the teacher is not careful in its usage.
- (g) **Case study** - as a teaching strategy this is an approach to teaching that incorporates many of the features and advantages of discussions, group work, cooperative learning and learner research. It is a story with a hidden message - a narrative that describes an actual or realistic situation in which an individual or a group has to make a decision to solve a problem (Sale 2001; p323).
- (h) **Writing as a strategy** - is defined by Sale (2001) as a strategy where learners can be asked to write for two very different reasons. These are writing to demonstrate learning and writing to learn.
- (i) **Hands-on or enquiry student centred strategy** - is suitable for Natural Sciences and Technology teaching. Sale (2001) mentioned that it leads to experimentation, exploration and self-discovery, helping engage learners in a more active classroom.

Hence Majumalon (2015) described it as a discovery approach where the motivation of learners is increased through experiencing something different from their day-to-day activities. An example given by Sale (2001) is nature study which, he said, is a wonderful hands-on way to learn about natural world, and which promotes effective teaching of the subject. He also mentioned that this can also be done through play, where the learners can build models, learning while playing like building paper airplanes.

- (j) **Laboratories and/or field work** - is also a strategy to be used in teaching Natural Sciences and Technology. Sale (2001) portrayed it as learning about science by doing laboratory activities or field work. On the other hand, Majumalon (2015) explained it as an inquiry approach. He verbalised it as the handling of situations in the physical world. He mentioned that it allows learners to develop skills of recognising problems, asking questions, applying laboratory procedures and providing consistent description, predictions and explanations. Sale (2001) concurred that it is hard to imagine learning about science without doing laboratory or fieldwork. He further mentioned that experimentation underlines all scientific knowledge and understanding. Laboratories are wonderful settings for teaching and learning science.
- (k) The other strategy is **Reflective teaching**, described by Majumalon (2015) as a strategy that helps learners to frame a problem, bridge a gap between theory and practice, understand and influence their own thinking, recognise depth and range of transferable skills learned and become lifelong learners. The researcher looked at the strategy as the one that can be effective to the teaching of Natural Sciences and Technology which can be used by the teachers when teaching the subject.
- (l) **Lecture and student recitation method** - could be used by teachers in the teaching of Natural Sciences and Technology. Majumalon (2015) described it as a lecture method used to explain, demonstrate and present information on the topic to be taken up. He mentioned that it should not to be used all the time. The researcher concurs with him in that there are topics that cannot be easy to learners, even if the teacher is using cooperative methods and others that might develop a constructivist approach, but some topics need to be explained by the teacher. This is when the lecture method can be effective.
- (m) **Field trip** - is also a teaching strategy effective for the teaching of Natural Sciences and Technology. Majumalon (2015) perceived it as a vehicle by which science can be

learned and taught. Krepel and Duvall (1981) defined field trips as “a trip arranged by the school and undertaken for educational purposes, in which the learners go to places where the materials of instruction may be observed and studied directly in their functional setting. Michie (1998) stated that field trips are valuable for cognitive and effective development of the learners. He also stated that field trips provide opportunities for hands-on, real world experiences, improved quality of education, motivation and development of positive attitude towards the subject, improvement of the socialisation between learners as well as development of rapport between teachers and learners. The researcher fully agrees with this method as it is effective towards his teaching when learners are taken to the nearest Science Centre at Richards Bay. Learners get a chance of watching exhibitions related to science, demonstrations by the facilitators who are science graduates and are given a chance to do some experiments. It is indeed an effective method that could be used by teachers in the development of science in learners.

- (n) **A project** - is also a method good for the teaching of Natural Sciences and Technology. In the assessment programme it is also included as a form of assessment in the subject. Majumalon (2015) described it as a teaching strategy that involves gathering and organising information about a concept and presenting it in a concrete form. With this method, the learners can do projects individually, in pairs or as a group. This promotes cooperative learning if they are in pairs and in groups.
- (o) Majumalon (2015) mentioned **Games** as one of the teaching strategies that can be used in teaching Natural Sciences and Technology. He mentioned that children love to play games. This can teach children to work together as well as becoming a well-coordinated team. It develops coordination skills necessary to perform delicate jobs.
- (p) **Concept mapping** is also a strategy that can be effective towards the teaching of Natural Sciences and Technology. Majumalon (2015) described it as a special form of a web diagram for exploring knowledge and gathering and sharing information. Concepts are presented by arrows, which are describing direction of relationship and read like jobs.
- (q) **Integrative teaching** - is defined by Corpuz and Salandanan (2003) as a strategy that puts together the parts of a whole in order to arrive at a holistic, complete and more accurate view of reality

Lack of pedagogical understanding is also an issue in South African schools. The Outcomes-Based approach (Curriculum 2005) encouraged and promoted learners to be active during the learning: “They must move some of the responsibilities of learning to the learners, the teachers must also use different approaches to teaching the learners” (Bentley and Watts 1989: 3). It has been made clear that there is a need for the teachers to know about different strategies in order to utilise them in classes especially in teaching Natural Sciences and Technology in the Intermediate Phase Schools. “There are different approaches or methods to teaching of the Natural Sciences and Technology that can be used by teachers in schools. These include examples of approaches or methods, inter alia: problem solving, investigation, practical work, exposition, discussions and the consolidation and practise” (Bentley and Watts, 1989: p8). These methods are learner-centred and content-centred in nature. They have also widespread applicability, and are beneficial in teaching the subject. Teachers are therefore encouraged to use the methods which are suitable for the subject as they are related to developing various skills in the learners.

According to the Department of Basic Education Curriculum and Assessment Policy Statement, Natural Sciences and Technology (2011), the Curriculum is the structure of the different subjects and their content areas and the topics that must be offered at schools. It further on stated that the curriculum policy for Natural Sciences and Technology Intermediate Phase also points out that a variety of approaches should be used in the teaching and learning of science (DoE, 2011: p8). Bertram, et al, indicate that the nature of science is a subject of enquiry not only of facts to be learnt. So this needs the teacher to be aware of the approach or the teaching strategy he or she will be using in teaching the content.

In the planning of lessons teachers need to be fully conversant with the approach or approaches to be used when the content is taught in the classroom. The way in which the classroom is set or designed and laid out by the teacher has an impact in the learning process. The Southern and Eastern Africa Consortium for Monitoring Educational Quality III (SACMEQ III) (2001) mentioned that classroom design must allow effective teaching that is suitable for the subject. It further states that South African school teachers generally exhibit poor subject knowledge in language and mathematics, and consequently an incomplete grasp of both the requirements of the curriculum and how to animate it in the classes. To animate means to make it live in the classroom during the teaching and learning. It further added that

there is a high prevalence of educators in the system that lack knowledge of the subjects they are teaching (SACMEQ III) (2001).

The following approaches from the literature reviewed will be discussed; (i) teacher-centred, (ii) learner-centred, (iii) content-centred and approaches. The teacher-centred approach is where the teacher is the one doing the most in the teaching of the learners. The teacher is taking the lead, and the learners follow. The learners' actions are guided by the teacher's perceptions. There's very little room for learners' opinions and perceptions. The learners comply with all that is said by the teacher. The Christian National Education (CNE), prior to 1994, was employing this approach. The teaching strategies used were promoting passiveness to the learners as they were supposed to do what they were told. Khoza (2013) pointed out that the content-centred approach is also called Cognitivism. The learner-centred approach is also known as the interactive approach since it promotes teaching that is supposed to be interactive. Its focus is on what the learners do to achieve learning (O'Neill & McMahon, 2005). This approach was suggested for Curriculum 2005 (OBE) and the Revised National Curriculum Statement (RNCS) as well as the National Curriculum Statement (NCS) in South Africa.

### **2.3.1 The Teacher-Centred Approach**

Here the teacher is the one who is considered as the source of the information as stated by Bruce (2004). Guàrdia, Maina, and Sangrà, (2013) pointed out that the teacher-centred approach is a competence based approach. Hence, according to Adam (2004) the emphasis is on the achievement of the outcomes and that the outcomes are assessed regularly through tests, questions and class work. All the planning and implementation is by the teacher. On the other hand, Borich and Tombari (1997) stated that teacher-centred approaches are sometimes referred to as direct instruction, deductive teaching or expository teaching. He elucidated that in this approach the teacher has direct control over what is taught and the information the learners are to learn. The Graduate Student Instructor (GSI) mentioned that this is a behaviouristic approach where the knowledge responds to the environmental stimuli. The learners are inactive. The learning is promoted through mostly repetition and positive

reinforcement. Schug (2003) wrote about teacher-centred instruction and stated that effective teaching needed effective teachers.

In addressing the issue of what effective teaching is, Delaney and Johnson (2010), outlined that Memorial University of Newfoundland learners were asked to provide their perception of effective teaching. Thirty-one percent of the learners who completed the survey study were in the faculty of science. The learners came up with what they think effective teaching is. For effective teaching to take place, there are qualities that the teacher needs to have. Effective University teachers at Memorial University which can produce effective teaching are: respectful, knowledgeable, approachable, engaging, communicative, organised, responsible, professional and humorous, and open-minded. These are qualities the teacher needs to produce effective learning. The researcher concurs with Dewey (1938/1998), that there are differences between traditional teaching and progressive teaching. He said that traditional teaching is the transmission of knowledge from the teacher to the student where the student follows the rules and adapts to adult standards.

Chan and Cole (1986) stated that effective teaching and learning are very complex processes that are influenced by many different factors. Phurutse (2005) outlined the factors as being HIV/AIDS among the learners and teachers, school fees to the schools where they are paid and, if the school fees are not paid, that affects the teaching and learning. He also mentioned the number of learners in the classes, including the educator-learner ratio that is not balanced. There are sometimes too many learners for the teacher to teach. If there are too many learners, teaching and learning becomes ineffective. Availability of resources, teachers' willingness to teach, poverty within homes and the community are included in the list that Phurutse (2005) outlined.

Chan & Cole (1986) emphasised that an effective teacher is one who maximises the achievement of learners by acting in accordance with an explicit set of principles that trace order, coherence and relevance in the particular instructional context. Although Chan & Cole (1986) expressed their ideas more than twenty years ago, they are still quite relevant today. Among learners, their learning is what matters, which means they have to make sure they do

it. To achieve high quality learning outcomes, learners need to see and understand that their learning matters (Department of Education and Training, 2003a: 14). It is therefore apparent that what Chan and Cole reveal is that effective teachers using effective pedagogical practices described by quality teaching are likely to be knowledgeable, enthusiastic, confident, resourceful, inventive, well organised, optimistic and ethical, which are the qualities of effective teachers using effective teaching strategies for effective results.

### **2.3.2 Content-Centred Approach**

This approach includes the strategies used where the focus is on the content to be taught at a certain pace, where the schedule states what needs to be taught by the teachers at a certain grade and at a specific time. Hence, Schunk (2004) affirmed that cognitive theories explain human learning and development where changes in the mental structures and intellectual processes are involved and where there is acquisition, organisation and utilisation of knowledge. This is performance-based in the sense that the approach is measured against international standards. It emphasises the teaching of school knowledge where the content that needs to be known is set per grade. So the teachers need to teach in such a way that the content is mastered by the learners in that grade. GSI (2015) articulated that where the knowledge is constructed within social contexts through interactions with a knowledge community, learners need first to know the content so as to construct the new knowledge. They further stated that there is integration of learners to the knowledge community. They team up the assimilation and accommodation to accommodate the new information.

Kember and Kwan, (2000) investigated lecturers' approaches to teaching and their relationship to the concept of good teaching. They found a close link between learners' perceptions of learning and teaching. Their aim was to characterise the alternative approaches to teaching by university lecturers, and to examine the relationship between lecturers' approaches to teaching and their perception of good teaching. The study adopted an open naturalistic approach. Seventeen lecturers in three departments in a university were selected for interview based on their rank, years of teaching and industrial or professional experience. Interview records were content analysed by two researchers of the study. Kember & Kwan

found that: (a) It was possible to characterise lecturers' approach to teaching. (b) The perceptions of teaching of the lecturers were best described by two main orientations of transmissive (teacher-centred) and facilitative (learner-centred) teaching. (c) Lecturers who perceived teaching as transmitting knowledge were more likely to use a content-centred approach to teaching while those who used facilitative methods were learner-centred where they used group work and allowed learners to give feedback after a task is completed. This is where learning is mostly based on more work done by the learners. This tended to use learner-centred approach. Their study concentrated on the Higher Education and Training (HET) level. They concluded by bringing up that fundamental changes to the quality of teaching are unlikely to happen without changes to lecturers' perception of teaching. The content to be taught need to be allocated accordingly for effectiveness of the teaching and learning. Mc Loughlin and Padraig (2009), avowed that the content-centred approach is a content-driven pedagogy. Hence, for the student to master material, it is necessary for the instructor to be a master of the material so that the instructor may guide the learners through the context (Mc Loughlin and Padraig, 2009).

On the other hand, Crawford (2007) wrote about teaching strategies in teaching science as an inquiry in high school. He used five prospective teachers to enact teaching science as an enquiry in a year during their high school fieldwork experience. He included interviews, field notes and artefacts. He found that the interns' teaching strategies represented an entire spectrum of practice, from traditional, lecture-driven lessons to innovative, open, full enquiry processes. Crawford suggested that one of the critical factors influencing a prospective teacher's intentions and abilities to teach science is an enquiry. The traditional and lecture driven approaches he talked about were teacher centred, so he observed them moving from that perspective to the one of giving the learners the opportunity to be innovative, open and learn through the enquiry strategy. Crawford's study was made in teaching of science as a subject in high schools. The participation of the learners in different phases is not the same. There are different causes for the learners not to be the same since the environment where they are coming from has an effect on the way the learners behave. In implementing this enquiry-based approach, teachers need to use the strategies that will encourage learners to be innovative in the way they will learn the subject.

Moeletsi (2005) investigated primary school teachers' understanding and interpretation of problem-solving in Lesotho. He further investigated how problem solving was promoted in science lessons. She explored how teachers teach (the strategies) and support problem-solving, using observation schedules and semi-structured interviews to collect data from teachers and learners. Moeletsi found that the teachers had a considerable understanding of problem solving and value it, but were unable to translate it into their teaching. Teachers will not translate the teaching strategies if they are not familiar with them. They therefore need to be helped to understand the strategies. Barraket (2005) wrote an article on teaching research methods using a learner-centred approach; critical reflection in practice. It was a case study analysis of an attempt to enhance student learning through the introduction of student-centred teaching methods in a Masters level, social research methods subject. Specific strategies were introduced; case study teaching, problem based learning, group work, role playing and simulation. Barraket concluded that the re-orientation of the curriculum towards student-centeredness had a positive effect on student performance, learning experience and subject evaluation. The use of student-centred techniques facilitated a strong social context for learning and provided learners with a common experiential framework from which to explore the technical aspects of the curriculum. The researcher saw a need to research in Intermediate Phase teaching of Natural Sciences and Technology in Grade 6.

### **2.3.3 Learner-Centred Approach**

This is an approach where the teachers give most of their time to the learners to initiate their learning. Hmelo-Silver, and Barrows, (2006), stated that, in the learner-centred approach, the teacher becomes the facilitator. Hence Borich and Tombari (1997) articulated that Learner-Centred Approach is sometimes called discovery learning, inductive learning or inquiry learning like cooperative learning. They guide the learners. In South Africa, the Learner-Centred Approach was advocated for *Curriculum 2005* commonly known as Outcomes Based Education (OBE), the Revised National Curriculum Statement and the National Curriculum Statement. Thanasoulas, (2000) stated that the Learner-Centred Approach is also known as constructivism. Learners get the motivation intrinsically as they learn on their own. They set their own goals and they motivate themselves in achieving those goals through learning. Here the teacher does not take a lead, but facilitates learning by providing an environment that promotes discovery, assimilation and accommodation (Jeffery, 2010).

The teacher needs to choose the correct teaching strategy to teach the learners. Harden and Crosby (2000) stated that learner-centred learning is regarded as the favoured teaching strategy, although it is not without some criticisms. In general, it has to be a positive experience. For example, it emphasises the value of student-centred learning. (Royer, 2005), expressed that cognitivism assumes that learners actively construct meaning from sensory input based on past experiences. Since CAPS emphasises developing problem solving in learners, Schunk (2004), testified that cognitivism includes the fundamental processes of attention, perception, memory, problem solving and metacognition and includes all the aspects of acquiring and utilizing knowledge and skills. It is through this that the curriculum is referred to as the cognitivist approach. GSI (2015) mentioned that the learners can be motivated intrinsically and extrinsically. Learning goals and motives are both determined by the learners. Extrinsic rewards are provided by the knowledge community. GSI (2015) also said that collaborative learning is facilitated and guided by the teacher through group work, so there is a need for the teacher to be aware of the strategies to be used to teach constructively.

Alexander (2012) affirmed that there is a need for improving teaching and learning in South Africa, to respond to unique educational needs in the sciences. His study focused on metacognitive instruction procedures in improving Natural Sciences and Technology teaching in Grade 9. Metacognitive instruction is relevant to the learner-centred approach since it is also called the cognitivism approach. Nine schools were selected through purposeful sampling. Learning is defined as the process of acquiring (i) knowledge; (ii) studying; (iii) skill. He found that participation in learning improved learners' performance in the Natural Sciences and Technology as a subject. Alexander's study addressed the issue of the relevant strategies that can be used by teachers in teaching Natural Sciences and Technology so that the subject can be loved and for the pass rate to improve in South African schools. Whereas the researcher's study will address the strategies effective in the teaching of Natural Sciences and Technology so that the learners will be able to pass the subject as a result of the effective teaching by the teachers in schools.

Abdi (2014) investigated the effects of the inquiry-based learning method in science learning. He argued for inquiry-based learning against traditionally instructed learning, and found out

that learners who were instructed through inquiry-based learning achieved higher scores than the ones instructed traditionally. He used 40 fifth grade learners from two different classes. He used a purposive sampling method. This indicates that, when the learners are fully involved in learning, learning becomes more effective than using the traditional ways of teaching sciences in schools.

Some of the literature reviewed was for the Further Education and Training Grades, not for the Intermediate Phase. Hence, this study will address the issues pertaining to the teaching of Natural Sciences and Technology in the South African context, and specifically in the Intermediate Phase at district level. Al-Zu'be (2013) wrote an article about the difference between the learner-centred and the teacher-centred approaches in teaching English as a foreign language despite glancing at the strategies or approaches in the teaching of Language, but what he says is relevant to the teaching of Natural Sciences and Technology. He articulated that the stakeholders argue about approaches to education that are the most efficient and effective. He referred to learner-centred strategy as where the teacher is placed to facilitate learning, where the teacher focuses on the interests, needs, and learning styles of learners.

Consequently, using the learner-centred strategy, learners work together in groups or pairs as per the demand and purpose of the activity. Killen (2010) referred to learner-centred strategy as discovery learning, inductive learning or enquiry learning, which places much stronger emphasis on the learners' role in the learning process. The example is co-operative learning. This makes teaching and learning enjoyable, friendly, active and rewarding hence making it easier for the learners to understand the lesson since they are actively involved in learning, (Al-Zu'be, 2013). Hence Sale (2001) talked about activity based approach which the researcher saw as fitting to this approach; Sale (2001) said that the learner-centred approach is an approach where learners learn best through active involvement with concrete experiences.

Hands-on activities can result in significant improvements in academic performance and attitudes towards science. Sale (2001) illuminated that teaching of science will be effective if

science is presented as a way of finding out rather than as a body of facts to be memorised. He also mentioned that teachers need to emphasise learning-by-doing in teaching science. Teachers need to encourage interactions among learners. Teachers must adapt science experiences to the learners' developmental levels and use a variety of approaches in teaching science. It is therefore understandable that, if the teacher uses learner-centred strategy in his or her learning, the learners will learn effectively because of the strategy used being effective. Argument is on what learners must do or teachers' activities as source of knowledge. In the learner-centred strategy, learners have the responsibility to often develop concepts, reasoning, and ideas on their own as they strain to tackle the task they have.

Practices of teachers will be investigated and the way teachers relate to learners, choice of learning materials and how learners' needs are met. The student-centred approach will be recognised as more suited for teaching English. Manjele (2017) asserted that the learner-centred teaching method, as replacing a teacher-centred method, had a challenge of resources as it was resource-reliant. He conducted his study from schools from different areas; rural, semi-rural and urban. He used qualitative research method to discern data from physical science teachers and Heads of Department (HODs). He conducted observations, analysed relevant documents and carried out interviews. He found that there are many challenges in implementing a learner-centred approach, especially in rural schools, because of the lack of relevant resources, the poor quality of teachers, and inappropriate and insufficient teacher-support programmes for teachers. He also testified that some teachers are unable to adopt and implement learner-centred pedagogy as an important part of the post-1994 educational innovations. He also stated that, as some schools are still subjected to teacher-centred learning by teacher pedagogy, learners do not acquire skills that could help them contest with those attending urban schools. The researcher concurs with him in that the strategy needs resources and competent pedagogy by teachers for it to be effective in making learners acquire skills. In accordance with Al-Zu'be (2013), the teacher-centred approach relies on teachers to use their expertise in helping learners understand and make connections where learners take a receptive role in learning. The teacher acts as a knowledge transmitter, learners act as the receiving end.

Teacher-centred learners work mostly alone doing work given by the teacher, while learner-centred learners work in groups or pairs as per the activity. Killen (2010) referred to the teacher-centred approach as direct instruction, deductive teaching or expository teaching. The teacher-centred approach portrays learners as passive, teachers as active and less engaged. In the student-centred approach, both participants are active and sharing learning responsibilities. In the teacher-centred classroom there is little noise, while in the one for learner-centred the class is busy and noisy because of group activities. Majoka (2010) outlined that Active Learning is a method of educating learners that confirms their active participation in the learning process. Consequently, Active Learning maximises learners' attention and increases the likelihood that learning is occurring (Stove, Neubert and Lawlor, 1993). The researcher concurs with Al-Zu'be (2013), in the implication that if the strategy is effective, there is collaboration, support and cooperation with one another. Learners are self-motivated and enjoy learning. If the teacher uses this strategy in his or her teaching, teaching and learning will be effective.

Vayrynen (2003) in her observation from South African classrooms; found out some inclusive strategies used during teaching and learning in the classroom. He mentioned that results pointed out those teaching strategies are suggested to be used in classes, and that they must be catering for diversity. She mentions the importance of inclusion of all learners in learning. Teachers must take into consideration that the learners learn differently and that they are unique; so they develop differently. It is imperative that teachers know their interests and needs in order to understand them and know the learning style and the teaching strategies to use. According to Wood and Ashfield (2008), the teaching strategies selected must enable the learners to be creative and imaginative and to develop each one's potential.

## **2.4 Theoretical Framework**

Harasim (2012) described a "Theory" as an explanation for why something occurs or how it occurs. Hence, the study will be looking at how teachers are effectively using various strategies in teaching Natural Sciences and Technology and why are they using those strategies. While Polanyi (2012) defined theory as something that we have sound reasons for,

and stated that it may be set out on paper as a system of rules and the more a theory is true, the more completely it can be put down in such terms and it cannot be led astray by personal illusions. This means that theory has a rigid formal structure and is not affected by the state of the person accepting it. Anfara and Mertz (2015) defined Theoretical Framework as a framework or theory that allows the researcher to “set” and understand certain aspects of the phenomenon being studied while concealing other aspects. The researcher concurs with their statement that no theory or theoretical framework provides a perfect explanation of what is being studied. Hence Harasim (2012) stated that a theoretical framework is typically generated by a question or by our curiosity and it offers a response to that question. The theory of learning aims to help us to understand how people learn. Lederman (2015) defined theoretical framework as the researcher’s approach to solving the problem or answering the questions. Swanson (2013) defined theoretical framework as the structure that can hold or support a theory of a research study. He further states that, the theoretical framework introduces and describes the theory that explains why the research problem under the study exists.

Theory is described as a specific realm of knowledge and explains how it works. In the applied disciplines there are realms of study and practice that are fully understood through their use in the functioning world. Swanson (2013) further stated that the impact of theories-in-use dominates our lives day in and day out. Vinz (2016) defined theoretical framework as one of the more infamous components of a theses. It gives you a strong scientific research base and provides support for the rest of the theses. It is said in this article that, after the problem statement has been identified together with the research questions, is the point where you determine what theories and ideas exist in relation to the chosen subject. You frame your research and show that you are knowledgeable about the key concepts, theories and models relating to the topic. It gives research direction; it also provides scientific justifications for your investigation. This study is putting more focus on curriculum. Hence, Pinar (2012) explicated that curriculum theory is the scholarly effort to understand the curriculum conceived as “complicated conversation.” Pinar (2012) further stated that theoretical framework focuses on educational experience.

This study will use the theory of constructivism to guide the researcher's investigation, e.g. the use of the constructive theory to investigate:

- (i) Teachers' conceptions of teaching, analysing the extent to which the conceptions comply with constructivism
- (ii) Observe teachers' methods/strategies, classify the strategies into teacher-learner-content centeredness, discuss the extent to which the methods used correlate with the teachers' conceptions of teaching, and then analyse the extent to which the methods encourage learners to acquire knowledge
- (iii) Assess the extent to which the strategies enable Active and Critical Learning as required by the CAPS. Active and Critical Learning relates directly with constructivism.

There are three basic curriculum designs which the study considered. These curriculum designs include subject-centred design, the learner-centred design and the problem-centred design, Datar, Jain, and Sharma, (2013). The researcher agrees with the definitions Datar, Jain, and Sharma, (2013) chose when saying subject-centred design is the design related to "textbook treatment". This kind of curriculum design neglects learners' needs, interests and experiences, but fosters learners' passivity. The researcher believes that this kind of design might have an input developing the love of the subject to the learners. The other design is the learner-centred design, which is also called the child-centred design. According to Datar, Jain, and Sharma, (2013) this design emphasised that learners must be active in their learning environment. It is based on the learners' likes, needs and interests. This denotes that the learners will learn faster if they are made active in their learning. From the familiarity of the researcher there are teachers who practice this strategy; the study will be considering its effectiveness where the teachers use it for teaching Natural Sciences and Technology in the circuit mentioned. The third curriculum design which teachers are using in their teaching of the subject is the problem-centred design. According to Datar, Jain, and Sharma, (2013) this design focused on the real-life problems of the individuals in the society. It makes use of the learners' past and present experiences to analyse basic aspects of learning. It also focuses on the problem-solving procedures. The teachers who will be found using this strategy under this

design will be using an effective strategy as it will be empowering the learners to become problem solvers. This will enable them to solve problems successfully in life.

As stated this study used the theory of constructivism. The researcher considers the meaning of ‘constructivism’ affirmed by Harasim (2012), to refer both to an epistemology and a theory of learning. He stated that constructivist’s epistemology holds that knowledge is constructed from our perception and our interpretations based upon contemporary conventions. He mentions that our perceptions are shaped through interactions with others, in particular with more knowledgeable persons and/or the appropriate knowledgeable community. He also expresses that epistemologies of knowledge are key to how we view and how we practise teaching and learning in the learning environment. According to Harasim (2012), learning theories of the 20<sup>th</sup> century that have emerged, shaping the study of learning are:

- Behaviourist learning theory,
- Cognitivist learning theory and
- Constructivist learning theory.

Consequently Fosnot (2013) defined constructivism as a theory about knowledge and learning. He further more mentioned that it identifies both what ‘knowing’ is and how one comes to ‘know’. He further spoke about psychology as the way learning is defined, studied and understood. This underlies much of the curricular and instructional decision-making process that occurs in education. Hence, from the early work of Fosnot (2013) wrote that he proposed, and demonstrated through much research, that the mechanism promoting change in cognition was the same as that of evolution. He mentioned that it is equilibration. Defining equilibration, he mentioned that it is a dynamic process of self-regulated behaviour balancing two intrinsic polar behaviours, assimilation and accommodation. Assimilation is defined as to make similar. It is the activity, the organisation of experience, individual’s self-assertive tendency, a tendency to view, understand, and act on the “surround” with one’s own activity or ideas to preserve one’s autonomy as a part within a whole system. Hence, accommodation is comprised of reflective, integrative behaviour (reflective abstraction) which serves to change one’s own self and explicate the object in order to function with cognitive equilibrium in relation to it. Fosnot furthermore goes along with constructivism as a theory about learning, rather than a description of teaching. Whereas learning is not the result of

development; learning is development, where the teacher needs to allow learners to raise their own questions, generate their own hypotheses and models as possibilities, test them out for viability, and defend and discuss them in communities of discourse and practice.

As Prouix (2006) stated that constructivists argued that knowledge is constructed by individuals through their experience, and is not necessarily a representation of the real world, the researcher concurred with the recent curriculum fitting under constructivism because it promotes Critical Thinking and problem solving in learners where the learner is not perceived as knowing nothing. They are perceived as knowing something before the new learning. Prouix (2006) confirmed that constructivists assert that our previous experiences serve as the lenses through which we read the world. He furthermore imparts that learners are not blank slates, and everything they experience in classroom is interpreted in the light of what they already know. If knowledge or information is transmitted to learners as traditional teachers do in a lecture-based classroom, learners are not acknowledged either as active or as an individual with pre-established cognitive structures. Therefore constructivists conceive the classroom as being learner-centred as opposed to teacher-centred (Prouix, 2006). CAPS is under this theory because Kretchmar (2015) expressed that constructivism is sometimes called a theory of knowing, and is not a theory of teaching. It does not tell teachers what they do, but rather provides a general framework within which they work with learners, which CAPS is also providing for teaching and learning. Therefore, constructivists suggest that the learner is much more actively involved in joint enterprise with the teacher and peers in creating (constructing) meaning.

Harasim (2012) further stated that Constructivist Learning Theory explains how learners construct meaning in their learning. Kirschner, Sweller and Clark (2006) argued that the constructivist-inspired learning strategies and environments include student-centred learning, inquiry based learning and self-directed learning. According to Scholnik, Kol and Abarbanel (2006), constructivism required more time than instruction. It involves student choice, which is likely to result in increased student involvement with the content and higher motivation, is more common in a student (learner)-centred approach. Kennedy (1998) expressed that constructivists believe that emphasis should be on designing activities which provide active knowledge, instead of traditional knowledge transmission. This means that teachers are encouraged to investigate learners' knowledge. To assign appropriate methods for teaching

science, learners' misconceptions need to be identified. The researcher believes that learners learn differently and at their individual paces. Harasim (2012) corroborated that constructivists' theory of learning holds that people learn by constructing their own understanding and knowledge of the world through experience and reflecting upon that experience.

## **2.5 Concluding Remarks**

This chapter viewed literature stressing Active and Critical Learning in the teaching of Natural Sciences and Technology in Grade 6. The love of the subject and having interest in the subject depends on the effective pedagogic skills and strategies the teacher uses during teaching and learning in the classroom. Active involvement of learners during teaching and learning was discussed. It was also discussed that, for learners to learn effectively, a teacher needs to engage learners in teaching in a lively classroom. Teaching approaches were talked about and the chapter also discussed the theoretical framework used in the study.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This section elucidates the research methodology and paradigm adopted to achieve the objectives of this study. Bryman (2003) maintained that the decision to choose a specific methodology should be based on its suitability to answer the research problem and questions. This chapter elaborates on the research design and methodology. The in-depth research was undertaken within a qualitative method paradigm using appropriate research instruments to collect in-depth information for analysis. Discussion in this chapter is presented under headings and subheadings eventually providing a gestalt of the research methodology.

### **3.2 Research Method and Design**

Durrheim (2006) described the research design of a study as a strategic framework for action that serves as a bridge between research questions and the execution or implementation of the research. Qualitative research can be narrative research, phenomenology, grounded theory, ethnography and case study. This study applied the qualitative methods as research design. According to Stake (2006), qualitative method study focuses on a single phenomenon (single-instrumental case research). Conway (2017) articulated that instrumental research design implies that one can use the knowledge to generate whether the context, boundaries, unit of analysis and trail of evidence are all described very carefully and clearly.

This is when the inquirer decides on a type of study within which of the three choices i.e. qualitative, quantitative, or mixed method it will be conducted. There are three approaches or research methods commonly used in research. These are: qualitative, quantitative and mixed methods. Qualitative and quantitative approaches should not be viewed as rigid, distinct categories, polar opposites or dichotomies. Instead, they represent different ends on a continuum (Newman and Benz, 1998). The three research methods are briefly discussed below.

- a. Quantitative approach – Burns and Grove (1987) identified quantitative research method as a scientific method where the research approach is an objective, formal, systematic process in which numerical data are used to quantify or measure phenomena and produce findings. It describes tests and examines cause and effect

relationships. Hence Newman and Benz (1998) clarified that the quantitative approach is used when one begins with a theory or hypotheses and tests for confirmation or disconfirmation of that hypotheses, whereas the qualitative approach does not utilise the hypotheses.

b. Mixed approach – it is characterised by Creswell and Plano (2007) as a research design or methodology in which the researcher collects, analyses and mixes (integrates or connects) both quantitative and qualitative data in a single study or a multiphase programme or enquiry. Hence the mixed methods approach has been captured in the works of Creswell (2003), Creswell and Plano Clark (2007) and Tashakkori and Teddlie (1998, 2003). They argued that the defining characteristics of the mixed methods approach involves its use of:

- Quantitative (QUAN) and Qualitative (QUAL) methods within the same research.
- A research design that clearly specifies the sequencing and priority that is given to the QUAN and QUAL elements of data collection and analysis.
- Pragmatism as the philosophical underpinning for the research.
- An explicit account of the manner in which the QUAN and the QUAL aspects of the research relate to each other, with heightened emphasis on the manner in which triangulation is used.

c. Qualitative approach - Cormack (1991) depicted qualitative research as a method where qualitative researchers are guided by certain ideas, perspectives or hunches regarding the subject to be investigated. Moreover, Leach (1990) stated that there is no explicit intention to count or quantify the findings, which are instead described in the language employed during the research process. Benohel (1985) expanded describing qualitative research as modes of systematic enquiry concerned with understanding human beings and the nature of their transactions with themselves and with their surroundings. Cormack (1991) mentioned that the aim of the qualitative method is to describe certain aspects of a phenomenon, with a view to explaining the subject of study. Decisively, Patton (2005) revealed that qualitative research methods do not primarily seek to provide quantified or numerate answers to research questions. He stated that it develops the concepts to help in understanding social phenomena in natural (rather than experimental) setting, giving due emphasis to the meanings, experiments and views of all the participants.

Denzin and Lincoln (2011) defined qualitative research as a situated activity that locates the observer in the world. Furthermore it consisted of a set of interpretive, material practices that make the world visible. Qualitative in the sense that it would be interpreting what is happening in the field based on the experiences of the teachers at work. Rossman and Rallies (2012), affirmed that qualitative research is the research that is pragmatic, interpretive in nature and is grounded in the lived experiences of the people. To clarify this, Rossman and Rallies (2012, p 8) differentiated between the qualitative research and the researcher thus:

**Qualitative Research:**

- Takes place in the Natural world.
- Uses multiple methods that are interactive and humanistic.
- Focuses on context.
- Is emergent rather than tightly prefigured.
- Is fundamentally interpretive.

**Qualitative Researcher:**

- Views social phenomena holistically.
- Systematically reflects on who she or he is in the inquiry.
- Is sensitive to her or his personal biography and how it shapes the study.
- Uses complex reasoning that is multifaceted and interactive.

The researcher chose the qualitative research method research design. Hence the qualitative research study process involves using multiple stages of data collection and refinement and interrelationship of categories of information (Charmaz, 2006; Corbin and Strauss, 2008). Concurrently, Conway (2017) articulated that a paradigm is a model according to which design actions are taken within a research study. Henceforth, Kuhn (1962) expressed paradigm as an accepted mode or pattern as an organising structure, a deeper philosophical position relating to the nature of a social phenomenon and social structures. Terre Blanche and Durrheim (2006) further elucidated that paradigms are all encompassing systems of interrelated practice and thinking that define for researchers the nature of their enquiry along three dimensions: ontology, epistemology and methodology. Concurrently, according to Guba (1990) paradigms can be characterised through their: ontology (what is reality?), epistemology (How do you know something?) and methodology (How to go about finding out the reality?). These characteristics create a holistic view of how we view knowledge:

How we see ourselves in relation to this knowledge and the methodological strategies we use to discover it.

Researchers need to know where their discipline belongs, that there are different ways of viewing the world and that the approach to knowledge is one of many. Different approaches to research are governed by particular paradigms such as:

Guba (1990) articulated that post positivist (qualitative) approaches, where assumptions have represented the traditional form of research and assumptions hold time more on quantitative research than qualitative research. It is also called the scientific method, doing science research, positivist or post positivist research, empirical science. Problems studied reflect the need to identify and assess causes that influence outcomes, such as may be found in experiments.

- I. Transformative Paradigm - holds to the philosophical assumption of the transformation approach. It has no uniform body of literature. It involves Marxists, Feminists, Racial and Ethnic minorities, persons with disabilities, indigenous and post-colonial peoples and members of the lesbian, gay, bisexual, transsexual, and queue-communities. It holds that research enquiry needs to be intertwined with politics and the political change agenda to confront social oppression whatever it occurs (Mertens, 2010).
- II. Pragmatic Paradigm (mixed methods) or pragmatism is designated by Feilzer (2010) as a research paradigm that supports the use of a mix of both the quantitative and the qualitative research methods. He further stated that it also uses modes of analysis and a continuous cycle of abductive reasoning while guided primarily by the researcher's desire to produce socially useful knowledge. Likewise, pragmatism sidesteps the contentious issues of truth and reality, accepts, philosophically, that there are singular and multiple realities that are open to empirical inquiry and orients itself toward solving practical problems in the 'real world' (Creswell and Plano Clark, 2007, pp. 20-28; Dewey, 1925; Rorty, 1999). The researcher advocated what Creswell and Plano Clark (2007) stated that pragmatism allows the researcher to be free of mental and practical constraints imposed by the forced choice dichotomy between post positivism and constructivism, and the statement of Robson (1993) that researchers do not have to be the prisoner of a particular research method or technique.

III. Constructivism (qualitative) is where each individual constructs his or her own reality so there are multiple interpretations. This is sometimes referred to as interpretive (Guba, 1990). It is seen as an approach to qualitative research. Lincoln and Guba (1985) named this paradigm as the ‘Naturalistic Inquiry’ whereas Berger and Luckmann (1967) named it the “Social Construction of Reality”, where individuals seek understanding of the world in which they live and work through experiences.

This study is underpinned by using constructivism or interpretive paradigm. The study employed the interpretive paradigm which essentially seeks to understand human actions. Construction of reality lies with the individual, in this case the teaching methods that the teachers apply in Intermediate Phase when teaching the Natural Sciences and Technology as a subject. This paradigm also looks at the human perspectives; here the teachers were interviewed to elicit their perceptions of teaching methods in the teaching of the subject of Natural Sciences and Technology.

The following are the questions that the researcher posed when undertaking selection of the research method and design, which the researcher followed (Durrheim, 2006, p. 35):

- ✓ How will the data be generated (methods)?
- ✓ What is done with the data once collected?
- ✓ How will the researcher analyse and make meaning from the data?

Creswell (2007) stated that in qualitative research the researcher employs a case study design to explore a bounded system (case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information. Hence Winter (2000) articulated that Quantitative research limits itself to what can be measured or quantified and qualitative research attempts to pick up the pieces of the unquantified, personal, in depth, descriptive and social aspects of the world.

The study used a qualitative research methodology through observation, interviews, questionnaires, and document analysis. The researcher opted to use the qualitative research because Creswell (2012) mentioned that it is a strategy used to study the case itself and that it engages participants in discussions through interviews. There is a realistic situation where individuals need to make a decision as a group or individually (Creswell, 2012). Concurrently, Denzin and Lincoln (2011) articulated that qualitative research enables the

researcher to change the data progressively, so that a deeper understanding of what is being investigated can be achieved. They further stated that qualitative research means that the researcher makes sense of or interprets phenomena in terms of the meanings which people bring to them. In this study, the focus was the teaching strategies that teachers are using when teaching Natural Sciences and Technology in Intermediate Schools around Ngwelezane circuit.

The researcher purposefully selected eight schools in which to carry out the research. The schools were selected from the rural area, semi-rural, township and suburb. This was done in order to get the vivid picture of the strategies being used in schools from various areas. The following are the details of the context or background of the schools that were selected in order to enable understanding of the results. Each school's background was based on each being selected, socio-economic status of communities served by the schools, human and material resources in the schools, the Quintile number of the school, availability of LTSM and the learner-teacher ratio in the class. This included the even the 3 schools that did not take part in the study because of their reasons. They will be named from school A to school H.

#### School A

The school is situated in town. It serves the community of the working class. Most of the learners come from the suburbs surrounding the school and those affording to take them to the school through using the transport. Most of the learner's parents are literate and working professionally as teachers, nurses, and other professional jobs. The school has enough teachers who are adequately qualified and enough buildings. There are adequate resources like Learning and Teaching Support Materials (LTSM). The school is categorised as Quintile 5 because it has most of the resources and is serving the community that is able to provide in the learning of their children. In the class, the teachers is working with learners not more than 35.

#### School B and C

The schools are situated in a semi-rural area that is an informal settlement under the leadership of Inkosi. The school is serving a community of various levels, there are those working who are able to afford providing for their children, and those who cannot as they are not working or working and earning little salaries. Some survive through the grant earned by

their children, which is why the schools are categorised as Quintile 3. Some parents are living on the pensions paid to grannies for survival. The schools do have building at a satisfactory level. At School B, there are many teachers and most of them are qualified. The challenge is that there are many learners in the class. Some classes have learners up to 70. Most of the classes have an average of 50 to 60 learners. Availability of LTSM is minimal; making it difficult for the teachers to match the standard of the teachers in school like School A. School C has few learners. The average in class is about 40. That result to the less number of teachers allocated to the school. Most of the teachers are teaching more than two subjects which some are not trained to teach them. They have to teach them due to the effect from the enrolment of the school

#### School D

This was a school selected from a deep rural area. The school has multi-grade teaching because of the enrolment it had. The school serves the community where a lot of people are not working. Few of the parents are working. Most of them survive through the grant from their children and the grannies in the families. The area is regarded as the one surrounded with poverty. Since there are few learners, there are also few teachers. I found that the principal was teaching seven subjects, which shows that she ended up teaching even the subjects she is not trained to teach, which include the teaching of Natural Sciences and Technology. There was very few classes as the school ended up teaching multi-grades due to the number of the learners. The school is categorised under Quintile 2 because of the community it is serving that has a lot of people not working. There were few learners in classes as some were multi-graded. A maximum of 35 both grades in the classes was discovered. The school is the one that its data was not used as the teacher that was observed was in Grade 4. The principal that was teaching Grade 6 was on sick leave. Because of the focus of the study, that is Grade 6, the researcher decided not to use that data, as it was irrelevant and was not going to produce required outcomes.

#### School E

This school is in the township. The school is serving a community with most of the parents working and affording to provide education for their children. The school is categorised as Quintile 4 therefore. It is a modern built school as it has more than enough classes with even the multi-purpose classrooms and media centre. The school has resources and LTSM, they

might not be enough but they do have resources. It is a face brick built and was built by the department as it is a new school. There are many learners in the school with the average of about 50 in the class. There are enough teachers, but it is in one of the schools where the teacher was trained to teach English and History at a High School, but was allocated to teach Natural Science and Technology in Grade 6. The teacher was not trained to teach the subject, but because he was at a primary school, the teachers are given any subject as it is stated that you cannot specialised at primary level.

#### School F

The school is situated in a Village where there are Reconstruction and Development Project and Low cost Houses. The school is serving the community of parents that are using the houses in the area for residence as they stay there mostly for work purposes. The school is therefore categorised as Quintile 3. The parents end up fetching their children at home so as to live with them. It is a newly built and a modern school. The school has enough classes because others are double story built. Most of the parents are working very low paying jobs, but there are also parent not working. The school has average availability of resources including the LTSM. There are many learners in the school, so there are also many teachers and most of them are adequately qualified. It is in the school where the teacher was well and relevantly qualified to teach Natural Sciences and Technology in Grade 6. The average number of learners in the class is 50 and some are above.

#### School G

The school is situated in an area far from the town. The area is fully led by Inkosi of the Tribal Authority. The school is serving a community of parents most of them not working. Very few of them are working. Some are working jobs paying very little such that it becomes difficult to provide for their children. Most of the families rely on the child support grants and the pension for the grannies. The school does have enough classes, but there are few learners since those who are affording to give better education to their children, they transport them to school in townships and in suburbs. There are therefore some classes that are not working; they then use them for activities like changing the class to be a library, but without sufficient books.

The school is categorised under Quintile 2, because of the level of the community the school is serving. Not many learners are in the classes, an average of 35 learners was found in most of the classes. There is a mixture on the quality of the teachers teaching, some of them are adequately qualified to teach, but some are not adequately qualified. The school is one of its data that was not utilised because the teacher said she could not teach the topic under the strand that was taught at that time, Planet Earth and Beyond. She said she did not get training in teaching that section during her training, and blamed the department that they are not getting enough assistance in being helped to teach the section. The teacher therefore ended up selecting any topic from Matter and Materials or Food Processing in Technology. She then taught that topic, the researcher therefore decided not to use that data since it does not fit to the objectives of the study.

#### School H

This was a school selected in a deep rural area. The school is under the full leadership of iNkosi. There are not enough buildings at the school, but there are not many learners in the whole school, the school had the building that was made by the community in the past. Resources are not well available at the school. It is categorised as Quintile 2 because of the community they are serving. The school is serving the community of the parents some working and many of them not working and failing to provide well for their children. There is a highly escalated level of poverty because of that. This is one of the three schools that were not included in the report of this study. This was due to the fact that the teacher said they are busy as a school, so they do not have time for people coming for researches. She postponed the appointments until he phoned and told me that she cannot continue with my request. Because of the unforeseen circumstances beyond the control of the researcher, there was not data presented and collected as the teacher did not get a chance to visit the teachers in classes.

### **3.3 Data Gathering Techniques or Instruments**

The research instruments that were employed to gather information in this study were classroom observation, interview, questionnaires, and document analysis to find out how teachers perceived the methods they used in teaching Natural Sciences and Technology. The above instruments will be discussed in depth in this section under data gathering instruments.

The researcher used pseudonyms during report compilation and ethics were followed accordingly. Permission to visit the schools to conduct the research was applied and received from the Head of Department in the KwaZulu-Natal Province (Appendix U, p. 185 of this theses) and were displayed when the principals were visited for arrangement. The researcher had to make sure that the teachers were told in advance as to the time they will spend under observation, to the individual interview. The researcher used the topic that was taught by the teacher at that time. The researcher recorded the strategies that the teacher used, looking at other teachers from different schools.

## **Interviews**

Hennink (2013) affirmed that this method falls under the qualitative research tradition. She further stated that it involves a discussion on specific issues, with a predetermined focus people participating in an interactive discussion. The analysis from the qualitative research will be involving the use of the quantitative research tradition, causing the researcher to use the mixed research method to cater for the two research methodologies for effective results. In particular, in the interviews, they sought to overcome the artificial nature of in-depth interviews with predetermined, closed-ended questioning, which could restrain participants' responses or lead them to respond in a particular way. Krueger and Casey (2014); Hennink, (2007); Flick, (2002) also wanted to reduce the overall influence of an interview on a participant. The researcher visited the schools to arrange this with the principals of the schools to be visited. Thus the researcher made the discussion interactive to gain participants' views on the research topic, and created an environment that made them feel comfortable. After presentation of the lesson, the researcher conducted an interview. Each teacher was interviewed after the lesson. The teachers were made aware of the time that the interview would take place prior to the conduction of the interview, the procedures to be followed and the duration of the time that would be taken for the whole interview process.

The researcher had to make sure that the questions were well structured and would be ready to clarify some questions and any follow up questions. There were sets of questions to be used during the interview. The interview applied a semi-structured approach. A semi-structured questionnaire is when the researcher knows enough about the domain of enquiry to develop questions about the topic in advance but not enough to anticipate the answers.

Questions were prepared in advance but were used to probe deeper in a direction of the respondents' answers. Open-ended questions were designed and arranged in a logical order to cover the ground required. This is appropriate when the researcher knows enough about the study topic to frame the needed discussion in advance, as long as there is no danger that structuring will limit the discovery of significant aspects not previously recognised (Holstein & Gubrium, 2003: p127). The research instrument used was the interview schedule. Subsequent to the data being gathered, they were transcribed and analysed according to the themes of the study.

## **Observations**

Mulhall (2003) explained observation as a process of capturing the whole social setting in which people function by recording the context in which they work. He mentioned that it informs about the influence of the physical environment. The researcher concurred with Mulhall (2003) in the sense that observation is a discrete activity whose purpose is to record physical and verbal behaviour. He said that, in contrast, in his view, observational data rather more than interview data, are subject to interpretation by the researcher. It was mentioned that observers have a great degree of freedom and autonomy regarding what they choose to observe, how they filter that information and how it is analysed.

That is why he mentioned clearly that, through observation, it is possible to ascertain whether what people say they do and what they do in reality tally. The researcher therefore decided to use observation as a data collection instrument to find out whether what teachers say they do in the class really tallies with the real environment in the classroom. During observation, the researcher visited the teacher during his/her lesson presentation in his/her classroom. The researcher observed how the teacher employed the strategies when teaching Natural Sciences and Technology. Arrangements were made with teachers to observe their lessons according to their convenience. At least one lesson per school was observed and documents analysed. If the school had one teacher, he or she was made aware that the researcher would be visiting and the teacher would be observed for effectiveness in terms of the study and its outcome. Each teacher was observed whilst presenting a lesson. The researcher used the observation schedule to record the useful information that was used during the analysis of data. The

observation schedule is furnished under the appendices at the end of the report (Appendix D, p. 124).

### **Observation Schedule**

Petty, Thomson and Stew (2012) stated that observation may be formal with an observation schedule of predetermined areas to notice or informal, where the researcher decides while observing what to attend. The researcher therefore used the instrument in order to write the observations for reporting. They further stated that the researcher writes what he or she is observing during the in-class observation. The researcher uses the codes to save time. It can also be labels, to sentences, phrases, paragraphs or lines. Codes are compared across the whole data set to identify variations, similarities, patterns and relationships. These will be used during the analysis of data. They further on mention that the researcher writes reflections and ideas related to sections of details to abstract from the data and deepen analysis. Codes are grouped to create a smaller number of themes that distil the key issues identified by the researcher in order to create a thematic map. The observation schedule was filled by the researcher to be used during the analysis of data. Each of the teachers selected to be observed had his or her observation schedule sheet so as to be used during the analysis of data.

### **Document Analysis**

Corbin and Strauss (2008), and Rapley (2007) described document analysis as a systematic procedure for reviewing or evaluating documents both printed and electronic (computer-based and internet-transmitted) material. They also mentioned that it requires that data be examined and interpreted in order to elicit meaning, gain understanding and develop empirical knowledge. Whereas Denzin (1970) articulated that document analysis is often used in combination with other qualitative research methods as a means of triangulation, which is the combination of methodologies in the study of the same phenomenon. It is an instrument where documents contain text (words) and images that have been recorded without a researcher's intervention.

According to Wong, Casey and Wahl (1982), a document analysis system could be applied to extract information from printed documents to create databases. The researcher decided to use the document analysis for the reasons discussed above as an instrument used for collection of data. The lesson plans were also analysed to see whether they align with the strategy the teacher was using in his or her teaching. That was to find different angles of the strategies the teachers were using. The researcher used the information gathered from the interviews, observations, document analysis in answering the third question “To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?”

During the visit, the researcher asked the teacher to provide his or her teacher file, with the intention to look at the lesson plan. If the teacher was not happy that his or her file was provided to the researcher, he or she was asked to provide the lesson plan for the day. This was used to check whether the teachers planned for the teaching of the subject, and whether they had used the strategies which they had planned from the lesson plan in the file, and that the teaching of the topic is taught at the right time as per the annual teaching plan. The researcher also used the document analysis as the instruments for collecting data. The documents to be analysed were the lesson plans during or after the lesson, depending on the arrangement made between the researcher and the participant. In this stage the researcher checked whether the strategies used by the participant (teacher) were aligned with the CAPS curriculum.

### **Research Survey Questionnaires**

Brace (2018) stated that the research survey questionnaire is a medium of communication between the researcher and the subject, albeit that sometimes this is administered on the researcher’s behalf by an interviewer. He further stated that, in the questionnaire, the researcher articulated the questions to which he or she wants to know the answers and through the questionnaires can thus be described as the medium of conversation between two people, albeit that they are remote from each other and never communicate directly. Brace (2018) also mentioned that the survey questionnaire is a method used to find out about how people feel about their product or services. At the same time, he stated that they are written in

many different ways to be used in many different situations and with many different data-gathering media.

Research survey questionnaires were given to all the teachers teaching Natural Sciences and Technology in all 20 primary schools under the circuit. The researcher was aware that there will be schools and teachers who will not be interested in participating. The researcher arranged suitable times with the school principal for collecting the completed questionnaires as data sets. The researcher used only the completed questionnaires for data analysis.

### **3.4 Population Sampling**

Collecting data involves visiting a research site and observing the behaviour of individuals where they are allowed to talk openly. The researcher decided to visit schools and individual teachers, motivated by Creswell (2012) who emphasised that, in qualitative inquiry, the intention is not to generalise to a population, but to develop an in-depth exploration of central phenomena. He further stated that to understand phenomena, the researcher selects individuals and sites. People or sites need to be understood.

In qualitative sampling the researcher chose purposeful sampling. In purposeful sampling, the researcher intentionally selected individuals and sites to learn or understand the central phenomenon. Purposeful sampling thus applied to both individuals and sites (Creswell 2012: 2016). Hence Guarte, and Barrios, (2006) defined purposeful sampling as a selection of sampling units within the segmented number of the population with the most information on the characteristic of interest. The researcher selected 20 schools in the circuit for issuing of research questionnaires and teacher profiles. The researcher then purposefully selected eight schools to visit for observation and conducting a research interview with the teachers teaching Natural Sciences and Technology in Grade 6. No learners were interviewed since the focus was about the teaching strategies. At least one teacher from the eight schools selected was observed and interviewed. Creswell (2012) emphasised that in choosing the sample size and the number of research sites in a qualitative research project, the number of people and sites sampled vary from one qualitative study to the next. He further articulated that, in some cases, a single individual or a single site might be studied. That caused the researcher to choose that number of schools to be visited and observed.

### 3.5 Data Collection

Data collection was defined by Doody and Noonan (2013) as a way to collect data to gain knowledge from the individuals. He mentioned that the researcher may only be able to observe a restricted range of subjects or a small sample of the behaviour that is of interest. Sapsford and Jupp (2006) mentioned that we do not have variables to measure, but it is still important that the circumstances of the data collection assure us that the evidence which is brought forward is plausibly interpreted. The researcher used multiple methods of data collection (sources of data). This was chosen because the rationale of using various methods of data sources is that the flaws of one method are often the strengths of another: and by combining methods, observers can achieve the best of each while overcoming their unique deficiencies, minimising bias to each data source (Denzin, 2008). Hence Webb, Campbell, Schwartz and Sechrest (1996) suggested that the use of appropriate multiple methods will result in more valid research findings.

That was why the researcher decided to purposefully select those schools to be used according to the environment they were in. The researcher understood that the schools were not equal, based on the sizes. The researcher was aware that some schools will be having one teacher teaching the subject in Grade 6 as per the focus of the study. The researcher decided to use one teacher as a participant each of the eight schools selected for observation, interview and document analysis. For the other 12 schools, the researcher issued the questionnaires and teacher profile document. In schools where more than one teacher who taught the same Grade and subject, the subject teachers were informed prior to the research and/or observation and they were asked to decide who would participate in the project. They were made mindful of the interview to be conducted immediately after the observation, and document analysis. The participants were made aware of the time projected for the interview conducted after the observation. The researcher held a meeting with the participants when the gatekeepers were sent to schools as permission to conduct the research, so that they would be attentive that the project is voluntary, they have autonomy to withdraw at any time should they feel not happy, and that their names will be protected in the report.

Four data collection techniques were used. These are observation, survey questionnaires, interviews and document analysis. Each is discussed below.

### **3.5.1 Observation**

The researcher concurred with Creswell (2012) that observation is the process of gathering open-ended, first-hand information by observing people and places at a research site. It has its own advantages and disadvantages. Advantages are: the opportunity to record information as it occurs in setting, to study actual behaviour, to study individuals who have difficulty verbalising their ideas (Creswell 2012:213). On the other hand, he further mentioned that the disadvantages are that: it is limited to those sites and situations where you gain access or can have difficulty developing rapport with individuals. It continues to be a well-accepted form of qualitative data collection. (Hammer and Atkinson, 1995) stated that it also requires good listening skills and careful attention to visual detail.

The researcher decided to use observation because it helps to assume different roles in the process. Observation was used to respond to the first question: “What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in Ngwelezane Circuit?” Spradley (1980) pointed out that observation represents a frequently used form of data collection, with the researcher able to assume different roles in the process. Observations were conducted from the process of teaching observed during teaching and learning in the classroom. During observation, the researcher visited the teacher during his/her lesson presentation in his/her classroom. An observation schedule or observation protocol was completed for data analyses. Creswell (2012) defined observation protocol as a document used to record information during an observation, just as interviewing. He further mentioned that it is a form designed by the researcher before data collection used for taking field notes during an observation. In this document, the researcher records a chronology of events, a detailed portrait of individual or individuals, a picture or map of the setting or verbatim quotes of individuals.

### **3.5.2 Interviews**

There are different types of interviews, but ahead of viewing the types of interviews, one needs to first understand what an interview is. Creswell (2012) defined interview as a data collection process in which the researcher asks questions of and records answers from only one participant at a time. Blackwell (2013) articulated that some interviews are tightly

structured, ordered and planned, whereas others are free-flowing spontaneous and meandering. He classified them into two, the structured and unstructured interviews. Fontana and Frey (2005) defined structured interviews as generally using an interview schedule, a list of questions that are repeated in the same order and in the same wording, like “theatrical script to be followed in a standardised and straightforward manner”.

Douglas (1985) outlined that unstructured interviews are more flexible and organic in nature. He further mentioned that the interviewer enters the conversation with flexible questions and probes, or maybe even with just a list of bullet points. The less structured interview guide is meant to stimulate discussion rather than dictate it. It also allows the interviewer to be creative, adapt to encouraging circumstances, and cede control of the discussions to the interviewee. He mentioned the advantages of unstructured interview as a chosen tool to be used for data collection; that they allow for understandings to blossom. It is also less likely to tap both content and emotional levels. Blackwell (2013) stated that because questions in unstructured interviews are organic, the resulting data are more meandering and also more complex. The other type of interview is the semi-structured interview. Willies and Jost (2007) defined it as an interview in which each informant is asked a set of similar questions. The participants will be asked the similar questions, but flexibility will be allowed for follow up questions during the activity if they arise from the interviewer or the interviewee.

The study used the one-on-one interview during the sessions at each site. The researcher totally concurred with Creswell (2012) in the sense that interviews are equally popular to observation in qualitative research in interviewing. Participants were asked the questions. Qualitative interviewing occurs when researchers ask one or more participants general open-ended questions and record their answers.

After presentation of the lesson, the researcher conducted an interview. In answering the second question; “What are the views of the Grade 6 Natural Sciences and Technology teachers in the teaching strategies they use in teaching the subject?” The researcher used interviews since the question needed responses from the interviewees. The study used the semi-structured interview. Semi-structured interview is when the researcher knows enough about the domain of enquiry to develop questions about the topic in advance but not enough to anticipate the answers. Questions were prepared in advance but probe deeper in the

direction of the respondent's answers. Open-ended questions were designed and arranged in a logical order to cover the ground required. This is appropriate when the researcher knows enough about the study topic to frame the needed discussion in advance, as long as there is no danger that structuring will limit the discovery of significant aspects not previously recognised (Holstein and Gubrium, 2003, p. 127). The information acquired from the interview was used to analyse data.

The researcher agreed with Creswell (2012) in the sense that audio materials consist of images or sounds that researchers collect to help them understand the central phenomenon under the study. Recording is essential during the interview. Skill is needed when the transcription is done. Creswell (2012) endorsed audio-recording of interviews to provide an accurate record of the conversation. He mentioned that the researcher locate a quiet, suitable place for conducting the interview. The researcher needed to obtain consent from the interviewee to participate in the study. When the recordings had been recorded using a voice tracer, the researcher transcribed the voice recording to be written as hard copy to help the researcher during the coding, analysis and interpretation. Creswell (2012) indicated that researcher records interviews then transcribes and types the data into a computer file for analysis.

### **3.4.3 Research Survey Questionnaire**

Questionnaires are important in the collection of data. Brace (2008) perceived them as important elements in successful research. The researcher has the questions he or she needs to answer in his or her study. The questionnaire serves that purpose. Brace (2008) stated that, in the questionnaire, the researcher articulates the questions to which he or she wants to know the answers and, through the questionnaire; the subjects' answers are conveyed back to the researcher. He further mentioned that questionnaires have an important role to play in the collection of the data; to provide a standardised interview across all the subjects and to elicit the information that is required to enable the researcher the objectives of the study.

It was articulated that a poorly written questionnaire will not provide the data that are required or, worse, will provide data that are incorrect, and that the questions need to be related to the research objectives (Brace, 2008). He further contended that questionnaires had

advantages in the sense that the respondents have time to consider their answers, and that they are going to provide accurate good-quality information that needs to be considered and planned before a single question is written. He also mentioned that the written questionnaire should ask the questions that are relevant to the objectives and resist the temptation to answer questions of areas that might be of interest but not relevant to the objectives. From the above discussion about research questionnaires, the researcher opted for the collecting of information through the use of research questionnaires. The researcher first left the survey questionnaires in schools under the circuit, and later collected them to be used during data analysis.

According to Brace (2008) researchers have to recognise that we cannot expect to be given perfectly accurate information by our respondents. Therefore we must construct and use the questionnaires to help respondents give the researcher the best information that they can, and that the questionnaires must not only collect the data required but collect the data in the most accurate way possible. He further stated that questionnaires are written in many different ways, to be used in many different situations and with many different data-gathering media. The questionnaires were distributed to each Natural Sciences and Technology teacher in each school. The aim of using the questionnaire was to answer the first question: “What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in Ngwelezane Circuit?” Analysis was done out of the responses from the teachers.

#### **3.4.4 Document Analysis**

Creswell (2012) wrote that documents can be seen as valuable sources of information in qualitative research. He also wrote that documents consist of public and private records that qualitative researchers obtain about a site or participants in a study and they can include newspapers, etc. These sources provide valuable information in helping researchers understand central phenomena in qualitative studies (Creswell, 2012:223). He further stated that documents represent a good source for text (word) data for qualitative study.

The responses from the survey questionnaires, and the schedule from the documents analysed during the visit of participants in schools, were organised under document analysis. Document analyses were used for answering research Question 1: “What teaching strategies

do the Grade 6 Natural Sciences and Technology teachers use in their teaching in the Ngwelezane Circuit?” and Question 3: “To what extent do the teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?” During the visit, the researcher asked the teacher to provide his or her teacher file. The focus here was on the lesson plans. Reference was based on the CAPS document to check whether the preparation fits with the current curriculum. This was used to check whether the teachers planned for the teaching of the subject, and whether they had used the strategies which they had planned for from the lesson plan in the file. Document analysis involved analysis of lesson plans and accompanying resources like worksheets if used.

### **3.4.5 Data Analysis**

Data analysis was executed from all the sources of data mentioned earlier - the research questionnaires, the interviews, the document analysis and the observation schedule. All the performances and the responses from the data collection documents or instruments were analysed per data collection instrument. The observations, lesson plans, and interview transcriptions were analysed to see whether they align with the Active Learning and critical learning principles as expected within CAPS policy and underpinned by the theory of constructivism. The Active and Critical Learning principles formed the basis of coding the transcriptions and observations during the analysis.

Question 1: The teaching strategies were identified in the questionnaire, lesson plans, observations and interviews. Although this is a qualitative study, the common strategies e.g. group works were expressed as percentage of the total number questionnaires returned.

Question 2: The interviews were transcribed. Categories for analysis of the transcriptions will include predetermined (e.g. Active and Critical Learning) and emerging categories. The categories were coded and applied to the transcription.

Question 3: Information from all the instruments, were used to see whether the teaching strategies aligned to the elements of Active and Critical Learning as stated the CAPS document.

### **3.4 Credibility and Trustworthiness**

Conway (2017) defined credibility as how believable the research is for all involved parties. Hence Boudah (2011) articulated that the credibility of the researcher is a component of quality. Concurrently Graneheim and Lundman (2004) mentioned that research findings should be as trustworthy as possible and every research study must be evaluated in relation to the processes used to generate the findings. They further mentioned that it is important to select the most appropriate method for data collection and the amount of data is also important in establishing credibility. This means that the researcher needed to take into cognisance that the research is believable.

Credibility of research findings also deals with how well categories and themes cover data, that is, no relevant data have been in advertently or systematically excluded or irrelevant data included (Graneheim and Lundman 2004:6). In qualitative research, the concepts of credibility, dependability and transferability have been used to describe various aspects of trustworthiness (for example: Guba, 1981; Lincoln and Guba, 1985; Patton 1987; Polit and Hungler, 1999; Berg and Hansson, 2000). Conway (2017) described dependability as ensuring that research findings are consistent and that they can be repeated over time. He further defined transferability as the degree to which research findings can be transferred to other contexts. However, Long and Johnson (2000; p. 31) proposed that validity and reliability have “the same essential meaning irrespective of research tradition and nothing is gained by changing labels.” Concurrently Merriam (2009) articulated that validity and reliability occurs when the researcher conducts the research in an ethical manner to establish validity and reliability and for the reader to find research believable.

Conway (2017) mentioned confirmability as the issue of neutrality and objectivity described under the term ‘confirmability’. He further mentioned that confirmability asks questions regarding the quality of the research. Whereas Patton (2015) uttered that, in qualitative

research, the researcher is required to understand how his or her own susceptibilities could influence the research process. On the other hand, Polit and Hungler (1999) stated that credibility of research deals with the focus of the research and refers to confidence in how well data and processes of analysis address the intended focus.

Trustworthiness was used in this study to find out whether the results can be used to generalise to some extent contexts that may be similar. The term 'trustworthiness' means worthy, relevant, plausible, confirmable, credible or representative (Winter: 2000: p7). According to Shenton (2004), trustworthiness has the components of credibility, transferability, dependability and confirmability. He further mentioned that it uses methods such as observation, focus groups and individual interviews. Consequently Lincoln and Guba (1985) articulated that another aspect of trustworthiness is dependability. They defined dependability as taking into account both factors of phenomenal or design induced changes. Examples such as questioning the same areas for all the participants, taking care of the risk of inconsistency during data collection, interviewing and observing is an evolving process. They further more state that during the data collection process, interviewers and observers acquire new insights into the phenomenon of study that can subsequently influence follow up questions or narrow the focus for observation. Polit and Hunger (1999) stated that trustworthiness also includes the question of transferability; it is valuable to give a clear and distinct description of culture and context, selection and characteristics of participants, data collection and the process of analysis.

The study used document analysis. Graneheim and Lundman (2004) stressed the fact that, in qualitative research, trustworthiness of interpretations deals with establishing arguments for the most probable interpretations. Shenton (2004) mentioned that, where possible, data may be obtained from documents. They will help to provide background to and explain attitudes and behaviour of those in the groups under scrutiny. In contributing to the credibility of data, the study used triangulation, persistent observation and member checks. Shenton (2004) defined triangulation as asking the same research questions of different study participants, and collecting data from different sources using different methods to answer the research questions.

### 3.5 Ethical Issues

All research studies must follow certain ethical principles. These principles are: autonomy, non-maleficence and beneficence (Durrheim and Wassenaar: 2004: p66). Lincoln (2009) pointed out that researchers need to respect indigenous culture or groups. This study ensured that the autonomy of the participants was taken into consideration. Lincoln (2009) stated that, under the ethical and safety issues, the following should be taken into consideration:

- The researcher respected the autonomy of all people participating in the research. They consented to participate voluntarily in the study, letter of concern included in this study (Appendix F, p. 126), and were informed of the option to be able to withdraw at any time. Nonmaleficence means ‘does no harm’. In this research, the research participants were not emotionally or socially harmed in any way through the researcher maintaining confidentiality and respect.
- Beneficence means that the study must be beneficial. This study is useful as it will contribute to the scholarship of teaching and learning. The study will also be beneficial to researchers conducting research on teaching strategies as well as student teachers pursuing teaching as a profession, for reference purposes.

Concurrently the following guidelines by Creswell (2012) were also adhered to:

- The participants were informed of the purpose of the research.
- The sharing of experiences with participants in an interview setting was explained.
- Disclosure of sensitive and potentially distressing information in the course of the interview was explained before the interview.

The researcher was aware that, before the data was collected, he needed to ask for permission to conduct the research in public schools from the authorities in different levels. The researcher applied for the permission to conduct research in public schools around KwaZulu-Natal from the office of the Head of Department (Appendix U, p. 185). The process started after the permission was granted by the office as well as the ethical clearance applied for and received from the institution (University of Zululand Research Ethics committee), included as (Appendix V, p. 186). Creswell (2012) stressed that there should be gate passers in qualitative research that need to be obtained firstly from the people in authority as well as from individuals and sites. That caused the researcher to ask for permission from the principals of schools and the participants. The researcher followed the following guidelines:

That it is important to negotiate approval with the campus board. Apply for permission to study individuals in qualitative research must go through the approval process of a campus institutional review board, including the informed concerns. That qualitative data collection research consists of lengthy periods of gathering information directly involving people and recording detailed personal views from individuals, you need to provide a detailed description of your procedures to the institutional review board (Creswell 2012: 210).

When entering schools, the researcher found gatekeepers, which Creswell (2012) defined as individuals who have an official or unofficial role at the site in providing entrance to a site. In this case gatekeepers were principals who granted access to the institutions. Hammersley and Atkinson (1995) stated that gatekeepers help researchers to locate people and assist in the identification of places to study.

When the researcher reached the schools, he first discussed with the principals all that was involved with the whole project. The researcher also reassured the principals and the participant about security through ethical issues, to make them interested in participation. The researcher assured them that their names would not be published in the report and that, if they wish to get copies, he could provide these for them to read the findings. Creswell (2012) mentioned that the researcher needs to give details how he will protect anonymity of participants, such as masking names, assigning pseudonyms to individuals and their organisations or choosing to withhold descriptors that would lead to the identification of participants and sites. The researcher assured teachers that they will be respected and that they will not be disturbed from their programmes, appointments were discussed and agreed upon for harmony. In doing that, the researcher was referring to what Creswell (2012) said of the need to respect the research site and not to destroy and to disturb it as little as possible.

The participants were made aware that they could withdraw at any time, and were informed that their participation was voluntarily. The principle of doing no harm was taken into consideration and applied. Participants were notified that there will be no act of harm in any respect to them, their lives, families or their identity in the process. They were made aware that this research will benefit their society. It will also benefit the province and country because the findings will help the policy making in deciding on effective strategies to be used to develop the love of school to learners.

Consent of the participant is vital. Participants must receive a clear explanation of what the research expects of them, to make an informed choice to participate voluntarily in the research, which will be done through the consent letters. Participants were assured of confidentiality of information supplied by them, which will be done through the use of anonymity. They must be careful to protect the identities of the groups and the individuals when the results are published (Durrheim and Wassenaar: 2004: p51). Researchers should not make up data in their publications, and need to be sure to point out the limitations of their studies.

The teachers were included in the discussion with their HODs for arrangements of the dates once the approval had been granted. The teachers signed the letters and the consent form to agree to be voice recorded. When the entire gate passers, which are the letters to the principal of school and the relevant teachers, had been filled, the application to conduct the research in public schools was applied for from the Departmental Head. This was done so that should anything happen while the researcher is still at the school; it was known that he was granted the permission. The participants were provided with a consent form stating that their participation was voluntary, and they were made aware that they were able to withdraw at any time should they wished to do so. This was made known to the participants for their autonomy. They duly signed the informed consent form and also agreed that the interviews could be recorded.

The results of the study will be made available to the principals of schools and the participants for the benefit of the school, in improving the teaching of Natural Sciences and Technology. Each participating school will be given a copy on request by the school. Researchers must be careful to protect the identities of the groups and the individuals when the results are published (Durrheim and Wassenaar: 2004: p51), this will be what the researcher will do to attain to what Dhurriheim and Wassenaar (2004) stated. Participants were assured of the confidentiality of the information supplied by them. Pseudonyms were used instead of their real names for their protection when the dissertation is published.

### **3.7 Concluding Remarks**

The Research Methodology chapter looked at the research design. The methods a researcher can use were discussed; research paradigms, approaches to research, data collection and the types of interviews were explained. The researcher discussed the methods of data collection, how sampling and population were conducted, instruments such as observation, interviews, and research questionnaires were briefly discussed as well as document analysis. The researcher also discussed credibility and trustworthiness. Ethical issues were taken into consideration and discussed. The following chapter will explain the presentation of data collected in the field.

## **CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION**

### **4.1 Introduction**

This chapter exhibits, interprets and discusses the results for each of the three research questions which underpinned this study.

Primarily Merriam (2015) described data as nothing more than ordinary bits and pieces of information found in the environment. She stated that data can be concrete and measurable as in class attendance, or invisible and difficult to measure, as in findings. The data was therefore presented based on the description stated. Merriam (2015) mentioned that data conveyed through words have been labelled qualitative, whereas data presented in number form are quantitative. This study presented data through words; it is therefore a qualitative research.

### **4.2 Data Analysis**

Data Analysis is defined by Merriam (2015) as the process of making sense of data. Merriam (2015) furthermore expressed that making sense of data involves consolidating, reducing and interpreting what people have said and what the researcher has seen and read – it is the process of making meaning. Hence Flick (2014) described the process of data analysis as the “classification and interpretation of linguistic (visual) material to make statements about implicit and explicit dimensions and structures of meaning-making in the material and what is represented in it” (p. 5). On the other hand Lewis (2015) stated that in qualitative research it consists of preparing and organising the data (i.e., text data as in transcripts, or image data as in photographs) for analysis then reducing the data into themes through a process of coding and condensing the codes, and finally representing the data in figures, tables or discussions. These meanings or understandings therefore constitute the findings of a study.

Merriam (2015) stated that findings can be in the form of organised descriptive accounts, themes or categories that cut across the data or in the form of models and theories that explain the data. The researcher organised findings as stated by Merriam. Likewise she mentioned that basically data analysis is the process used to answer your research question(s). It is obvious therefore that the goal of data analysis is to find answers to your research

questions. Merriam (2015) articulated that these answers are also called categories or themes or findings. She explained themes as interpretive concepts or propositions that describe or explain aspects of the data, which are the final output of the analysis of the whole data set. Hence themes are articulated and developed by interrogating data categories through comparison between and within cases. Merriam (2015) mentioned that usually a number of categories would fall under each theme or sub theme. She mentioned that the development of themes is a common feature of qualitative data analysis, involving the systematic search for patterns to generate full descriptions capable of shedding light on the phenomenon under investigation. The researcher classified the Themes into two, the Learner -Centred Pedagogy the use of strategies talked about in the document above, it has to be the strategies we talked about as subthemes. The other theme identified is the Teacher-Centred Pedagogy where the teacher does all the work in the teaching and learning. Sub-themes were made by the strategies dealt with.

In analysing data the researcher made sure that he thinks about the process of data analysis as follows:

1. First think about the purpose of your study.
2. Think about the lens of the epistemological framework and look through that lense.
3. Focus on constructivist form on how people construct knowledge or make meanings.
4. Code your data, focus on patterns and insights related to your purpose and question and be guided by your theoretical framework.
5. Step back from the data and think “forest”, what are the main themes that emerge when you think about the study.
6. Go back to the trees (individual data bits).
7. Try to develop some categories using the constant comparative method (Merriam: 2015: p. 207 – 208).

When analysing data the researcher referred to the procedure for data analysis by Gale, Heath, Cameron, Rashid and Redwood (2013), who stated it into seven stages;

- Stage 1: Transcription where a good quality audio recording or verbatim (word to word) transcription of interviews was needed, which gives a good opportunity to become immersed in the data.

- Stage 2: Familiarisation with the interview - The researcher became familiar with the interview using the audio recording and/or transcript and any contextual or reflective notes that were recorded by the interviewer as a vital stage.
- Stage 3: Coding – after familiarisation, the researcher carefully read the transcripts line by line, applying a paraphrase or label (a ‘code’) that described what have been interpreted in the passage as important. “Open coding” took place, i.e. coding anything that was relevant from as many different perspectives as possible. Coding aimed to classify all of the data so that it could be compared systematically with other parts of the data set.
- Stage 4: Developing a working analytical framework. After coding the first few transcript, all the researcher completed the labels applied and agreed on a set of codes to apply to all subsequent transcripts.
- Stage 5: Applying the analytical framework – working analytical framework was applied by identifying subsequent transcripts using the existing categories and codes. Each code was usually assigned a number or abbreviation for easy identification.
- Stage 6: Charting data into the framework material – a spreadsheet was used to generate a matrix and the data were ‘charted’ into the matrix. Charting involved summarising the data by category from each transcript.
- Stage 7: Interpreting data – separate notebook was used to note down impressions, ideas and early interpretations of data, throughout the research. Characteristics of and differences between the data were identified to explore relationships and/or causality. Findings were generated through this process and could go beyond description of particular cases to explanation of, reasons for the emergence of phenomena, predicting an organisation to respond to a situation.

In the whole process of data analysis, the researcher used the Constant Comparative Method (CCM). Merriam (2002) explained CCM of data analysis as involving continually comparing one unit of data with another in order to derive conceptual elements of the theory, even though they may not be developing theory. She furthermore stated that many qualitative approaches use the ‘constant comparative method’, which involves making systematic comparisons across cases to refine each theme. Hence Hewitt-Taylor (2001) expressed CCM

as one method that can be used to identify broad themes and patterns, or categories that emerge from the qualitative research studies.

The results, interpretation, and discussion will follow the order of the three research questions, as stated in Chapter 1, which are:

- (a) What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in the Ngwelezane Circuit?
- (b) What are the views of the Grade 6 Natural Sciences and Technology teachers on the teaching strategies they use in teaching the subject?
- (c) To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?

However, before the results are presented, the biographical information of the participants is presented.

### **4.3 Profile of the Participants**

Originally, the plan was to collect data from 20 primary schools in the Ngwelezane Circuit. The researcher first visited the schools to discuss with the principals the process to be followed and to make arrangements for data collection. Of the initial 20 schools, 17 eventually participated in the survey. This was an eighty-five percent (85%) success on the initial expected participation. The reasons for non-participation included change of mind due to school activities and discomfort with having a researcher observe a lesson. Natural Sciences and Technology teachers had to complete the research questionnaire (Appendix A, p. 119) included in this study. Table 4.1 and table 4.2 below show the biographical details of the participants. Pseudonyms instead of the names of the teachers were used as per the ethical consideration. The teachers were given letters A to P.

**Table 4.1:** The Biographical details of the participating teachers

Teacher codes	Age	Gender	Years of teaching experience
A	32	Female	3
B	47	Male	6
C	45	Female	9
D	39	Female	5
E	27	Female	1
F	43	Male	13
G	33	Female	2
H	40	Female	10
I	30	Male	1
J	47	Female	6
K	32	Female	5
L	53	Male	5
M	29	Female	4
N	32	Female	5
O	45	Female	7
P	52	Female	5
Q	35	Female	1

**Table 4.2:** Summary of the biographical details

Items	Male	Female	Total
Gender	4	13	17
<i>Age 20 – 30</i>	1	2	3
<i>Age 31 – 40</i>	Nil	7	7
<i>Age 41 – 50</i>	2	3	5
<i>Age 51 – 60</i>	1	1	2
<i>Teaching experience 1 – 5 years</i>	2	9	11

<i>Teaching experience 6 – 10 years</i>	1	4	5
<i>Teaching experience 11 – 13 years</i>	1	Nil	1
Qualified to teach the subject	2	7	9
Not qualified to teach the subject	3	5	8

Of 17 teachers who participated in this study, four were males (24%) and thirteen were females (76%). This shows that, in this study, there were more females than males teaching Natural Sciences and Technology in the Intermediate Phase Grade 6. The ages of the teachers ranged from 29 to 53 years. The teaching experience ranged from 1 year to 13 years. However, most of the teachers (eleven) had between one and five years of experience.

The researcher found it interesting that some teachers were not trained in teaching the subject but had to teach as per instruction from the school management. The World Economic Forum has ranked South Africa 137<sup>th</sup> out of 139 countries in terms of mathematics and science teaching (Shepherd, 2013). A reasonable assumption could be that unqualified/untrained teachers have contributed to this ranking. Two male and eleven female teachers indicated that their training included Natural Sciences and Technology teaching. This means that eight of the teachers teaching Natural Sciences and Technology did not get appropriate training to teach the subject.

In addition, some teachers had undergone training a while ago, raising the concern that there are some sections or concepts that were not taught at that time and which are taught presently. Also, whether there was adequate training for education curriculum policy changes which had taken place in South Africa within the last ten years comes in to question. Killen (2010) expressed that teachers can help learners develop knowledge or skills, but no single teaching strategy is effective all the time for all the learners. It calls for the teacher to be flexible and to be equipped with various strategies in teaching whilst training in order to use them in their teaching field.

#### 4.4 Data Presentation and Analysis

The information collected in this study was analysed to get an understanding of the strategies used by Grade 6 Teachers in the teaching of Natural Sciences and Technology in the Ngwelezane Circuit schools. The following data collection tools were used in the study to find out how teachers use the various strategies in the teaching of Natural Sciences and Technology in schools: research survey questionnaire, classroom lesson observation, interviews, and document analysis. Data from the relevant parts of each data collection tool are presented under each research question. The results and analysis will be followed by the discussion in sub-section 4.4.

##### 4.4.1 What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in the Ngwelezane Circuit?

Information for this research question was gathered from the following instruments: Questionnaires, Interviews, Document Analysis (Lesson Plans) and Observation Notes. Each is discussed after each table presented.

###### (i) Questionnaires

The responses of 17 teachers who participated in the study are presented in the table below.

**Table 4.3:** Responses to the question: What strategies (Methods) do you use when teaching Natural Sciences and Technology in Grade 6?

Teacher	Strategies
Teacher A	Telling, demonstration, observation and question and answer method.
Teacher B	Integration technology in the class and using their specific contexts, question and answer and telling method.
Teacher C	Showed no understanding of strategies. Response not about strategies.
Teacher D	Interactive Learning strategy. Others were not strategies. Question missed.

Teacher E	Group teaching.
Teacher F	Telling, question and answer methods.
Teacher G	Group activities, experiments and discussions.
Teacher H	Group teaching, practical tasks and hands-on methods.
Teacher I	Practical based and real life scenarios.
Teacher J	Discussion, question and answer, practical work, investigation, demonstration,
Teacher K	Practical work. The rest was an explanation on how to present a lesson.
Teacher L	Investigations, designs, inventions.
Teacher M	Problem solving, practical tasks. Confused with ways or types of assessment.
Teacher N	Demonstration and discussion.
Teacher O	Practical activities, investigation, textbooks.
Teacher P	Discussion, question and answer, telling and research.

The results show that teachers in this study state that they use a variety of teaching strategies in the teaching of Natural Sciences and Technology in the Intermediate Phase. According to the CAPS document (DoE, 2011, 12):

“The Scientific Process is a way of investigating things about the world. Scientists use this process to find out about the world and to solve problems. One of the steps of the scientific process is to “make inferences about the observations recorded in the tables, graphs, drawings, photographs and make some conclusions.”

However, it was observed that teachers are predominantly use strategies such as telling methods that do not develop Active and Critical skills in learners as required by CAPS. According to Roche, Adiga and Nayak (2016) alluded to the point that Active Learning, comprehension and Critical Thinking promote horizontal and vertical integration between subjects.

Kurfiss (1988) mentioned that, in Critical Thinking, learners are active, involved, consulting and arguing with each other, and responsible for their own learning. So, if the learners are not exposed to being actively involved (i.e. using the telling strategy) and not motivated to argue

with each other because of the strategies used by the teachers, they are categorically not being supported in the development of Critical Thinking skills. This means that, in some cases, the learners are not being developed along the lines of the scientific process.

(ii) Interviews

Eight schools were identified to be interviewed, but three of them failed to cooperate in the process because of various reasons some were personal and some were because of the school's phasing. So the researcher ended up working with five schools out of the 17. The teachers were interviewed as per the sampling strategy used. Their responses are presented in the table below.

**Table 4.4:** Strategies from the teachers' responses in the interview

Teacher	Strategies
Teacher A	Telling, demonstration, observation and question and answer method.
Teacher B	Question and answer, group work.
Teacher C	Experimental activities, telling, question and answer.
Teacher D	Interactive Learning strategy.
Teacher E	Question and answer, group work.

In the interviews teachers also mentioned a variety of strategies used in the teaching of Natural Sciences and Technology in the Intermediate Phase (Grade 6). As in the responses given in the questionnaire, strategies which do not align to active and Critical Thinking (such as telling) were mentioned.

The results show that the teachers' responses in the questionnaire differed from those in the interviews, and differed from what is observed in the actual classroom situation. The researcher points this out because there are Active Learning strategies mentioned in the questionnaire which differed from what the teachers said when interviewed and, more specifically, when observed in the classroom. Teachers seem to be clear as to what is supposed to happen, but what they know does not align with how they teach in their classes.

This requires teachers to be skilled in pedagogy, in order to equip learners with relevant skills for the future, meaning that teachers should not only be aware of the teaching strategies that will be effective in the development of active and Critical Thinking in learners but also be able to effectively implement the strategies in the actual classroom situation.

(iii) Document analysis

Five out of the 17 teachers who were interviewed were also asked to submit their lesson plans to the researcher for document analysis. The details of the analysis of the lesson plans are presented in Appendix I. The analysis of the teaching strategies indicated in the lesson plans is presented in Table 4.5 below.

**Table 4.5:** Analysis of teaching strategies stated by the teachers in their lesson plans

Teacher	Strategies
Teacher A	Telling, demonstration, observation and question and answer method
Teacher B	Question and answer, group work.
Teacher C	Experimental activities, telling, question and answer.
Teacher D	Interactive Learning strategy.
Teacher E	Question and answer, group work.

As in the case of the questionnaire and interviews, teachers stated a variety of strategies that they use in the teaching of Natural Sciences and Technology in the Intermediate Phase (Grade 6). In the lesson plan, strategies such as telling methods, which do not correspond with what was observed during the lesson presentation and also do not align with Active and Critical Learning were also mentioned. Nelson and Crow (2014) explained that Active Learning strategies develop learners to think critically, and must therefore be the type of activities that are designed to mentally stimulate and engage thinking in a relevant context. If teachers increase the level of using strategies that develop Critical Thinking, it is more likely that learners will be good critical thinkers.

(iv) Observation Notes

Five out of the 17 teachers who responded to the questionnaire were interviewed and were also observed during the lesson presentation in class. The full details of the lesson observation notes are presented in Appendix Q. The analysis of the teaching strategies from the observation notes are presented in the table below.

**Table 4.6:** Analysis of teaching strategies using the lesson observation notes

Teacher	Topic	Strategies
Teacher A	The Solar System - The sun, the planets and the asteroids	Question and answer, narrative/telling and the demonstration strategies.
Teacher B	The Solar System - Rotation and revolution of the earth around the sun and the axis.	Question and answer Method, Narrative/telling strategies.
Teacher C	The Solar System - Rotation and revolution of the earth around the sun and the axis.	Question and answer, telling, guided discovery thorough questioning.
Teacher D	The Solar System - Revolution and rotation of the earth around the sun and the axis.	Narrative/telling, group discussions, demonstration, question and answer teaching strategy, interactive Learning strategy.
Teacher E	The Solar System - Revolution and rotation of the earth around the sun and the axis.	Textbook, question and answer, narrative/telling, teaching strategies.

It is noted that the teachers were teaching the same theme (Solar System) as per the CAPS document, and classified as per the Annual Teaching Plan that outlines what is to be taught by all schools per term and per week. The above table on analysis of teaching strategies using the classroom lesson observation notes reaffirms that the teaching strategies for Active and Critical Learning stated in the questionnaires and in their lesson plans, and the ones mentioned in the interviews differ from actual strategies used.

Critical and Active Learning Strategies that were mentioned in the survey questionnaires and interviews included group work, experiments, discussions, practical tasks, real life scenarios, investigations, designs, inventions, problem solving and research. However, when teachers were observed, these strategies did not emerge. On the other hand, more passive learning, teacher-centred strategies were observed. For example the usual strategies of question and answer (largely closed questions within little time for the learners to respond which is the “wait time” which is required for constructivist learning to be applied or somewhat rhetorical in approach), narrative or telling, and textbook methods were actually used. Teacher D is such an example. In the lesson plan the teacher stated “interactive strategy” whereas in the classroom observation, it was a narrative (telling) strategy which was teacher-centred with passive learners. Learners were not involved in the learning process in class. Of the five teachers observed, only one catered for learner involvement during their presentation of the lessons. Nearly all of them used similar strategies (narrative, closed questions and answers, demonstration) in ways which did not align to the development of critical and Active Learning advocated by the CAPS policy document.

The table below is a composite analysis of the teaching strategies used by the teachers as analysed from the different data collection instruments.

**Table 4.7:** Composite analysis of the teaching strategies used based on all data sets.

<i>No.</i>	<i>Strategies</i>	<i>Questionnaire</i> <i>(n =17)</i>	<i>Interviews</i> <i>(n =5)</i>	<i>Lesson Plan</i> <i>(n =5)</i>	<i>Observation</i> <i>schedules</i> <i>(n =5)</i>
1.	Telling or narrative	4 (23.53%)	2 (40%)	2 (40%)	5 (100%)
2.	Demonstration	3 (17.65%)	1 (20%)	1 (20%)	2 (40%)
3.	Learners making observation	1 (5.88%)	1 (20%)	1 (20%)	-
4.	Question and answer method	5 (29.41%)	3 (60%)	3 (60%)	5 (100%)
5.	Guided discovery through questioning	1 (5.88%)	1 (20%)	1 (20%)	1 (20%)
6.	Interactive Learning	3 (17.65%)	2 (40%)	2 (40%)	-

7.	Group work (teaching)	1 (5.88%)	1 (20%)	1 (20%)	-
8.	Experiments	4 (23.53%)	-	-	-
9.	Discussions	6 (35.29%)	-	-	-
10.	Learner practical work (task)	1 (5.88%)	-	-	-
11.	Hands-on method	3 (17.65%)	-	-	-
12.	Investigation	1 (5.88%)	-	-	-
13.	Inventions	1 (5.88%)	-	-	-
14.	Problem solving	1 (5.88%)	-	-	-
15.	Textbook	1 (5.88%)	-	-	-

The narrative/telling strategy is wholly teacher-centred. According to the above table, just about a quarter of the participants (23.53%) use the narrative/telling strategy. The Question and answer strategy can be teacher-centred if the questions are closed and where the teacher undertakes to immediately answer the question without giving learners the time to think (no wait time) and respond. While 29.41% of the participants use this strategy (Table 4.7), the classroom observation showed that the strategy was used in a teacher-centred way. The textbook method can contribute to passive learning if learners merely copy notes. One teacher indicated that they use this strategy. This was used in a passive way. According to the responses to the questionnaire, although overall there are a variety of strategies indicated, the responses are very sparsely spread across the strategies to account for Active Learning and for the development of Critical Thinking - for example learner practical task (1%) and group work (1%).

Practical work is a valuable strategy for Active Learning. A critical point is that in the CAPS policy document, practical work is given importance both in the suggested teaching and learning activities and as well in the weighting in the continuous assessment. However, according to the results, only one teacher mentioned learner practical work in the questionnaire and none in the interviews. In the questionnaire, this also seemed to be the case for group work. Group work is considered a valuable strategy for Active and Critical Learning if planned and executed efficiently.

There are strategies mentioned in the questionnaires such as experiments, investigation, problem solving, hands-on and discussions, but from the observation in class these were not used at all. These methods equip learners with suitable skills for Natural Sciences and Technology. For example, learners can develop writing skills during report writing in experiments and investigations. Learners also follow steps during methods and can develop observation skills. Problem solving solves real problems, promotes creative, divergent, and critical or convergent thinking in learners. Learners are able to exchange ideas, express, explore their views and apply knowledge and reflecting attitudes and values through the discussion as a strategy. Hands-on activities are suitable for Natural Sciences and Technology as it develops skills, provides opportunities for exploration and self-discovery, and engages learners in Active Learning. While experiments, investigation, problem solving, hands-on work and discussion feature in table 4.7, these strategies were not evident in the classroom observation. This means that the learners are given limited opportunities for Active and Critical Learning and for the development of essential skills in the Natural Sciences and Technology.

Demonstration is a strategy that involves direct instruction, is teacher-centred since the teacher is the one to give the directions through guidance on what to do and leads the teaching/learning process (Rupley, Blair and Nichols, 2009). Two of the five teachers observed (40%) used demonstration in their lessons. The learners are once again limited in their opportunity to engage in Active and Critical Learning. Table 4.7 also indicates that the strategy/strategies indicated in the lesson plan do not always translate into the way the lesson is implemented (telling and narrative strategy and demonstration).

#### **4.4.2 What are the views of the Grade 6 Natural Sciences and Technology teachers on the teaching strategies they use in teaching the subject?**

This part of the results refers to the views expressed by the teachers in the questionnaire (Table 4.8) and in the interviews (Table 4.9).

**Table 4.8:** Views of teachers on teaching strategies expressed in the questionnaires

<b>Teacher</b>	<b>Strategy</b>	<b>Teacher quotations on the views on teaching strategies</b>
Teacher A	General comment	Learners learn best when the teacher is hands-on and does not talk a lot, not showing them how things occur.
	Telling	The teacher must not only talk to them.
	Demonstration	Show something to them.
	Observation	Learners learn by observing.
	Question and answer	It creates a welcoming learning environment for all learners.
Teacher B	General comment	Learners understand better when one uses their pre-knowledge, because that helps them know that daily experiences are not far removed from the reality of classroom interaction.
	Group work	No comment.
	Question and answer	No comment.
Teacher C	General comment	I use these strategies in order to give the learners an analysis of their assessment data, recording and reporting as the feedback.
	Experimental activities	Participate fully in science learning.
	Telling method	No comment.
	Question and answer method	No comment.
Teacher D	General comment	Learners must know previous concepts before learning new ones. Some learners are visual and need visual aids to remember concepts

		and to reinforce learning.
	Interactive Learning strategy	Interactive Learning and tasks re-enforce learning.
Teacher E	General comment	I want learners to be involved in the lesson so that they will have clear understanding of the lesson.
	Question and answer method	No comment.
	Group work	Grouping learners allow them to help each other.
Teacher F	General comment	Because it suits the learners.
	Question and answer method	No comment.
	Telling method	No comment.
Teacher G	Discussions	So that all the learners can be actively involved.
	Experimental activities	Same as the above comment.
	Group activities	Same as the above comment.
Teacher H	Practical tasks and activities	The learners need to physically be involved with practical a task as that is the only way to learn.
	Hands-on	No comment.
	Group teaching	Group teaching allows for interaction and peer support.
Teacher I	Practical based method,	It is very resourceful and learner friendly or easy for the learners to grasp the concept.
	Real life scenarios strategy	To explain some concepts.
Teacher J	General comment	In order to help learners make connection between the ideas and the concepts in their minds.
	Demonstration	No comment.
	Investigation	To equip the learners with skills and knowledge that they can use in everyday life.

	Question and answer method	No comment.
	Discussion	To equip the learners with skills and knowledge that they can use in everyday life.
Teacher K	Practical work	In order to help them to understand the subject.
	Question and answer	No comment.
Teacher L	Investigations	The subject deals with practical mostly.
	Analysing	No comment.
	Production	No comment
	Inventions	No comment
	Designs	No comment
Teacher M	General comment	Knowledge of learners and skills can be evaluated through prior knowledge by using the strategies stated and to stimulate creativity.
	Problem solving	No comment.
	Practical Tasks	No comment.
Teacher N	General comment	To equip learners with knowledge, skills and values necessary for self-fulfilment and meaningful participation. To develop scientific and technological knowledge and understanding.
	Group Activities	No comment.
	Demonstrations	No comment.
	Question and answer method	No comment.
Teacher O	Practical activities	Learners learn quicker by seeing practical activities and experiments.
	Textbooks	No comment.
	Research	It allows learners to be able to work independently.

Teacher P	Question and answer	Finds out what the children know.
	Research	No comment.
	Telling method	No comment.
	Discussion	Discussion helps them get more knowledge from the others.

Table 4.8 above presents the views of teachers on teaching strategies expressed in the questionnaires. Teachers A, C, E, G, H, I and O believe that learners should be involved in the learning process. For example, Teacher E refers to question and answer and group work, and provides the following rationale for this: “I want learners to be involved in the lesson so that they will have clear understanding of the lesson.” and Teacher H believes in giving learners practical tasks because: “The learners need to physically be involved with a practical task as that is the only way to learn.” It is obvious that what is stated aligns with CAPS, that the strategies mentioned are based on principles encouraging an Active and Critical approach to learning rather than rote learning. CAPS aims to produce learners that are able to identify and solve problems and make decisions using critical and creative thinking. Overall in the questionnaire, the Natural Sciences and Technology teachers are aware of strategies that promote Active and Critical Learning and are in agreement that learners should be actively involved in the learning process. However, some teachers did not provide any comments for the strategies that they use.

**Table 4.9:** Views of teachers on teaching strategies expressed in the interviews.

Teacher	Strategy	Teacher quotations on the views on teaching strategies
Teacher A	General comment	They make them understand the lesson clearly and make it easier for them to understand different topics.
	Telling	No comment.
	Question and answer	No comment
	Observation	No comment
	Demonstration	No comment
Teacher B	Question and answer	It is easier if you ask someone about things that

		they know before introducing new things. There is no active and Critical Thinking involved.
	Group work	No comment.
Teacher C	Experimental activities, demonstration	It helps them not to forget easily and it accommodates them to help them catch up quickly, which caters for those who are slow learners as well. Active and Critical Thinking catered for.
	Question and answer method	No comment.
	Telling Method	No comment.
Teacher D	Interactive Learning Strategy.	To make them enthusiastic to learning, and to memorise concepts and terms which are difficult to understand to others. Active Learning is involved here.
	Demonstration	No comment.
Teacher E	Group work	Learners cooperate when they hear from other learners, and help to hear the feedback from them. Active and Critical Learning involved.
	Question and answer method	No comment.

The literature indicates that the best teaching strategies are those which make the learners active participants in the learning process. Kirschner, Sweller and Clark (2006) argued that the constructivist-inspired learning strategies and environments include student-centred learning, inquiry based learning and self-directed learning. Dewey (1998) clearly reflected that the learning must be rooted in the conditions of experiences and arouse an active request for information and new ideas. In table 4.9 above, teachers B, C, and E have mentioned strategies which are learner-centred: B (group work); C (experimental activities) and E (group work). Teacher D's response was interesting. Teacher D mentions an "Interactive Learning strategy" but makes mention of "memorisation of concepts and terms". This shows perhaps a confusion of what Active Learning actually means. The literature points out that Active Learning is where learners construct their own understanding and knowledge of the

world through experience and reflecting upon that experience rather than through rote learning (Harasim, 2012). In the interviews teachers also mentioned strategies that do not show the involvement and engagement of the learners during their teaching viz. telling, which is against what the new curriculum CAPS is intending to implement during teaching and learning.

#### **4.4.3 To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?**

Data on the teaching strategies was gathered using four instruments, questionnaires, interviews, lesson plans and classroom observation schedules. The researcher elects to comment in greater detail on the strategies actually observed by the researcher in the classroom, as some strategies may have been stated in the questionnaire, lesson plan or interviews but not implemented in the lessons. Tables 4.10 and 4.11 make reference to the alignment of the teaching strategies to active and to critical learning respectively.

**Table 4.10:** Alignment of the teaching strategies to Active Learning

<i>Teacher</i>	<i>Strategies used /description (what the learners do)</i>	<i>Learner-centred strategies</i>
A	<p><i>Telling-</i> Learners listened to what the teacher was telling them what to do.</p> <p><i>Demonstration</i> – The teacher showed the learners how the earth rotates around the sun, learners then practised under the teacher’s guidance.</p> <p><i>Question and answer</i> – Learners answered the questions asked.</p>	<p>None</p> <p>X</p> <p>None</p>
B	<p><i>Question and answer</i> - Learners listened to what the teacher was telling them what to do.</p> <p><i>Telling-</i> Learners listened to what the teacher was telling them what to do.</p>	<p>None</p> <p>None</p>
C	<p><i>Demonstration</i> – The teacher demonstrated the movement of the earth around the sun and the learners had to do that in groups after demonstration.</p> <p><i>Teacher guided through question and answer method</i> – The teacher asked questions and when the learners did not give the correct answers the teacher guided them through questioning to the correct answers.</p> <p><i>Telling method</i> - Learners listened to what the teacher was telling them to do.</p>	<p>X</p> <p>X</p> <p>None</p>

D	<p><i>Interactive Learning strategy</i> – The learners are made such that they interact in the teaching and learning. The teacher invited questions from the learners and allowed for discussion.</p> <p><i>Demonstration</i> – The teacher demonstrates the activity to the learners and they perform that in groups to practise what was demonstrated to them.</p> <p><i>Group discussions</i> – The learners were given a problem or concept to discuss about in groups and then gave feedback to the whole class.</p>	X  X  X
E	<p><i>Question and answer method</i> – The teacher asked the questions and the learners gave answers to the questions asked.</p> <p><i>Narrative or lecture (telling) method</i> – the teacher gave the lecture to learners about the concept for the day. Learners listened and took notes given by the teacher.</p> <p><i>Textbook method</i> – the teacher uses the textbook as a guide to his or her teaching. The teacher uses the textbook as a source of the information that needs to be used during the teaching and learning.</p>	None  None  None

According Table 4.10, lessons observed for teachers A, B, and E in practice showed greater teacher domination than being learner-centred. The lessons of teachers B and E were completely teacher-dominated and the learners were passive in the learning process. Teachers A and C, on the other hand, used some learner-centred approaches such as group work and guided practice.

Teacher D is deduced as the one who completely used a learner-centred approach using an Interactive Learning Strategy, Demonstration and Group Discussion, which are Active Learning strategies. The teacher used demonstration in an active way by giving the learners the opportunity to perform the task in groups following the demonstration. This is an interesting observation, since all teachers observed were doing the same topic according to the curriculum policy work schedule or Annual Teaching Plan. Teacher D is an example which shows that Active Learning strategies can be used by Grade 6 Natural Sciences and Technology teachers.

The following Table 4.11 that is going to appear the next is based on the observation during the teaching and learning of the teachers in the classroom. It is aimed at looking at the alignment of the teaching strategies they were using to whether they develop the Critical Learning to learners.

In the table there is a column talking about the self-reflection. Cranton (2002) defined Critical Self-Reflection as a way to encourage critical self-reflection to the learners. He mentioned that we need to provide the opportunity for students to question their assumptions during teaching and learning: teachers have to let them examine what they think and how they feel and consider the consequences of holding certain assumptions. Cranton (2002) further on mentioned that Critical self-reflection may take place in the classroom, but it is perhaps more likely to take place outside it as well. This means that the teacher can do it even in the Teaching Strategies that take the learners to go out of the class. So the column is set to check if the Teaching Strategy that was used did give a chance to learners for self-reflection which is in line with the Critical learning as Cranton (2002) called it the Critical Self-Reflection.

**Table 4.11:** Alignment of the teaching strategies to critical learning

<i>Teacher</i>	<i>Strategies used /description of the tasks /questions)</i>	<i>Self-reflection</i>	<i>Peer discussion /group work</i>	<i>Learners express thoughts/view s</i>	<i>Responding to data</i>	<i>Teacher providing feedback</i>	<i>Teacher asks open-questions</i>	<i>Teacher invites questions</i>
A	Telling, demonstration, question and answer	None	None	None	None	None	None	None
B	Question and answer, group work	None	Yes (group Work)	None	None	Yes (group work)	None	None
C	Experimental activities, telling method, question and answer method.	Experimental activities	None	Experimental activities	None	Experimental activities	Experimental activities	Yes

D	Interactive Learning strategy, demonstration, group work	Interactive Learning	Yes (group work)	Yes (group work)	None	Yes (group work)	None	Yes
E	Question and answer method, group work.	None	Yes (group work)	Yes (group work)	None	Yes (group work)	None	None

According to Table 4.11, alignment to critical learning can be mainly seen in the group work strategy where learners are given the opportunity to discuss and express their views. However, the teacher's role in promoting critical learning is minimised as open questions and inviting questions from learners was not evident in all lessons.

Teacher C was able to promote critical learning in her teaching, as most of her activities were experimental where learners expressed their thoughts; the teacher was able to ask open questions; the learners were able to respond; the teacher also invited questions from them.

The findings of this study revealed that most of the teachers who participated were mindful of the teaching strategies that promote Active and Critical Learning as indicated by the responses from the questionnaires and the interviews, but did not use those strategies in the delivery of the lesson. The CAPS policy document (DoE, 2011, 4) categorically encourages "Critical and active approaches to learning, rather than rote and uncritical learning of given truths" but, from Tables 4.11 above, the analysis to alignment to critical and Active Learning in the teaching of Natural Sciences and Technology, are so minimal that one may conclude that the strategies used did not serve the purpose of developing the critical skills in the learning of the subject.

## **4.5 Discussion**

In considering what has been noted from the above analysis, the following discussion is derived for each instrument used per research question.

- (a) What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in the Ngwelezane Circuit?

From the questionnaires it is observed that Teachers A, B, F, J, P and O mentioned the telling method as well as the question and answer method which do not promote Active and Critical Learning, but instead made the learners passive. This contradicts the literature on what is expected to be happening during teaching and learning especially for Natural Sciences and

Technology. The teaching of science will be effective if you present science as a way of finding out rather than as a body of facts to be memorised (Sale, 2001; Alexander, 2012; Abdi, 2014). According to Wood and Ashfield (2008), the teaching strategies selected to be used by the teachers must enable the learners to be creative and imaginative and to develop each one's potential.

There are strategies mentioned that could have been used by the teachers for Active and Critical Learning such as discussion. Borich and Tombari (1997) point out that it is an appropriate teaching strategy. This is a strategy in teaching where there is a class discussion or talk about something, in this case scientific, to create a decision to exchange ideas. It is also used to organise and control the classroom. However, while teachers in this study mentioned Critical Learning strategies they did not use them significantly and effectively.

Problem solving as a strategy is defined by Borich and Tombari (1997), as the learning that takes place to solve the real problem to show that the learners have understood the information. Sale (2001) mentioned that problem solving promotes creative or divergent thinking and critical or convergent thinking in learners. However, only one teacher (Table 4.7) mentioned the strategy and none were actually observed using it in classroom.

Field trips are an effective teaching strategy for the teaching of Natural Sciences and Technology. No teacher made mention of field trips in this study. Majumalon (2015) perceived it as a vehicle by which science can be learned and taught. Krepel and Duvall (1981) defined field trips as “a trip arranged by the school and undertaken for educational purposes, in which the learners go to places where the materials of instruction may be observed and studied directly in their functional setting”. Michie (1998) stated that field trips are valuable for cognitive and effective development of the learners. He further stated that field trips provide opportunities for hands-on, real world experiences, improved quality of education, motivation and development of a positive attitude towards the subject, improvement of the socialisation between learners as well as development of rapport between teachers and learners. While field trips may not have suited the topic of the solar system, it was also not mentioned in the questionnaire which was open ended. Perhaps another study is required within this education district on field trips as a strategy for Active and Critical Learning. While field trips are valuable for experiential learning, the researcher agrees with

Behrendt and Franklin (2014) that much of the success of field trips depends on planning on the part of the teacher.

With reference to the solar system, revolution and rotation of the earth around the sun and the axis, under the strand Planet Earth and Beyond, for that period of visit to schools, the topic suited the strategy of Role-playing, which Sale (2001) advocated. This is a strategy with learning activities in which one or more learners are required to “act” a part, for example in the learning of how the earth rotates and revolves around the sun, the teacher can let them role play after he or she has explained the process. However, none of the teachers made mention of the strategy and none used the strategy in the classroom. This leaves the question of why teachers were not using such as strategy in a topic that provides ample opportunity for Active Learning. The Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences and Technology and Technology Grades 4-6 (Intermediate Phase), stated that the National Curriculum Statement (NCS) is based on the principles encouraging an active and critical approach to learning, rather than rote learning and uncritical learning of given truths.

There are benefits from Active Learning as a strategy. Roche, Adiga and Nayak (2016) reinforced that Active Learning strategy has many benefits for the learners (learners). They stated that its aim is to enhance Active Learning, comprehension and Critical Thinking with a view to promote horizontal and vertical integration between subjects. Hence Nelson and Crow (2014) explained Active Learning strategies as strategies that teach learners to think critically, and must therefore be the type of activities that are designed to mentally stimulate and engage thinking in a relevant context. Arslan, and Demirtas, (2016) endorsed Critical Thinking is a self-regulated process of reasoning that is defined as an individual making a judgement of conclusions by questioning, affirmation, approval and correction in the process of cognitive activities focused on a special purpose. It is encouraging to note that Teachers A, C, D, E, G, H, I, J, K, L, M, N and O mentioned strategies that are suitable for the teaching of Natural Sciences and Technology, which included demonstration, observation, group work, experimental, interactive learning, practical tasks and activities, investigations, problem solving, research and discussions. These align to Active and Critical Learning to the learners during the teaching and learning of Natural Sciences and Technology. However, a variety of these strategies were not evident in the classroom.

(b) What are the views of the Grade 6 Natural Sciences and Technology teachers on the teaching strategies they use in teaching the subject?

The researcher observed that when the teachers were asked through the questionnaires, they mentioned learner-centred strategies that align to Active and Critical Learning. However, these are not translated into the actual lesson. Teachers A, B, C and E mentioned strategies aligned to Active and Critical Learning, as stated in the interviews and the questionnaires, but used telling and question and answer when observed in the classroom. Teachers C, D and E, in their responses to the interviews, made reference to learner participation and Active Learning. Teachers are of the view that learners should be active participants in the learning process.

In the questionnaires, lesson plans and interview responses, teachers made reference to a variety of teaching strategies to teach Natural Sciences and Technology in the Intermediate Phase. Nevertheless, Teachers A, B, C, E, F, J, K, N, O and P mentioned the “telling”, “question and answer” as well as some of those that are critical and Active Learning strategies. This means that most of the strategies mentioned were mainly teacher-centred with very few mentioning learner-centred ones, and even fewer implementing these during teaching and learning. Teachers D, G, H, I, L did show knowledge of the strategies that can be effective to the teaching of Natural Sciences and Technology and that can be critical and active in nature. This is succoured by the responses from the interview that Teachers A, B, C and E also mentioned the commonly used “teacher dominated” strategies like telling method, question and answer and textbook.

Killen (2010) expressed that teachers can help learners develop knowledge or skills, but no single teaching strategy is effective all the time for all the learners. This means that the teachers need to be aware of the various teaching strategies they can use in order to develop the skills for learners in the teaching and learning. While the researcher agrees with Killen, the problem arises when teachers tend to choose teacher-centred strategies such as telling/narration and when they dominate the lesson, as was the case during the classroom observation in this study. This negates the Active and Critical Learning advocated by the CAPS curriculum.

- (c) To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?

From the five teachers observed, interviewed and their lesson plans analysed, it is evident that Teachers A, B, C and E implemented question and answer as well as the telling method in their teaching which are not aligned with the aim of the CAPS as a current curriculum in our education system. The CAPS aims to produce learners that are able to identify and solve problems and make decisions using critical and creative thinking. In this study the strategies most teachers used did not allow the learners to think critically and become active in their learning. Looking at the alignment to critical and Active Learning as per CAPS, Teachers A, B, C and E did not enable learners to be active and to be critical during their learning. Closed question and answer and as well as the telling method to do not stimulate higher order Critical Thinking or engage learners in Active Learning. Bean (2011) described Active Learning as strategies that make learners more powerful thinkers and better arguers. Teacher D, whose teaching was interactive, gave learners a chance to be involved in their learning. This was only one of the five teachers observed.

#### **4.6 Concluding Remarks**

This chapter presented data as collected using the following instruments: questionnaires, interviews, lesson plan analysis and observation schedule. Using the information, a profile of the participants was composed as well an analysis of the data presented both qualitatively and quantitatively.

With reference to the observation, it was noted that most of the teachers observed were in the same scope of work that needed to be done as per the Department of Education's Annual Teaching Plan for CAPS. This enhanced the study by providing a common topic to understand the strategies used by Grade 6 Natural Sciences and Technology teachers.

Bhalli, Sattar and Asif (2016) describe teaching strategies as the methods, techniques and procedures a teacher uses during instruction to achieve desired learning objectives. Kurfiss (1988) mentioned that, in Critical Thinking, learners are active, involved, consulting and

arguing with each other, and responsible for their own learning. They mentioned that the best teaching strategies are those which make the learners active participants in the learning process. Its focal point is on what the learners do to achieve learning (O'Neill & McMahon, 2005). The analysis shows that teachers have knowledge of learner-centred teaching strategies which were noted in responses to the questionnaire. However, the interviews, lesson plans and the actual observation showed otherwise in the implementation of the strategies. The implementation was skewed in favour of teacher dominance compared to active learner-centred engagement and to limited, if or no opportunities for critical development. Hmelo-Silver and Barrows (2006) point out that in the learner-centred strategy the teacher becomes the facilitator. However, this study shows in reality, in the context of the teachers observed, the teacher seemed to be more of a narrator than a facilitator and focused less on inspiration but more on explanation.

Further, within the constructivist teaching paradigm, learners should be the focus of the teaching and learning context. While this notion of constructivism is advocated in CAPS, and acknowledged by teachers, the reality of the classroom lessons observed deviated significantly from the principle of learner-and activity centred learning.

## **CHAPTER 5: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION**

### **5.1 Introduction**

This chapter presents a summary of the findings from the data analysed in response to the research questions. The chapter also presents the limitations of the study, makes recommendations and concludes the study. Killen (2010) outlines that teaching strategies support learners in the development of knowledge or skills. The teacher therefore needs to have the skills to develop knowledge and skills in learners. Hence, Active Learning strategies must be the type of activities that are designed to mentally stimulate and engage thinking within a relevant context (Nelson and Crow, 2014). Within the context of teaching strategies and the development of Critical Thinking the following research questions were addressed in this study:

- (1) What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in the Ngwelezane Circuit?
- (2) What are the views of the Grade 6 Natural Sciences and Technology teachers on the teaching strategies they use in teaching the subject?
- (3) To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?

A mixed-method approach was used in this study. Mixed methods research is defined as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study or a multiphase programme or enquiry (Johnson and Onwuegbuzie, 2004; Creswell and Plano, 2007). The mixed-method approach was applied to the analysis through quantifying the different strategies used by teachers within the study and through critical narratives of the teachers' response to the questionnaires, interviews and researcher observation notes. The different data collection methods also contributed to the trustworthiness of the data.

The summary of the research findings is first presented followed by the limitations of the study, recommendations and recommendations for further research for further study.

## 5.2 Summary of Research Findings

The data, presentation, analysis and interpretation that were presented in Chapter 4 provided the response to the three research questions. The following presentation of the summary of findings is therefore shown according to the research questions using the instruments stated in the research methodology chapter.

- i) 'What teaching strategies do the Grade 6 Natural Sciences and Technology teachers use in their teaching in the Ngwelezane Circuit?'

It was found that some teachers are using strategies like Telling Method, Textbook, Question and answer in a dominant way. This promotes passive learning. The dominant use of these strategies does not align with and develop active and critical skills in learners as required by CAPS.

Teachers mentioned various critical and Active Learning strategies in the survey questionnaires and interviews such as groupwork, experiments, discussions, practical tasks, real life scenarios, investigations, designs, inventions, problem solving and research. However, during in-class observation most of these strategies did not emerge.

It was evident that teachers are aware of the strategies to be used for effective teaching of Natural Sciences and Technology to develop critical, active and creative thinking, but when observed there is a tendency to use these strategies to a lesser extent if at all. In respect to Active Learning, critical learning and problem solving, lessons were more content based. Very few or no Critical Thinking skills were developed in the learners in the sense that the learners were not actively involved in the learning. Thought-provoking questions were not asked, as observed with the classroom participants. It was only in one school where the teacher involved learners and allowed them to ask questions in a meaningful way i.e. through giving adequate time for thinking and for a response.

In summary, while Grade 6 Natural Sciences and Technology teachers are aware of teaching strategies for Active and Critical Learning. However, the reality of the lessons observed in practice showed greater teacher domination, with little or no alignment to Active and Critical Learning.

- ii) ‘What are the views of the Grade 6 Natural Sciences and Technology teachers on the teaching strategies they use in teaching the subject?’

In the interviews, teachers voiced strategies that they use when teaching Natural Sciences and Technology. These strategies were: Telling, Demonstration, Observation, Question and Answer Method, Group work, Experimental Activities and Interactive Learning Strategy. As in responses to question 1, it was noted that the teachers are aware of the teaching strategies that will be effective for Active and Critical Learning in the Natural Sciences and Technology in the Grade 6 curriculum. However, some teachers mentioned that they did not get proper and appropriate training in the teaching of the subject, and were mandated by the school’s management to teach the subject in the located grade. A point that was brought up was that it would be of assistance to their development in the teaching of the subject if they were given appropriate training towards the strategies available in teaching the subject.

Teachers seem to link content knowledge to pedagogic knowledge. A view that was expressed from the questionnaires and the interviews conducted was that, at the time of their training, there were sections in the Natural Sciences and Technology which were not offered in the curriculum (such as the strand of Earth and Beyond on which teachers were focusing during this study). From the interviews conducted, it came out that teachers expressed that they lack background to such topics, and expect the management at the school level and/or those in the education offices to provide support through need on the effective ways of teaching the topic. Killen (2010) expressed that teachers can develop knowledge and skills, and that not only one single teaching strategy is effective. It then follows that teachers need to be familiar with the teaching strategies and be able to apply these strategies to different topics in the curriculum. Teachers assume that the outcomes will be positive if in-service training is conducted frequently on various strategies in teaching for the teaching of the Natural Sciences and Technology.

The responses of the teachers were similar to those given in the questionnaires. Of note is that some teachers believed that learners should be involved in the learning process physically through the use of practical tasks and strategies encouraging Active Learning. Teachers mentioned a variety of strategies aligned to Active and Critical Learning but the responses were different to what the researcher observed during the classroom observation. In the class,

contrary to what was expressed in the interviews, teachers used strategies that were inappropriate or did not promote active, critical and problem-solving skills to the learners. So the views teachers expressed about the teaching of Natural Sciences and Technology as per the interviews were different from the experience the researcher encountered in the in-class observation. In-class observation revealed teacher dominated lessons.

iii) ‘To what extent do teaching strategies used by the Grade 6 Natural Sciences and Technology teachers align to the principle of Active and Critical Learning as expressed in the CAPS document of the Department of Education?’

As stated in the introduction to this chapter, it is advocated within the Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences and Technology and Technology Grades 4-6 in South Africa that teaching of the Natural Sciences and Technology should take an active and critical approach to learning. To align to the expectation that curriculum produces learners who are able to identify and solve problems and make decisions using critical and creative thinking, teachers are expected to use teaching strategies which support the latter.

Learners will be able to develop their Critical Thinking only if teachers increase the level of using effective strategies during their teaching. The teachers in this study in all the data gathering, mentioned effective strategies like group work, experiments, discussions, practical tasks, real life scenarios, investigations, designs, problem solving and research, which are suitable for the teaching of Natural Sciences and Technology. For an example - in the interviews and in the questionnaire, within the concept of Active and Critical Learning, the respondents articulated that hands-on activities and experiment during teaching and learning is beneficial to the learners.

Reviewing the analysis on what was observed in the in-class observation, as per Table 4.6, the results skew against the alignment to Active and Critical Learning. In reference to what was written in Document Analysis, Table 4.5, it is clearly shown that the teachers are aware of the effective strategies, but they do not use them in their teaching and learning environment. Comparing the two tables mentioned, the first (table 4.5) contains teaching strategies for Active Learning; however, the second table (4.6) contains strategies that do not develop active, creative, critical, interactive and problem-solving skills in learners. Teachers

are using closed question and answer, telling or narrative and text book strategies which do not make them participants in the presentation of the lesson. They are more teacher-centred where most of the planning and work is done by the teacher instead of the learners; learners are passive.

It was observed that most of the strategies that were actually used by teachers in their teaching were not aligned to the CAPS since they promoted passive learning rather than Active and Critical Learning. In making the latter point, the researcher acknowledges that only five teachers were actually observed in the classroom. The teachers who were observed were teaching the strand Planet Earth and Beyond according to the Annual Teaching Plan (ATP). The time allocation for the topic was nearly the same; it only varied as per the pace of the learners being taught per school. This formed a uniform context to explore the teaching strategies used within the observed sample of teachers.

It was noted that the teachers had lesson plans, in which mention was made of teaching strategies for Active and Critical Learning. However, the implementation of the presentation methodology for Active and Critical Learning during the actual lesson did not manifest or align to their lesson plans. Few teachers used the strategies aligning to the CAPS document; collectively, these include questioning, expanding teacher demonstration to learner activities and group discussions. These are learner-centred and need to be encouraged to be used by the teachers in making the learners more active in the teaching and learning environment.

Telling still seems to dominate the classroom within the sample observed in this study. The reasons for this were not explored and hence there could be a range of assumptions that may be unreasonable at this point. Overall, teachers were using strategies that did not provide opportunities to develop Critical Thinking, problem solving and creative thinking skills in learners.

The best teaching strategies are those which make the learners active participants in the learning process through Active Learning, where learners construct their own understanding and knowledge of the world through experience and reflecting upon that experience (Harasim, 2012) rather than through rote learning. The CAPS categorically advocates that the learners need to be physically involved with practical tasks as that is a meaningful way to learn. The kind of the learners that CAPS envisaged will not materialise if teaching strategies for Active

and Critical Learning are not predominantly and effectively used in the teaching of the Natural Sciences and Technology.

### **5.3 Recommendations**

Based on the findings of the study, the researcher makes the following recommendations:

The teachers' profiles reveal that some teachers were not trained in teaching the subject and only did so because of the instruction from the school management as per the policy that there is no specialisation in primary schools. A reasonable assumption is that teachers may not be able to use relevant strategies because of grappling with the knowledge strand of Planet Earth and Beyond. Some teachers were not introduced to the knowledge strand during their teacher training.

It is recommended that the Department of Education provides on-going support for teachers teaching Natural Sciences and Technology in the Intermediate Phase, with focus on teaching strategies that promote active and Critical Thinking learning. Teaching strategies that promote Active and Critical Learning should be encouraged to negate rote learning. This could be supported in school cluster groups. As per the National Curriculum Statement, learners should be able to identify and solve problems as well as making decisions using critical and creative thinking. The researcher perceives that to produce critical and creative thinking learners, effective teaching skills are as important as content knowledge, and hence teachers need to be adequately supported interdependently and not in isolation.

Focused workshops on the use of effective strategies in teaching Natural Sciences and Technology need to be conducted by the Department of Education and aided by the subject education specialists, with follow up and support.

An effective teacher is a lifelong learner. This implies that, for teachers to be competent and to develop their skills, they need to develop themselves academically (professional development) along with content knowledge, teaching approaches (strategies) and professional attitudes (Kriek and Grayson, 2009). The Provincial Education Department needs to strengthen science teachers' content knowledge as an essential component of any

professional development programme. As mentioned by a teacher in this study, they need content support in the strand of Planet Earth and Beyond. There should be sufficient in-service training to cater for teachers teaching the subject having not been trained in some topics like Planet Earth and Beyond which was not there during their teacher training. Formal in-service training is likely to bridge the gap between the current topics and the training they received before these topics were included. Perhaps a better understanding of the strand may encourage teachers to move away from the content focus to the strategy focus.

Teachers need to make sure that the strategies they are using promote the desire to understand the world as portrayed in the CAPS document. In this regard, as suggested by Dhurumraj (2013), teachers need to use teaching strategies which promote Active Learning instead of passive learning. Reflective practice is one the ways to support change in the way in which things are being done. The researcher suggests that Natural Sciences and Technology teachers be formally encouraged to engage in reflective practice after their lessons within the context of teaching strategies for Active and Critical Learning.

The use of strategies that do not promote Active and Critical Learning to learners should be discouraged. The proper use of Integrated Quality Management Systems (IQMS) should serve this purpose, where development is done by the teacher's Development Support Group (DSG) after the lesson has been presented in the learning environment. It is also recommended that teaching of Natural Sciences and Technology as a subject must be taught by the teachers with a background in the subject (Bantwini, 2010). Teaching of Natural Sciences and Technology needs to use inquiry based teaching – which is the strategy that involves learners' engagement in the use of Critical Thinking skills. This means that the Department of Education needs to recruit teachers joining the field having Natural Sciences and Technology as a major subject from the university, or have a background of the subject when allocated that subject to teach. Teachers for Natural Sciences and Technology in primary schools should be allocated to teach the subject based on their training.

It is suggested that schools have functional laboratories. Although laboratory work is an expectation in teaching science, the response to using laboratory work as a teaching strategy was almost negligible in this study. Training and encouragement to conduct field work in the Natural Sciences and Technology as a strategy for Active Learning is likely to contribute to the CAPS advocacy of Active Learning.

#### **5.4 Limitations of the study**

The researcher acknowledges that this study had certain limitations. Prince and Murnan (2004) articulated that a common limitation is when respondents do not respond truthfully to items on an instrument such as a questionnaire. At times their responses reflect neither true perceptions nor the perception of the population from which they were drawn. In this study, when asked about teaching strategies that they use, teachers could have just listed strategies to be impressive rather than mention the ones that they actually use.

There are incidences that occur during data collection which might not be controlled and that might be affecting the results of the project (Price and Murnan, 2004). In this study, teachers could have behaved differently from their usual teaching compared to the actual lesson the researcher had observed. Teachers could have been influenced by the researcher's presence during the classroom observation. This would have impacted on the findings.

The researcher acknowledges that the study was conducted only in schools in the Ngwelezane Circuit and also, within this circuit, five schools were identified for actual classroom observation. Logistical reasons contributed to limiting the study to a circuit and to the number of teachers that were observed. The findings may have been different if other circuits were involved in the study and if a far greater number of teachers were observed in the classroom.

#### **5.5 Recommendations for further Research**

The study focused on the teaching strategies that teachers use in teaching Natural Sciences and Technology in schools in the Ngwelezane Circuit. The study could be extended to other circuits to compare the findings to this study. The study can also be extended to more urban schools in higher socio-economic areas and compared to the findings in rural and semi-rural schools as in this study.

The study explored the strategies teachers use, teachers' views and the alignment of teaching strategies to Active and Critical Learning advocated by CAPS. Due to the Annual Teaching Plan and the timing of study, the strand of Planet Earth and Beyond provided the content

context for the study. Further research can also be extended to the other strands in the Natural Sciences and Technology and comparisons should be made to the findings of this study.

Further studies could explore the most effective and relevant teaching strategies within the strand of Planet Earth and Beyond, of the Natural Sciences and Technology curriculum. Formal in-service training could be conducted both on content and teaching strategies for Active and Critical Learning. Follow-up could be done through peer or research observations to further explore the teaching strategies as advocated by CAPS for the Natural Sciences and Technology.

## **5.6 Conclusion**

The literature indicates that the best teaching strategies are those which make the learners active participants in the learning process. The CAPS policy in South Africa advocates teaching strategies that promote Active and Critical Learning within the Natural Sciences and Technology. The three research questions explored the teaching strategies used by teachers in the Ngwelezane Circuit and to understand the alignment to Active Learning and Critical Thinking. The findings from this study show that Natural Sciences and Technology teachers within the Ngwelezane Circuit are aware of the teaching strategies that promote Active Learning and Critical Thinking (research question 1) and acknowledge that learners are the focus of learning thinking (research question 2). However, the interviews and more especially the actual classroom observation, showed that passive teaching still seems to be dominant and that teaching strategies that promote Active Learning and Critical Thinking, when used, were not sufficiently effective. This does not align to the advocacy of Active and Critical Learning in the CAPS policy (research question 3).

In exploring the teaching strategies used by Grade 6 Teachers in the teaching of Natural Sciences and Technology in the Ngwelezane Circuit Schools, given the acknowledgement of the limitations of this study, the research reveals that teachers are aware of a variety of teaching strategies that promote Active and Critical Learning. However, within the strand of Planet Earth and Beyond, the classroom observation reveals a greater slant towards teacher dominated strategies which promote passive and rote learning rather than Active and Critical Learning.

The researcher strongly advocates a reflective teaching practice, further training and support from the Department of Education to achieve the advocacy outcomes of the CAPS policy i.e. Active and Critical Learning in the Natural Sciences and Technology.

## REFERENCE LIST

- Abdi, A. (2014). The effect of inquiry-based learning method on learners' academic achievement in science course. *Universal Journal of Educational Research*, 2(1), 37-41.
- Adam, S. (2004). Using learning outcomes. In *Report for United Kingdom Bologna Seminar* (pp. 1-2).
- Adler, J., Slonimsky, L. & Reed, Y. (2002). Subject-focused INSET and teachers' conceptual knowledge-in-practice. *Challenges of Teacher Development: An investigation of take-up in South Africa*, 135-152.
- Alake-Tuenter, E., Biemans, H.J.A., Tobi, H., Wals, A.E.J., Oosterheert, I. & Mulder, M. (2012). Inquiry-based science education competencies of primary school teachers: A literature study and critical review of the American National Education Standards. *International Journal of Science Education*, 34(17), 2609–2640.
- Alexander, B. (2012). Web 2.0: A new wave of innovation for teaching and learning? *Educause Review*, 41(2), 32.
- Al-Zu'be, A.F.M. (2013). The difference between the learner-centred approach and the teacher-centred approach in teaching English as a foreign language. *Educational Research International*, [www.erint.savap.org.pk/PDF](http://www.erint.savap.org.pk/PDF), 2(2), 2-2.
- Anfara, V.A. & Mertz, N.T. (2015). Setting the stage. *Theoretical Framework in Qualitative Research*, 1, 20.
- Arslan, S. & Demirtas, Z. (2016). Social emotional learning and critical thinking disposition. *Studia Psychologica*, 58 (4), 276-285. doi: 10. 21909/SP. 2016.04.723.
- Bantwini, B.D. (2010). How teachers perceive the new curriculum reform: Lessons from a school district in the Eastern Cape Province, South Africa. *International Journal of Educational Development*, 30, 83-90.
- Bantwini, B. D. (2015). Analysis of the state of collaboration between Natural Science schools district officials and primary school Science teachers in South Africa. *Journal of Baltic Science Education*, 14(5).
- Barraket, J. (2005). Teaching research method using a student-centred approach? Critical reflections on practice. *Journal of University Teaching & Learning Practice*, 2(2), 3.
- Bean, J.C. (2011). *Engineering ideas: The professor's guide to integrating writing critical thinking and active learning in the classroom* (2<sup>nd</sup> ed.). San Francisco, CA: Jossey-Bass.
- Bean, J.C. (2011). *Engaging ideas: The Professor's Guide to Integrating Writing Critical Thinking and Active Learning in the classroom*. John Wiley & Sons.
- Benohel, J.Q. (1985). Advancing nursing science qualitative approaches. *Western Journal of Nursing Research*, 6(3), Suppl, 1–8.

- Bentley D. & Watts M. (1989). *Learning and teaching in school Science: Practical alternatives*. Milton Keynes, England: Open University.
- Berger, P. L., & Luckmann, T. (1991). *The social construction of reality: A treatise in the sociology of knowledge* (No. 10). Penguin UK.
- Berg, A. & Welander Hansson, U. (2000). Dementia care nurses' experiences of systematic clinical group supervision and supervised planned nursing care. *Journal of Nursing Management* 8(6), 357–368.
- Bertram, C. (2011). What does research say about teacher learning and teacher knowledge? Implications for professional development in South Africa. *Journal of Education*, 52(5), 26.
- Bertram, C., Christiansen, I. & Land, S. (2014). *Understanding research: An introduction to reading research*. Pretoria, South Africa: Van Schaik.
- Educational Development. September 2013 33(5):448-456 Language: English. DOI: 10.1016/j.ijedudev.2012.10.001, Database: Science Direct.
- Beyer, B.K. (1995). *Critical Thinking*. Bloomington, IN: Phi Delta Kappa Educational Foundation Educational Development. September 2013 33(5):448-456 Language: English. DOI: 10.1016/j.ijedudev.2012.10.001, Database: Science Direct
- Bhalli, M.A., Sattar, A. & Asif, M. (2016). Teaching strategies. *Professional Medical Journal*, 23(5), 614–619. doi: 10.17957/TPMJ/16.3206
- Blackwell, M. (2013). A framework for dynamic causal inference in political science. *American Journal of Political Science*, 57(2), 504-520.
- Bogdan, R. & Biklen S.K. (2003). *Qualitative research for education: An introduction to theory and methods 4<sup>th</sup> ed*. Boston, MA: Allyn and Bacon.
- Booyse, J.J., Le Roux, C.S., Seroto, J. & Wolhuter, C.C. *A History of schooling in South Africa: Method and Context*. Pretoria: Van Schaik.
- Boudah, D.J. (2011). *Conducting educational research: Guide to completing a major project*. Thousand Oaks, CA: Sage.
- Brace, I. (2018). *Questionnaire design: How to plan, structure and write survey material for effective market research*. Kogan Page.
- Brown, A. & Dowling, P. (1998). *Doing research/reading research: A mode of interrogation for education*. London, England: Falmer.
- Bruce, C. (2004). Information literacy as a catalyst for educational change: a background paper". White paper prepared for UNESCO, the US NCLIS and National Forum for Information Literacy. In *3rd International Lifelong Learning Conference* *Lifelong Learning: Whose responsibility and what is your contribution*.

- Bryman, A. (2003). *Quantity and quality in social research*. Routledge.
- Burns, N. & Grove, S.K. (1987). *The practice of nursing research conduct, critique and utilisation*. Philadelphia PA. W.B. Saunders.
- Campbell, D.T. & Fiske, D.W. (1959). Convergent and discrimination validation by the multitrait – multimethod matrix. *Psychological Bulletin*, 56 (2), 81 – 105.
- Centre for Development and Enterprise (2007). *Doubling for growth: Addressing the Mathematics and Science challenge in South Africa's schools*. The Centre for Development and Enterprise, Johannesburg, South Africa.
- Chan, L.K. & Cole, P.G. (1986). The effects of comprehension monitoring training on the reading competence of learning disabled and regular class learners. *Remedial and Special Education*, 7(4), 33-40.
- Charmaz, K. (2006). *Constructing grounded theory – A practical guide through qualitative analysis*. London, England: Sage.
- Christensen, M. (2012). Critical issue: providing hands-on, and authentic learning experiences in science.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education*. London, England: Taylor & Francis.
- Cohen, M. & Seria, N. (2010). South Africa struggles to fix dysfunctional schools. *Market Snapshot, US Europe Asia*.
- Conway, C. (2017). *Teacher's perspectives of learner support in a full-service school: A case study* (Doctoral thesis). Stellenbosch University, Stellenbosch, South Africa).
- Corbin, J & Strauss, A. (2008). *Basics of qualitative research: techniques and procedures for developing grounded theory* (3<sup>rd</sup> ed.) Thousand Oaks, CA: Sage.
- Corbin, J & Strauss, A. (2015). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (4<sup>th</sup> ed.). Thousand Oaks, CA: Sage.
- Cormack, D.F.S. (ed.) (1991). *The Research Process in Nursing 2<sup>nd</sup> ed.* Oxford, England: Blackwell Scientific.
- Cranton, P. (2002). Teaching for transformation. *New Directions for Adult and Continuing Education*, 2002(93), 63-72.
- Crawford, B.A. (2007). Learning to teach science as inquiry in the rough and tumble of practice. *Journal of Research in Science Teaching* 44, 613-642 doi:10.1002/tea.20157.
- Crawford, B.A. (2014). From inquiry to scientific practices in the science classroom. In S.K. Abell and N.G Lederman (eds.), *Handbook of Research on Science Education* (pp. 515 – 541). Mahwah, NJ: Lawrence Erlbaum.

- Corpuz, B.B., & Salandanan, G.G. (2003). *Principles and strategies of teaching*. Metro Manila, Philippines: Lorimar.
- Creswell, J.W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches (2<sup>nd</sup> ed.)*. Thousand Oaks, CA: Sage.
- Creswell, J.W. (2007). *Qualitative inquiry & research design: Choosing among five approaches. (2<sup>nd</sup> ed.)*. Thousand Oaks, CA: Sage.
- Creswell, J.W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research. (4<sup>th</sup> ed.)* Boston MA: Pearson.
- Creswell, J.W. & Clark, V.L.P. (2017). *Designing and conducting mixed methods research*. Sage publications.
- Creswell, J.W. & Plano Clark, V.L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.
- Cruickshank, D.R. & Applegate, J.H. (1981). Reflective teaching as a strategy for teacher growth. *Educational Leadership*, 38 (7), 553–554).
- Datar, A., Jain, A. & Sharma, P.C. (2013). Design and performance analysis of adjustable window functions based cosine modulated filter banks. *Digital Signal Processing*, 23(1), 412-417.
- Delaney, J., Johnson, A.N., Johnson, T.D. & Treslan, D.L. (2010). *Learners' perceptions of effective teaching in higher education*. St John's, NL: Distance Education and Learning Technologies.
- Denscombe, M. (2008). Communities of practice: A research paradigm for the mixed methods approach. *Journal of Mixed Methods Research*, 2(3), 270-283.
- Borich, G. D., & Tombari, M. L. (1997). *Educational psychology: A contemporary approach*. Longman Publishing/Addison Wesley L.
- Denzin, N.K. (2008). *The research act: A theoretical introduction to social methods*. New York NY: Aldine.
- Denzin, N.K. & Lincoln, Y.S. (2008) *Introduction. The discipline and practice of Qualitative research*. In N.K. Denzin & Y.S. Lincoln (eds), *The landscape of qualitative research (3<sup>rd</sup> revised ed.)*. Thousand Oaks, CA: Sage.
- Denzin N.K. & Lincoln Y.S. (2011). *Handbook of Qualitative Research*. California: Sage Publications.
- Department of Education. (2001). *Education in South Africa: Achievements since 1994*. [online] Available at: [www.dhet.gov.za](http://www.dhet.gov.za) (accessed 7 November 2016).

- Department of Education and Training. (2010). *National Qualifications Framework Act 67amendment*. Available at: <http://www.saqa.org.za/docs/legislation/2010/act67.pdf>
- Department of Basic Education (2011). *Curriculum and assessment policy statement: Natural sciences and technology and technology Grades 4-6*. Pretoria, South Africa: Government Printers.
- Dewey, J. (1925). *Experience and nature*. Whitefish, MT: Kessinger.
- Dewey, J. (1938/1998). *Experience and education* (60<sup>th</sup> anniversary ed.). West Lafayette, IN: Kappa Delta Pi.
- Dewey, J. (1938/2004). *Democracy and education*. Mineola, NY: Dover Publications.
- Dillon, J. (2010). Towards the professional development of science teachers. In *International Seminar, Professional Reflections*. York, England: National Science Learning Centre.
- Durrheim, K., & Wassenaar, D. (2004). Putting design into practice: Writing and evaluating research proposals. In M. Terre Blanche & K. Durrheim (eds.), *Research in practice: Applied methods for the social sciences* (pp. 30-45). Cape Town, South Africa: University of Cape Town.
- Dhurumraj, T. (2013). Contributory factors to poor learner performance in physical sciences in KwaZulu-Natal Province with special reference to schools in the Pinetown district (Doctoral dissertation).
- Doody, O., & Noonan, M. (2013). Preparing and conducting interviews to collect data.
- Douglas, J.D. (1985). *Creative interviewing*. Beverly Hills, CA: Sage.
- Durrheim, K. (2006). *Research design*. In M. Terre Blanche, K. Durrheim & D. Painter (eds.). *Research in practice: Applied methods for the social sciences*. Cape Town, South Africa: University of Cape Town.
- Felder, R.M. & Brent, R. (2009). Active Learning: An introduction. *ASQ Higher Education Brief*, 2(4), 1-5.
- Fitzgerald, A. Dawson, V. & Hackling, M. (2013). Examining the beliefs and practices of four effective Australian primary science teachers. *Research in Science Education*, 43(3), 981–1003.
- Flick, U. (2002). Qualitative research-state of the art. *Social Science Information*, 41(1), 5-24.
- Flick, U. (2018). *An introduction to qualitative research*. Sage Publications Limited. Geography, 189-201.
- Foskett, N. (1997). Teaching and learning through fieldwork. *Teaching and Learning*
- Fontana, A. & Frey, J.H. (2005). *The interview: From neutral stance to political involvement*. In N.K. Denzin & Y S. Lincoln (eds.), *Handbook of qualitative research* (3<sup>rd</sup> ed.) 695–727). Thousand Oaks, CA: Sage.

- Fosnot, C.T. (2013). *Constructivism: Theory, perspectives, and practice*. Teachers College Press.
- Johnson, R.B. & Onwuegbuzie, A.J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), 14-26.
- Gale, N. K., Heath, G., Cameron, E., Rashid, S., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology*, 13(1), 117.
- Goodman, E. J., & Lehmann, J. (2010). Active Research on Active Learning Strategies. *Team Performance Management*, 10, 145-151.
- Government Gazette 36774, 2013. [online]. Available from: [www.gov.za/constitution](http://www.gov.za/constitution) (Accessed 7 November 2016).
- Graneheim, U.H. & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2), 105-112.
- Grossman, P. (1990). *The making of a teacher. Teacher knowledge and teacher education*. London, England: Teachers College.
- Guàrdia, L. Maina, M. & Sangrà, A. (2013). MOOC design principles: A pedagogical approach from the learner's perspective. *eLearning Papers*, (33).
- Guba, E.G. (1981). Annual review paper: Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational communication and technology: a journal of theory, research and development* 29 (2), 75–91.
- Guba, E.G. (Ed) (1990) *The Paradigm Dialog*. London, England: Sage.
- Guarte, J.M. & Barrios, E.B. (2006). Estimation under purposive sampling. *Communications in Statistics - Simulation and Computation*®, 35(2), 277-284.
- Hammersley, M. & Atkinson, P. (1995). *Ethnography: Principles in practice*. (2<sup>nd</sup> ed.). New York: Routledge.
- Harasim, L. (2012). *Learning theory and online technologies*. Routledge.
- Harden, R. M., Crosby, J., Davis, M. H., Howie, P. W., & Struthers, A. D. (2000). Task-based learning: the answer to integration and problem-based learning in the clinical years. *Medical Education-Oxford*, 34(5), 391-397.
- Harding, J. (2018). *Qualitative Data Analysis: From Start to Finish*. SAGE Publications Limited.
- Hechter, M. & Horne, C. (2009). *Theories of Social Order*. Stanford, CA: Stanford University.

- Henning, E. Van Rensburg, W. & Smith, B. (2004). *Finding your way in qualitative research*. Pretoria, South Africa: Van Schaik.
- Hennink, M., Hutter, I.I. & Bailey, A. (2011). *Qualitative research methods*, London: Sage.
- Hennink, M.M. (2013). *Focus group discussions*. Oxford, England: Oxford University.
- Hewitt-Taylor, J. (2001). Use of constant comparative analysis in qualitative research. *Nursing Standard (through 2013)*, 15(42), 39.
- Hmelo-Silver, C.E. & Barrows, H.S. (2006). Goals and strategies of a problem-based learning facilitator. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 4.
- Hofstein, A., Eilks, I. & Bybee, R. (2011). Societal issues and their importance for contemporary science education: A pedagogical justification and the state of the art in Israel, Germany and the USA. *International Journal of Science and Mathematics Education*, 9, 1459–1483.
- Holbrook, J. (2003). Increasing relevance of science education: The way forward. *Science Education International*, 14(1), 5–13.
- Holstein, J.A. & Gubrium, J.F. (2003). *Inside Interviewing*. Thousand Oaks, CA: Sage.
- Hugo, W., Jack, M., Wedekind, V. & Wilson, D. (2010). The state of education in KwaZulu-Natal: A report to the provincial treasury. Pietermaritzburg, South Africa. KZN Provincial Treasury.
- Jeffery, H. (2010). Student-centred learning: Options for the application of constructivist thinking in occupational therapy education. *WikiEducator.org*.
- Jones, M. & Straker, K. (2006). What informs mentors' practice when working with trainees and newly qualified teachers? An investigation into mentors' professional knowledge base. *Journal of Education for Teaching*, 32(2), 165-184.
- Joubert, R. & Prinsloo, S. (2009). *The Law of Education in South Africa* (2nd impression). Hatfield, South Africa: Van Schaik.
- Joppe, G. (2000). Testing reliability and validity of research instruments. *Journal of American Academy of Business Cambridge*, 4(1/2), 49-54.
- Kember, D. & Kwan, K.P. (2000). Lecturers' approaches to teaching and their relationship to conceptions of good teaching. *Instructional Science*, 28(5), 469-490.
- Kennedy, M.M. (1998). Education reform and subject matter knowledge. *Journal of Kent, Research in Science Teaching*, 35(3), 249-263.
- M., Gilbertson, D.D. & Hunt, C.O. (1997). Fieldwork in Geography teaching: A critical review of the literature and approaches. *Journal of Geography in Higher Education*, 21 (3) 313–332.

- Khoza, S.B. (2013). Learning Outcomes as Understood by 'Publishing Research' facilitators at a South African university. *Online Submission*, 3(2), 1-11  
<http://dx.doi.org/10.13054/mije.13.09.3.2>
- Khoza, S. B. (2013). Learning Outcomes as Understood by" Publishing Research" Facilitators at a South African University. *Online Submission*, 3(2), 1-11.
- Killen, R. (2006). *Effective teaching strategies: Lessons from research and practice*. Australia: Cengage Learning.
- Killen, R. (2010). *Teaching Strategies for Quality Teaching and Learning*. Claremont, South Africa: Juta.
- Killen, R. (2012). *Teaching Strategies for Quality Teaching and Learning*. Claremont, South Africa: Juta.
- Kirschner, P.A., Sweller, J. & Clark, R.E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologists*, 41(2), 75–86.
- Kitchens, A.N., Barber, W.D. and Barber, D.B. (1991). Left brain/right brain theory: Implications for developmental math instruction. *Research in Developmental Education*, 8(3), 3–6.
- Kuhn, T.S. (1962). *The structure of scientific revolutions* (1<sup>st</sup> ed.). Chicago, IL: University of Chicago.
- Kumar, R. (2011). *Research methodology: A step-by-step guide for beginners*. (3<sup>rd</sup> ed.) London, England: Sage.
- Kurfiss, T.G. (1988). *Critical thinking: theory, research, practice, and possibilities*. ASHE-ERIC Higher Education Report No. 2, 1988. Washington, DC. ASHE-ERIC Higher Education Reports, George Washington University.
- Krepel, W.J & DuVall, C.R. (1981). *Field trips: A guide for planning and conducting educational experiences*. Analysis and Action Series. West Haven, CN: NEA Distribution Center,
- Kretchmar, J. (2015). Constructivism. *Research Starters: Education* (Online Edition). physical science teachers. *South African Journal of Education*, 29(2), 185-203.
- Kriek, J. & Grayson, D. (2009). A holistic professional development model for South African
- Krueger, R.A. & Casey, M.A. (2009). *Focus groups: a practical guide for applied research* (4<sup>th</sup> ed.) Thousand Oaks, CA: Sage.
- Kruger, W. & Mitchell. (2012). *Research Methodology*. (3<sup>rd</sup> ed.). Oxford University Press. South Africa

- Leach, M. (1990). Philosophical choice. *Nursing: The Journal of Clinical Practice, Education and Management*, 4(3), 16–18.
- Lederman, N.G. & Lederman, J.S. (2015). The status of preservice science teacher education: A global perspective. *Journal of Science Teacher Education* 26, 593. doi:10.1007/s10972-015- 9443-2.
- Legotlo, M.W., Maaga, M.P. & Sebego, G.M. (2002). Perceptions of stakeholders on causes of poor performance in Grade 12 in a province in South Africa. *South African Journal of Education*, 22(2), 113-118.
- Le Roux C. (2013). The History of Education in South Africa. Chapter 1 (pp.1-41). In C.S. Le Roux (2011). European foundations shaping schooling in South Africa: early Dutch and British colonial influence at the Cape. Chapter 4 (pp. 57 – 84)
- Le Roux, J. (ed.): 1993. *The black child in crisis- A socio-educational perspective*. Vol 1, Hatfield, South Africa: Van Schaik.
- Lewis, S. (2015). Qualitative inquiry and research design: Choosing among five approaches. *Health promotion practice*, 16(4), 473-475.
- Lincoln, Y.S. Guba, E.G. (1985). Establishing trustworthiness. *Naturalistic Inquiry*. London, England: Sage.
- Lincoln, Y.S. (2009). *Ethical practices in qualitative research*. In D.M. Mertens & P.E. Ginsberg (eds.). *The handbook of social research ethics*. (pp. 150-169). Los Angeles, CA: Sage.
- Lindahl, B. (2003). *Lust att lara naturvetenskap oor teknik? Enlongitudinell studieom vagen till gymnasiet*. Dissertation, Goteborg, Sweden: Acta Universtatis Gothoburgensis.
- Long, T. & Johnson, M. (2000). Rigour, reliability and validity research. *Clinical Effectiveness in Nursing* 4(1), 30–37.
- Loyens, S.M. & Gijbels, D. (2008). Understanding the effects of constructivist learning environments: Introducing a multi-directional approach. *Instructional science*, 36(5-6), 351-357.
- Majoka, M.I., Dad, M.H. & Mahmood, T. (2010). Student Team Achievement Division (STAD) as an active learning strategy: Empirical evidence from mathematics classroom. *Journal of Education and Sociology*, 4, 16-20.
- Manqele, C.M. (2017). *An evaluation of learner-centred teaching as part of curriculum delivery in under-resourced schools* (Doctoral dissertation).
- Marshall, C. & Rossman, G.B. (2016). *Designing Qualitative Research* (6<sup>th</sup> ed.). London, England: Sage.
- Maxwell, J.A. (2011). *A realist approach for qualitative research*. Thousand Oaks, CA: Sage.

- Maxwell, J.A. (2012a). *Qualitative research design: An interactive approach*, (3<sup>rd</sup> ed). Thousand Oaks, CA: Sage.
- Maxwell, J.A. & Miller, B.A. (2008). *Categorising and connecting strategies in qualitative data analysis*. In P. Leavy and S. Hesse-Biber (eds.), *Handbook of Emergent Methods*. New York, NY: Guilford. pp. 461–477.
- Mc Millan, J.H. & Schumacher, S. (2001). *Research in education: A conceptual introduction*. New York, NY: Longman.
- Merriam, S. B. (2002). Introduction to qualitative research. *Qualitative research in practice: Examples for discussion and analysis, 1*, 1-17.
- Merriam-Webster Online dictionary. 2009. *Case Study*. Available at Manqele, C. M. (2017). An evaluation of learner-centred teaching as part of curriculum delivery in under-resourced schools (Doctoral dissertation).
- Merriam, S.B. (2009). *Qualitative research and case study appliances in education*. San Francisco, CA: Jossey-Bass.
- Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.
- Mertens, D.M. (2010). Philosophy in mixed methods teaching: The transformative paradigm as illustration. *International Journal of Multiple Research Approaches*, 4(1), 9-18.
- Michie, M. (1998). Factors influencing secondary science teachers to organise and conduct field trips. *Australian Science Teacher's Journal*, 44(4), 43-50.
- Miles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis: A sourcebook for new methods*. (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Miles, M.B., Huberman, A.M. & Saldana, J. (2013). *Qualitative data analysis*. Sage.
- Mji, A. & Makgato, M. (2006). Factors associated with high school learners' poor performance: A spotlight on mathematics and physical science. *South African Journal of Education*, 26(2), 253-266.
- Moeletsi, M.M.V. (2005). *Primary school teachers' understanding and interpretation of problem-solving: how it is promoted in science lessons, why and why not?* Doctoral dissertation, Durban, South Africa: University of KwaZulu-Natal.
- Mooney C.G. (2000). *An introduction to Dewey, Montessori, Erikson, Piaget & Vygotsky*. St Paul, Canada : Red Leaf.
- Mulhall, A. (2003). In the field: notes on observation in qualitative research. *Journal of Advanced Nursing* 41(3), 306-313.
- Muwanga-Zake, J.W.F. (2003). *Is Science education in a crisis? Some of the problems in South Africa*. On-line Science Magazine, issue 2, June 11, [www.scienceinAfrica.co.za](http://www.scienceinAfrica.co.za), *Science Education*.

- National Curriculum Statement (NCS). (2011). *Curriculum and assessment policy statement. natural sciences and technology and technology Grades 4-6*. Department of Basic Education. South Africa: Government Printing Works.
- Nelson, L.P., Crow, M.L.(2014) *Higher Education Studies*, 4(2) 77-90.. (EJ 1076485).
- Newman, I. & Benz, C.R. (1998). *Qualitative-quantitative research methodology: Exploring the interactive continuum*. SIU.
- Nilsson, P. (2009). From lesson plan to new comprehension. Exploring student teachers' pedagogical reasoning in learning about teaching. *European Journal of Teacher Education*, 32 (3), 239-258.
- NGSS Lead States, (2013). *Next Generation Science Standards: For States, by States*. Washington, DC: National Academies.
- O'Neill, G., & McMahon, T. (2005). Student-centred learning: What does it mean for learners and lecturers.
- Osborne, J. and Dillon J. (2008). *Science education in Europe: Critical reflections*. London, England: The Nuffield Foundation.
- Osborn J. & Dillon J. (2010). *Good practice in Science teaching*. What research has to say. (2<sup>nd</sup> ed.). Maidenhead, England: McGraw-Hill.
- Pandor, N. (2008). Speech by Minister of Education at the Wits SRC Education Week (5 August, 2008). Pretoria, South Africa: Department of Education,
- Paul, R., & Elder, L. (2005). Critical Thinking competency standards. *Tomales, CA: Foundation for Critical Thinking*.
- Paul, R. and Elder, L. (2009). Critical and creative thinking: Ethical reasoning and fair minded thinking, Part1. *Journal of Developmental Education*, 33 (1), 36.
- Patton, M.Q. (1987). *How to use Qualitative Methods in evaluation*. London, England: Sage
- Patton, M. Q. (2005). Qualitative research. *Encyclopedia of statistics in behavioural science*.
- Patton, M. (2015). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage.
- Peez, G. (2002). 'Rezension zu: Norbert Dittmar, Transkription. Ein Leitfaden mit Aufgaben für Studenten, Forscher und Laien. Opladen: Leske + Budrich 2002. *Gesprächsforschung – Online – Zeitschrift zur verbalen Interaktion*, 3:24 – 8: [www.gespraechsforschung-ozs.de](http://www.gespraechsforschung-ozs.de) (retrieved 20 October 2011).
- Petty, N.J., Thomson, O.P. & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy*, 17(5), 378-38.

- Phurutse, M. C. (2005). Factors affecting teaching and learning in South African public schools. HSRC press.
- Piawa, C.Y. (2010). Building a test to assess creative and critical thinking simultaneously. *Procedia-Social and Behavioral Sciences*, 2(2), 551-559.
- Pinar, W. F. (2012). What is curriculum theory?. Routledge.
- Pinar, W.F. (2012). *What is curriculum theory?*. Routledge
- Pinar, W. F. (2012). What is curriculum theory?. Routledge.
- Polanyi, M. (2012). *Personal knowledge*. Routledge.
- Polit, D.F. & Hungler, B.P. (1999). Nursing Research. Principles and Methods (6th ed.) New York, NY: J.B. Lippincott.
- Polkinghorne. D.E. (2005). Language and meaning: Data collection in qualitative research. *Journal of Counseling Psychology*, 52 (2), 137.
- Potter, J. (2004). 'Discourse analysis'. In M. Hardy and A. Bryman, *Handbook of Data Analysis*. Thousand Oaks, CA: Sage. pp.607-24.
- Price, J.H. & Murnan, J. (2004). Research limitations and the necessity of reporting them.
- Prouix, J. (2006). Constructivism: A re-equilibration and clarification of concepts, and some potential implications for teaching and pedagogy. *Radical Pedagogy*, 7, 5. Retrieved June 10, 2007 from EBSCO Online Database Education Research Complete.
- Rapley, T. (2007). *Doing conversation, discourse and document analysis*. London: Sage.
- Reed, Y. (2009). A conceptual framework for analysing the selection and organization of content in teacher education, materials. *Journal of Education* 47, 173-194.
- Reddy, V. (2006). *Mathematics and science achievement at South African schools in TIMSS 2003*. Cape Town, South Africa: HSRC.
- Republic of South Africa. (1996). *Constitution of the Republic of South Africa, Act 108 of 1996*. Government Gazette, 378.
- Ridley D. (2012). *A Step-by-Step Guide for Learners* (2<sup>nd</sup> ed.). London, England: Sage.
- Robson, C. (1993). *Real world research*. Oxford, UK: Blackwell.
- Roche, M., Adiga, I.K. & Nayak, A.G. (2016). PBL trigger design by medical learners: An effective learning strategy outside the classroom. *Journal of Clinical & Diagnostic Research*, 10(12), 6-8. doi:10.7860/JCDR/2016/21813.9015.
- Rorty, R. (1999). *Philosophy and social hope*. London: Penguin.
- Rossmann, G.B. & Rallies, S.F. (2012). *Learning in the field: An introduction to qualitative research* (3<sup>rd</sup> ed.), Thousand Oaks, CA: Sage.

- Royer, J. (ed.) (2005). *The cognitive revolution in educational psychology*. Greenwich, CT: Information Age.
- Rupley, W.H., Blair, T.R. & Nichols, W.D. (2009). Effective reading instruction for struggling readers: The role of direct/explicit teaching. *Reading & Writing Quarterly* 25(2-3) 125-138.
- Sale, D. (2001). Practical steps in designing a curriculum to promote critical and creative thinking. *CDTL Brief* 4(6). Retrieved May 29, 2006, from [www.cdtl.nus.edu.sg](http://www.cdtl.nus.edu.sg)
- Sanyin, C. & Li-Fang, Z. (2017). Thinking styles and quality of university life among deaf or hard of hearing and hearing learners. *American Annals of the Deaf*, 162(1), 8-23. doi:10.1353/aad.2017.0011.
- Sapsford, R. & Jupp, V. (eds.). (2006). *Data collection and analysis*. Sage.
- Scholnik, M., Kol, S., & Abarbanel, J. (2006). Constructivism in theory and in practice. In *English teaching forum* (Vol. 44, No. 4, pp. 12-20). US Department of State. Bureau of Educational and Cultural Affairs, Office of English Language Programs, SA-5, 2200 C Street NW 4th Floor, Washington, DC 20037.
- Schug, M C. "Teacher-Centered Instruction." *Where Did Social Studies Go Wrong?* (2003): 94-110.
- Schunk, D.H. (2004). *Learning theories: An educational perspective* (4<sup>th</sup> ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.
- Sechrest, L. & Sidana, S. (1995). Quantitative and qualitative methods: Is there an alternative? *Evaluation and Programme Planning*, 18, 77-87.
- Shenton, A.K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63-75.
- Shepherd, D.L. (2013). The impact of teacher subject knowledge on learner performance in South Africa: A within-pupil across-subject approach. In *International Workshop on Applied Economics of Education, Cantanzaro* (pp. 1-32).
- Shepherd, D. (2015). *Learn to teach, teach to learn: A within-pupil across-subject approach to estimating the impact of teacher subject knowledge on South African grade 6 performance*.
- Silverman, D. (ed). (2010). *Qualitative research: Theory, method, and practice* (3<sup>rd</sup> ed.). London, England: Sage.
- Sternberg, R.J. (1988). Mental self-government: A theory of intellectual styles and their development. *Human Development*, 31, 197-224.
- Spradley, J.P. (1980). *Participant observation*. New York, NY: Holt, Rinehart and Winston.
- Stake, R.E. (2006). *Multiple case study analysis*. New York, NY: The Guilford Press.

- Stoves, L.T., Neubert, G.A. & Lawlor, J.C. (1993). *Creating interactive environment in the secondary school*. Washington, DC. National Education Association.
- Spaull, N. (2013). South Africa's education crisis: The quality of education in South Africa 1994-2011. *Johannesburg: Centre for Development and Enterprise*, 1-65.
- Swanson, R.A. (2013) *Theory Building in applied disciplines*. San Francisco, CA: Berrett-Koehler 2013.
- Tashakkori, A., & Creswell, J. W. (2007). The new era of mixed methods [Editorial]. *Journal of mixed methods research*, 1(1), 3-7.
- Tashakkori, A. & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.
- Tashakkori, A. & Teddlie, C. (eds.) (2003). *Handbook of mixed methods in social and behavioural research*. Thousand Oaks, CA: Sage.
- Taylor, N. (2009). The state of South African schools Part 1: Time and regulation of  
Terre Blanche, M. & Durrheim, K. (2006). Histories of the present: Social science research in context. In M. Terre Blanche, K. Durrheim & D. Painter, (eds.). Cape Town, South Africa: University of Cape Town.
- Terre Blanche, M., Durrheim, K. & Painter, D. (2010). *Research in practice - Applied methods for the social sciences* (2<sup>nd</sup> ed.).Cape Town, South Africa: University of Cape Town.
- Thanasoulas, D. (2000). What is learner autonomy and how can it be fostered. *The Internet TESL Journal*, 6(11), 37-48.
- The Presidency (2011). *National Development Plan: Vision for 2030*. Pretoria, South Africa: National Planning Commission.
- Van der Sandt, S., Nieuwoudt, H.D. (2003). Grade 7 Teachers' and prospective teachers' content knowledge of geometry. *South African Journal of Education* 23, 199-205.
- Väyrynen, S. (2003). Observations from South African classrooms: Some inclusive strategies. *National Institute for Higher Education Northern Cape in Co-operation with the South-African-Finnish Co-operation Programme in the Education Sector (SCOPE)[online]* Available at: <http://www.google.co.za/url>.
- Villanueva, M.G.F. (2010) *Integrated teaching strategies model for improved scientific literacy in second language learners*. Unpublished doctoral dissertation. Port Elizabeth, South Africa Nelson Mandela Metropolitan University.
- Vinz, S. (2016). Relevance of your topic.
- Webb, E.J., Campbell, D.T., Schwarz, R.D. & Sechrest, L. (1996). *Unobtrusive measures*. Chicago, IL: Rand Mc Nally.

- Walan, S. (2016). *From doing to learning: Inquiry and context-based science education in primary school* (Doctoral dissertation, Karlstad University).
- Willis, J. W., Jost, M., & Nilakanta, R. (2007). *Foundations of qualitative research: Interpretive and critical approaches*. Sage.
- Winter, G. (2000). A comparative discussion of the notion of 'validity' in qualitative and quantitative research. *The qualitative report*, 4(3), 1-14.
- Wong, K.Y., Casey, R.G. & Wahl, F.M. (1982). Document analysis system. *IBM Journal of Research and Development*, 26 (6), 647 – 656.
- Wood, R. & Ashfield, J. (2008). The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: A case study. *British journal of Educational Technology*, 39(1), 84-96.
- Yvonne Feilzer, M. (2010). Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, 4(1), 6-16.
- Zhang, L.F. (2002). Thinking styles and cognitive development. *Journal of Genetic Psychology*, 163, 17-195.
- Zhang, L.F. & Sternberg, R.J. (2006). *The name of intellectual styles*. Mahwah, NJ: Erlbaum.

Background reports by Professor Charles Simkins, Performance in the South African Education System and Nicholas Spaull, South Africa's Education crises: the quality of education in South Africa 1994-2011. These documents are available on [www.cde.org.za](http://www.cde.org.za). Published October 2013 by the Centre for Development enterprise Johannesburg, South Africa.

Government Gazette RSA, vol. 596, Pretoria. 19 February 2015, no. 38487: National Qualification Framework Act, 2008 (Act no. 67 of 2008).

Links for articles and journals:

<http://hdl.handle.net/10019.1/20212>

[E.W.Jenkins@education.leeds.ac.uk](mailto:E.W.Jenkins@education.leeds.ac.uk)

<http://dx.doi.org/10.1016/j.bbr.2011.03.031>

<http://www.iwae.org/papers%20sito%202013/shepherd.pdf>

[theoriesofcurriculumdesign.blogspot.com/](http://theoriesofcurriculumdesign.blogspot.com/)

[www.slideshare.net/majumalon/science-teaching-approaches-and-strategies](http://www.slideshare.net/majumalon/science-teaching-approaches-and-strategies). Retrieved October 28, 2015

## **APPENDICES**

Appendix A: Survey Questionnaire

Appendix B: The Teacher Profile

Appendix C: Interview Questions

Appendix D: Interview Schedule

Appendix E: Request for permission to conduct research at School A (Principals of Schools)

Appendix F: Request to participant for permission to conduct research

Appendix G: Informed concern declaration

Appendix H: Research Questionnaires with responses from participants

Appendix I: Document Analysis of the teacher per school observed and interviewed.

Appendix J: Teacher Profile – Detailed Analysis

Appendix K: Interview Transcript 1

Appendix L: Interview Transcript 2

Appendix M: Interview Transcript 3

Appendix N: Interview Transcript 4

Appendix O: Interview Transcript 5

Appendix P: Detailed Analysis of Lesson Plans

Appendix Q: Detailed Analysis of Observations

Appendix R: Certificate of Language Editing

Appendix S: Turn-it-in Results

Appendix T: Analysis of Interviews

Appendix U: Permission to conduct Research in the KZN DoE Institutions

Appendix V: Ethical Clearance Certificate from the Institution (University)

**SURVEY RESEARCH QUESTIONNAIRE**  
**Natural Sciences and and Technology**  
**teaching in Grade 6 in Ngwelezane Circuit**  
**schools.**

**Name of the Participant:** .....

**Subject(s) and Grade teaching:** .....

Kindly respond to the following questions for the completion of the research which will contribute to the teaching of Natural Sciences and Technology in the Intermediate Phase Schools in the country.

1. What strategies (Methods) do you use when teaching Natural Sciences and Technology in Grade 6?

.....  
.....  
.....  
.....  
.....

2. Why do you use the strategies mentioned above?

.....  
.....  
.....  
.....  
.....

3. Are they effective towards the teaching and learning?

.....  
.....  
.....  
.....

4. How have you witnessed this in your teaching experience?

.....  
.....

.....  
.....  
5. If you were teaching other Strand/ Topic, will you be using the same strategies? Why?

.....  
.....  
.....  
.....

**Thank you for participating in this survey aimed at contributing to the study in promoting effective teaching of Natural Sciences and Technology in schools.**

**Appendix B**

**TEACHER’S PROFILE**

Name of the teacher participating: .....

(The Participant may not provide Name if not willing).

Age: ..... (This is only for statistics).

Gender: ..... (For statistical purposes)

Grade being taught: .....

Subject(s) taught: .....

.....  
.....  
.....  
.....

Years in teaching Natural Sciences and Technology & Technology the in Grade 6: .....  
Years.

Qualifications in possession: .....

.....  
.....  
.....  
.....  
.....

When were the qualifications acquired? .....

(This is for comparing of the previous strategies compared to the recent ones).

Thank you for taking part in this research. It is for the benefit of the department, teachers and schools for the knowledge of the strategies teachers use when teaching Natural Sciences and Technology in schools.

**Thank you!**

## Appendix C

### INTERVIEW QUESTIONS

#### TO BE ASKED DURING THE INTERVIEW PROCESS

1. What are the experiences you have encountered in the teaching of Natural Sciences and Technology in Grade 6, either good or bad?
2. What strategies (Methods) do you use when teaching Natural Sciences and Technology in Grade 6?
3. Why do you use the strategies mentioned earlier on?
4. Are they effective towards the teaching and learning, do they help you meet your objectives?
5. How have you witnessed this in your teaching experience?
6. Do you think your teaching strategies developing Active Learning, Critical Thinking and Problem Solving in learners?
7. Are the strategies you acquired in your teacher training working in the current teaching of the subject, if not why?
8. How do you make your teaching of the subject interesting to the learners to develop the love of the subject to them?
9. What strategies do you suggest are important in teaching the subject effectively?
10. Is there a support you get from the Department in the form of Subject Advisors visiting the school or School Departmental Heads in developing teaching of the subject, where challenges are shared and skills given to novice (beginner) teachers, and even those challenged in the teaching of the subject are assisted?
11. Is there anything you would like to add or comment on?

**Appendix D**

**INTERVIEW SCHEDULE**

**TO BE FILLED DURING THE INTERVIEW PROCESS.**

1. What strategies (Methods) do you use when teaching Natural Sciences and Technology in Grade 6?  
.....  
.....  
.....  
.....  
.....  
.....
2. Why do you use the strategies mentioned above?  
.....  
.....  
.....  
.....  
.....
3. Are they effective towards the teaching and learning?  
.....  
.....  
.....  
.....
4. How have you witnessed this in your teaching experience?  
.....  
.....  
.....  
.....  
.....  
.....
5. If you were teaching other Strand/ Topic, will you be using the same strategies? Why?  
.....  
.....  
.....  
.....  
.....  
.....
6. Is there anything you would like to add or comment on?  
.....  
.....  
.....

## Appendix E

P. O. Box 1765  
Empangeni  
3880  
23 April 2017

The Principal

.....  
.....  
.....  
.....

Dear Sir/ Madam

### **REQUEST FOR PERMISSION TO CONDUCT RESEARCH**

I, **Bonithemba Wellington Buthelezi**, am a Masters student in the Faculty of Education at the University of Zululand, studying under the guidance of Dr. R. P. Pillay and Dr. R. Mosoloane.

The title of my research is: **Strategies used in the teaching of the Natural Sciences and Technology in the Intermediate Phase in schools in the Ngwelezane Circuit**, to be undertaken in the King Cetshwayo District (previously known as Uthungulu District) of KwaZulu Natal.

I hereby request permission to conduct research in your school. This research involves the **teacher(s) teaching Natural Sciences and Technology and Technology in Grade 6**.

Please find attached copies of the questionnaires and interview questions which I intend using with all the participants. Please feel free to contact me should you have any queries in this regard.

Thank you.

Yours faithfully,

**Bonithemba Wellington Buthelezi**

Mobile: **082 4342 662**

Email Address: [buthelezi.bw@gmail.com](mailto:buthelezi.bw@gmail.com)

## Appendix F

P. O. Box 1765  
Empangeni  
3880  
23 April 2017

The Teacher  
.....

### REQUEST FOR PERMISSION TO PARTICIPATE IN THE RESEARCH

I, **Bonithemba Wellington Buthelezi**, am a Masters student in the Faculty of Education at the University of Zululand, studying under the guidance of Dr. R.P. Pillay and Dr. R. Mosoloane. My research is on the: Strategies used in the teaching of the Natural Sciences and Technology in the Intermediate Phase in schools in the Ngwelezane Circuit, to be undertaken in the King Cetshwayo District (previously known as Uthungulu District) of KwaZulu Natal.

I hereby request your permission to participate in this study. This research involves interviews and questionnaire administration to **teacher(s) teaching Natural Sciences and Technology and Technology in Grade 6**.

Please find attached copies of the questionnaires and interview questions which I intend using.

Please feel free to contact me should you have any queries in this regard.

Thank you.

Yours faithfully,

**Bonithemba Wellington Buthelezi**

Mobile: **082 4342 662**

Email Address: [buthelezi.bw@gmail.com](mailto:buthelezi.bw@gmail.com)

## Appendix G

### INFORMED CONSENT DECLARATION

Participant: .....

Project Title:

**Strategies used in the teaching of the Natural Sciences and Technology in the Intermediate Phase in schools in the Ngwelezane Circuit.**

**Mr BONITHEMBA WELLINGTON BUTHELEZI** from the **Department of Maths, Science and Technology Education, University of Zululand** has requested my permission to participate in the above-mentioned research project.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

1. The purpose of the research project is to explore **Strategies used in the teaching of the Natural Sciences and Technology in the Intermediate Phase in schools in the Ngwelezane Circuit.**
2. The University of Zululand has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.
3. By participating in this research project I will be contributing towards understanding Strategies used in the teaching of the Natural Sciences and Technology in the Intermediate Phase in schools in the Umhlathuze Circuit.
4. I will participate in the project by being observed during the teaching and learning in the learning environment (classroom), participating in the survey prior to the research project, participating in the interview.
5. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.
6. I will not be compensated for participating in the research, but should I incur out-of-pocket expenses they will be reimbursed.

7. There may be risks associated with my participation in the project. I am aware
  - a. the following risks are associated with my participation: there are no known risks at the moment
  - b. the following steps have been taken to prevent the risks: N/A
  - c. there is a 0 % chance of the risk materialising: N/A
8. The researcher intends publishing the research results in the form of an article. However, confidentiality and anonymity of records will be maintained and that my name and identity will not be revealed to anyone who has not been involved in the conduct of the research.
9. I will receive feedback in the form of the copy a verbal mode or written note if applicable and agreed upon.
10. Any further questions that I might have concerning the research or my participation will be answered by mobile communication or using the provided email address.
11. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies.
12. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, ..... have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

.....

.....

**Participant's signature**

**Date: .....**

## Appendix H: Research Questionnaires

In answering the first question one which was asking the strategies or methods they use when teaching Natural Sciences and Technology in Grade Six:

*Teacher A: Telling, Demonstration, Observation and Question and Answer Method.*

*Teacher B: Integration technology in the class and using their specific contexts and daily expenses to enhance their understanding of the subject.*

*Teacher C: I recognise and respond to learner's diversity and encourage them to participate fully in science learning. I also use multiple methods and systematically gather data on learners' understanding and ability.*

*Teacher D: Recapping previous concepts, Using visual aids, Inter-Active Learning, Written Tasks and Easy memory tools.*

*Teacher E: Learner-centred, Group teaching and Teacher-centred approach.*

*Teacher F: I use telling and questioning methods.*

*Teacher G: I actively involve learners in their own learning and make sure they are involved in group activities and discussions and also do experiments accordingly.*

*Teacher H: Group teaching, Practical tasks and Hands on.*

*Teacher I: I use practical based method, Integrated with theory. I also use real-life scenarios strategies to explain some of the concepts.*

*Teacher J: I use different strategies or methods such as discussion, question and answer, practical work, investigation, demonstration, comparing, identifying, explain, describe, sort, presentation, measure, draw and evaluate.*

*Teacher K: I prepare a lesson plan in advance then when introducing the lesson I ask learners what they know about the topic. After each lesson I give them an activity or practical work to test their understanding.*

*Teacher L: Investigations, Designs, Inventions, Production and Analysing.*

*Teacher M: Diagnostic assessment, Problem solving, Practical tasks.*

*Teacher N: I involve learners in their own learning. I begin each class with something*

*familiar, end each class by summarising the main points I have made. I move around the class, maintain eye contact with learners in all parts of the room. I promote learner discussions and group activities. I also demonstrate.*

*Teacher O: Cognitive strategies, Practical activities, Research from reference books, Material from different Grade 6 textbooks.*

*Teacher P: Discussion, Question and answer, Telling and Research.*

In response to the second question asking why they use those strategies, these were their responses:

*Teacher A: Sometimes learners learn best when the teacher is hands on and does not just talk to them, and not showing something else, and the lesson becomes an interesting to them, as they learn by observing, it creates a welcoming learning environment for all learners.*

*Teacher B: They understand better when one use their pre-knowledge, because that help them know that daily experiences are not fair removed from the reality of classroom interaction.*

*Teacher C: I use these strategies in order to give them an analysis of their assessment data, recording and reporting as the feedback.*

*Teacher D: Learners must know previous concepts before learning new ones. Some learners are visual learners and need visual aids to remember concepts. Interactive Learning and tasks re-inforce learning.*

*Teacher E: I use learner centred strategy because I want learners to be involved in the lesson so that they will have clear understanding of the lesson grouping learners allow them to help each other.*

*Teacher F: Because it suits our learners.*

*Teacher G: So that all learners can be actively involved.*

*Teacher H: The learners need to physically be involved with practical tasks as that's the only way to learn. Group teaching allows for interaction and peer support.*

*Teacher I: I find them very resourceful and learner friendly or easy for the children to group the concept.*

*Teacher J: I use the strategies in order to help learners make connection between the ideas and the concepts in their minds. Equip learners with skills and knowledge that they can use in everyday life.*

*Teacher K: To help them to understand the subject.*

*Teacher L: Because NS and Tech deal with practical mostly and natural aspects as well, for example identifying, findings collection of data, conducting investigations and predictions as well.*

*Teacher M: Children's knowledge and skills can be evaluated (Prior knowledge) through using the above mentioned strategies. It also stimulates creativity.*

*Teacher N: Yes to equip learners with the knowledge, skills, and values necessary for self-fulfilment and meaningful participation. To develop scientific and technological knowledge and understanding.*

*Teacher O: Many learners learn quicker by seeing practical cognitive activities and experiments. It allows learners to be able to work independently.*

*Teacher P: Question and answer I find out what the children know discussion. When they discuss, they get more knowledge from the others. Telling, I give them new information.*

Responding to the third question asking whether the strategies are effective towards the teaching and learning, teachers responded thus:

*Teacher A: Yes, but it depends on my lesson, but some methods are not required or suitable.*

*Teacher B: Yes.*

*Teacher C: Yes they are, use see to that when the learners engage in an interactive process involving assembling and testing tools, designing and testing forms of data collection.*

*Teacher D: Yes, they are effective and they make it easier to put the lesson across. They also make it easier for the learners to grasp concepts.*

*Teacher E: Yes because it helps the learners to have more understanding of this subject content.*

*Teacher F: Yes they do.*

*Teacher G: Yes they are.*

*Teacher H: Yes, learners are exposed to the physical tasks which allows them to have a better understanding of experiments.*

*Teacher I: Yes, they are effective based on the performance of the children.*

*Teacher J: Yes because most learners develop the ability to think objectively and use*

*a variety of forms of reasoning. It also provides learners with opportunities to put together ideas that they have about nature so that they make sense.*

*Teacher K: Yes because when I do the feedback of the activity, they do the activity well.*

*Teacher L: Very effective because learners are discovering things for themselves.*

*Teacher M: Yes, because pupils knowledge is increased and stimulates the problem solving skills.*

*Teacher N: Yes, allows learners to explore investigation and also to be critical when experimenting. Find solutions to problem solving the how part, why and end result.*

*Teacher O: This empowers the student to adopt the most effective approach for learning in a particular context. Learners awareness of his or her thinking process.*

*Teacher P: Yes, they are effective because it is the way in which they acquire more information.*

The fourth question was the continuity of the previous one which was asking for the evidence witnessing the fact that they are effective if they said so or not. In responding to that they mentioned the following:

*Teacher A: By assessing after each lesson they do.*

*Teacher B: Use of other resources that are teacher oriented or centred allows learners to actively participate in the class. They take active interest in own learning.*

*Teacher C: I have witnessed a lot of excitement from my learners and they become more and more independent when they do or make things for themselves.*

*Teacher D: Learners show more enthusiasm while learning with these strategies and are able to answer questions more effectively.*

*Teacher E: Due to the pass rate of learners.*

*Teacher F: I have my good and bad experiences because some things like resources are not provided in our school.*

*Teacher G: By obtaining good results or percentage required.*

*Teacher H: It has made the learners more confident in their understanding of natural science.*

*Teacher I: I witnessed this by the analysis of academic performance or results of the*

*children.*

*Teacher J: I witnessed this as most of my learners are able to analyse problems that need some practical ability, skills and solutions.*

*Teacher K: By looking at the learners results, practical, participation and levels achieved.*

*Teacher L: By giving learners assignments dealing with electricity, circuits, food groups and ecosystems.*

*Teacher M: Practical assessments allowed the children to change their opinion about certain concepts of knowledge.*

*Teacher N: Because learners participate during teaching and learning. They use models to showcase their understanding. Presentation skills of learners have improved both individually and working as a group.*

*Teacher O: Evidence is seen in their projects, research, assessments and activities.*

*Teacher P: Children remember well the information they have seen, heard and when you ask them questions they record the answers in their minds.*

In responding to the last question asked checking if they will use the same strategies if they were to teach a different topic, they said:

*Teacher A: If those strategies or topics needed or suits them I would apply them.*

*Teacher B: Yes using alternative teaching techniques help to engage learners.*

*Teacher C: Definitely yes, because I like to involve each and every learner in my lesson, even those who are shy or battles with the lesson I try and pair them with others.*

*Teacher D: Yes, the strategies can be implemented with other topics and can be combined with other strategies to produce the desired effect.*

*Teacher E: Yes because those strategies are the key in teaching any topic.*

*Teacher F: Yes, I will use the same strategies because it makes learners to be more interested when taught.*

*Teacher G: Yes because it is working so far.*

*Teacher H: Yes, a hand on approach is the only way to expose learners to science.*

*Teacher I: No because the concept is not the same, therefore it requires another strategy.*

*Teacher J: Yes I will use it to make most of my learners develop interest about nature and curiosity about the world and have values that make them care and appreciate scientific discoveries and technological solutions.*

*Teacher K: Yes because learners learn by doing practical in real situation.*

*Teacher L: Yes because NS and Tech teaching require those strategies in order to get better results.*

*Teacher M: Yes it is a good way to assess learners' knowledge and to change perceptions of learners. Not all subjects involve practical tasks and should be implied in a different way.*

*Teacher N: Yes because these strategies really work for me and learners. Though depending on the uniqueness of learners, at times I do change the strategy to accommodate learners inclusivity and holistically.*

*Teacher O: Yes, as learners learn more topics through concrete examples and they are able to understand the abstract concepts.*

*Teacher P: The topics will vary according to the strand we are dealing with.*

## Appendix I: Document Analysis

### Teacher A at School 1

1. Is the topic aligning with Annual Teaching Plan?

*The topic aligned with the Annual Teaching Plan such that the teacher is even a bit before the teaching plan, to cover the work for exam.*

2. Is it taught at the correct time scheduled for it?

*The topic was taught at the correct time scheduled for it. The individual pace of the learners was taken into consideration.*

3. Is the lesson plan user friendly and are the Learning and Teaching Support Materials prepared and used effectively?

*The lesson plan was clear, user friendly activities clearly tabulated for the teacher, learner and for assessment as well.*

4. Comment on Active Learning during presentation, Critical Thinking and Problem Solving.

*The lesson is more of content based approach directed. Some ability of Critical Thinking was shown. Cognitive levels catered for in the teaching and learning.*

### Teacher B at School 2

1. Is the topic aligning with Annual Teaching Plan?

*Yes the topic taught aligned with the Annual Teaching Plan.*

2. Is it taught at the correct time scheduled for it?

*The topic presented aligned with the Annual Teaching Plan, but the date was not indicated in the lesson plan.*

3. Is the lesson plan user friendly and are the Learning and Teaching Support Materials prepared and used effectively?

*The lesson plan is user friendly, it can be used by any teacher if the one teaching is not in, the way the lesson plan is clear.*

4. Comment on Active Learning during presentation, Critical Thinking and Problem Solving.

*The lesson shows that there is not enough Active Learning during presentation. No Critical Thinking portrayed during the lesson presented and shown from the lesson plan. No activity showed development of problem solving as a skill to the learners.*

### **Teacher C at School 3**

1. Is the topic aligning with Annual Teaching Plan?

*Yes the topic taught aligns with the Annual Teaching Plan.*

2. Is it taught at the correct time scheduled for it?

*The topic is taught at the correct time scheduled for it to be taught.*

3. Is the lesson plan user friendly and are the Learning and Teaching Support Materials prepared and used effectively?

*The lesson plan is user friendly, such that it can be taught even when the teacher is not there. All concepts catered for, except allocation of the individual pace, catering for those with barriers to learning.*

4. Comment on Active Learning during presentation, Critical Thinking and Problem Solving.

*Methods used fairly made learners active during teaching and learning. The teacher demonstrated using LTSM brought in the class using the learners.*

### **Teacher D at School 4**

1. Is the topic aligning with Annual Teaching Plan?

*The topic aligns with what needs to be taught in the term.*

2. Is it taught at the correct time scheduled for it?

*The topic was taught at the right time as per the Annual Teaching Plan.*

3. Is the lesson plan user friendly and are the Learning and Teaching Support Materials prepared and used effectively?

*The lesson was prepared by knowing how it will flow but no physical lesson plan provided. The teacher explained that their focus is on the learner learning, not paperwork. But the researcher noted that the teacher prepared for the lesson very well and was involving the learners.*

4. Comment on Active Learning during presentation, Critical Thinking and Problem Solving.

*The learners were made cooperative and were active during the teaching and learning. Questions that were asked by the learners show inquisitive minds and Critical Thinking.. The researcher was happy the way the teacher attended to the questions asked by the learners.*

### **Teacher E at School 5**

1. Is the topic aligning with Annual Teaching Plan?

*The topic was aligning to the Annual Teaching Plan. The topic covered the content that needed to be covered at that time.*

2. Is it taught at the correct time scheduled for it?

*Yes it was taught at the right and correct time.*

3. Is the lesson plan user friendly and are the Learning and Teaching Support Materials prepared and used effectively?

*The teacher was not ready to produce the lesson plan, which made it difficult to comment about the lesson plan of the teacher.*

4. Comment on Active Learning during presentation, Critical Thinking and Problem Solving.

*The level of Active Learning was very minimal. More talking was from the teacher. One may argue that it wasn't easy to present it based on learner-centred approach since information needs to be elicited by the teacher him or herself.*

## **Appendix J: Teacher Profile**

### **Teacher A**

*This is a female teacher. She did not like to expose her years teaching Grade 6. She has taught Grade 6 for 6 years. Subjects that have been taught were Natural Sciences and Technology in Grade 4, and Technology. She has taught Grade 6 for one year. Qualifications in possession are B, Ed and ABET Certificate obtained in 2008 and 2013 respectively.*

### **Teacher B**

*Teacher B was 47 years, a male teaching Grade 6. He was teaching NSTECH, English and IsiZulu. He had taught Grade 6 for 6 years and is having B Ped (Arts) and BA Honours in English. He got his qualifications in 1998 and 2000 respectively.*

### **Teacher C**

*She is a female of 45 years, having taught Grades 4, 5 and 6. Subjects that she has taught are English Grade 5, NSTECH Grades 4, 5 and 6. She had taught Grade 6 Natural Sciences and Technology and Technology for 9 years. Qualifications obtained are Bachelor of Education, Science and Technology for Foundation and Intermediate Phases. They were obtained in 2005 – 2008.*

### **Teacher D**

*Teacher D is a female of 39 years teaching Grade 6. Subjects taught were Maths, English, Afrikaans, Social Sciences and Natural Sciences and Technology. She had taught NSTECH in Grade 6 for 5 years. Qualifications in possession are Bachelor of Education (B Ed) obtained in 2012.*

### **Teacher E**

*The teacher was a female of 27 years, has taught Grade 6. Subjects she had taught are Natural Sciences and Technology and Technology and Mathematics. She had taught Natural*

*Sciences and Technology and Technology in Grade 6 for 1 year. Qualifications in possession is Bachelor of Education (Bed), acquired in 2013.*

#### Teacher F

*Teacher F is a male teacher of 43 years of age. He had been in Grade 6 for 4 years, and had taught IsiZulu, English, NSTECH and Social Sciences. He had 13 years teaching Natural Sciences and Technology and Technology at the phase. Qualifications in possession are SPTD (Senior Primary Teachers Diploma) and Adult Basic Education and Training (ABET) obtained in 1998 and 2009 respectively.*

#### Teacher G

*Teacher G is a female of 33 years of age. She has taught Grade 6 teaching Natural Sciences and Technology for 2 years. Qualification in possession is Bed acquired in 2009.*

#### Teacher H

*The teacher is a female of 40 years teaching Grade 6. Subjects taught are Mathematics, Natural Sciences and Technology, Social Sciences and Life skills. She had taught Natural Sciences and Technology and Technology in Grade 6 for 10 years. Qualification in possession is Diploma in Education obtained in 1999.*

#### Teacher I

*Teacher I is a male of 30 years of age teaching Grade 6. Subjects taught are Natural Sciences and Technology and Technology. He has taught NSTECH for a year. He obtained B. E degree for Intermediate, acquired in 2017.*

#### Teacher J

*Teacher J is a female of 47 years old. She had taught Grades 4, 5 and 6. He had taught B. Ped Degree and Secondary Teacher's Diploma, but he did not indicate when the degree was obtained.*

#### Teacher K

*This is a female of 32 years teaching Grade 6. She has taught IsiZulu Grade 4, and 5, NSTECH Grade 6, EMS Grade 7 and Technology Grade 7. She has taught NSTECH in Grade 6 for 5 years. She is in possession of Advanced Certificate in Education (ACE), obtained in 2013.*

#### Teacher L

*Teacher L is a 53 years male teaching Grade 6. Subject taught was NSTECH, and has been taught at the same Grade for 5 years. He is in possession of SPTD, obtained in 1994.*

#### Teacher M

*This is a 29-year-old female teacher. She had taught Grades 5 – 7. Subjects that have been taught are NSTECH, NS Grade 7 and English Home Language. She has been teaching NSTECH in Grade 6 for 4 years. Qualifications obtained at tertiary institution are Bachelor of Technology in Somatology (B. Tech), Post Graduate Certificate in Education (PGCE) in Biology and Life Sciences for Senior and Further Education and Training (FET) phases, acquired in 2014.*

#### Teacher N

*Teacher N is a female of 32 years of age having taught Grade 6. She had taught NSTECH, Mathematics, Technology and English (FAL). NSTECH has been taught for 5 years in Grade 6. Qualifications obtained were National Professional Diploma in Education (NPDE) and ACE. They were both obtained in 2014 and 2017 respectively.*

#### Teacher O

*This is a female teacher of 45 years of age teaching Grade 6. Subject taught were NSTECH, Maths, English and Arts and Culture. She has taught Natural Sciences and Technology and Technology for 7 years. Qualifications obtained are ABET Diploma 2005 and NPDE which was obtained in 2008.*

Teacher P

*Teacher P is a female of 52 years of age teaching Grade 6. Subjects taught are English, NSTECH and Life skills. She has taught NSTECH in Grade 6 for 5 years. Qualification acquired are SPTD, B. A. Honours obtained in 2014.*

## Appendix K: (Interview Transcript 1)

2017.11.01\_11.19\_01

Teacher A: School No. 1

Transcribed audio interview

(Transcribed and edited)

Interviewer: *I am interviewing Teacher A from School 1 (name to be confirmed) Primary School. Thank you for taking time to participate in this interview. We are doing the interview after the class observation where we got what happens in class. First of all what are the experiences you have encountered in teaching Natural Sciences and Technology grade six good or bad?*

Respondent: *Good...*

Interviewer: *Yes...What have you experienced? Is it the same with when you were not teaching?*

Respondent: *No it's not the same; there are things I learnt...*

Interviewer: *Anything bad...?*

Respondent: *Yes sometimes when we don't have resources...*

Interviewer: *What about the learners, are they respectful, are they co-operating are they passing in the tests you give or assessments you give?*

Respondent: *Yes.*

Interviewer: *All of them?*

Respondent: *Not all of them. There are learners who are slow in all learning areas.*

Interviewer: *What is it that you do to help those learners?*

Respondent: *I try to give them more time. Buts it's not easy but I try...*

Interviewer: *What strategies or strategies are you using in teaching Natural Sciences and Technology in grade six?*

Respondent: *It depends on the lesson that I'm teaching at that time. Like in today's lesson I used observing, telling and question and answer.*

Interviewer: *If I may ask, why did you choose them...?*

Respondent: *To make them understand that lesson clearly. It's easier for them if they observe things...*

Interviewer: *It depends on the topic.*

Respondent: *The topic... Yes. Because the topics are not the same. Some you just, not observing, no demonstration – it depends on the lesson.*

Interviewer: *The methods or strategies you are using are they effective to the learners?*

Respondent: *Yes they are.*

Interviewer: *How do you see that?*

Respondent: *Like when I'm demonstrating something. I demonstrate it first then they see. If I then ask one of them to do it in front of the class, they would be able to do it.*

Interviewer: *If you give them an assessment task how do they perform? Like you said some of the pass...*

Respondent: *Yes some of them pass...*

Interviewer: *Maybe we have been looking at the end of the term or so...but let's say in a period,*

Respondent: *If I give them an activity...?*

Interviewer: *An activity, how do they perform if it's something they have recently just done?*

Respondent: *Some pass but some fail. But it depends on the activity. If it's easy they pass.*

Interviewer: *Are you aware of the terms Active Learning, Critical Thinking and problem solving?*

Respondent: *Yes,*

Interviewer: *Active Learning,*

Respondent: *Active Learning, like involving the learners,*

Interviewer: *Yes do you do that in your teaching?*

Respondent: *Yes*

Interviewer: *And it helps?*

Respondent: *Yes it helps.*

Interviewer: *Then if you give them, like we know their levels in the assessment that you are giving to learners, cognitive levels...*

Respondent: *Yes.*

Interviewer: *If you look at Critical Thinking, how do you see the performance of the learners after giving that activity?*

Respondent: *Critical Thinking...?*

Interviewer: *They are good in recalling?*

Respondent: *Some of them...Not all of them.*

Interviewer: *When you give them problems, do they solve the problems like in experiments where they have to give a report on how they did it or support on why they did that. Do they respond in levels that you will be expecting?*

Respondent: *Some of them, not all of them. There are some learners who are very intelligent...*

Interviewer: *Do you use groupwork?*

Respondent: *Yes.*

Interviewer: *How do you see the way they perform in groups? Do they all get involved in the activity?*

Respondent: *I don't get what you are saying.*

Interviewer: *In your teaching do you use group works?*

Respondent: *Yes I use group work.*

Interviewer: *If you go to them, how do they work in groups? Do they cooperate?*

Respondent: *Yes they do. But there are others...*

Interviewer: *Other who do not?*

Respondent: *Yes there are those learners who are always saying nothing.*

Interviewer: *Okay. When you went for training, your teacher training, or basic training?*

Respondent: *Yes.*

Interviewer: *Looking at the methods you learnt there are they the same with the one you are using in class?*

Respondent: *Yes.*

Interviewer: *All of them?*

Respondent: *Not all of them.*

Interviewer: *So In other words, it helped to get that training?*

Respondent: *Yes it helped me a lot.*

Interviewer: *So If you at the real classroom life and the methods you learnt – any difference?*

Respondent: *From university or workshops?*

Interviewer: *University*

Respondent: *Yes...sometimes it helps...*

Interviewer: *Okay. My focus for this study is looking at matric-the pass rates of Physical Sciences in grade twelve...*

Respondent: *Okay.*

Interviewer: *Is it not the way we are teaching at the intermediate phase where we are giving the background of the subject. Since CAPS says the teaching of Natural Sciences and Technology needs to be interesting to make the learners interested in the subject and to be actively involved learners. That's why we are looking at whether we are doing that to develop love in the learners so that when they go to grade ten they can choose Natural Sciences and Technology as a subject...My question is how do you make them interested in the subject? How do you make your teaching interesting such that you develop love in the subject in the learners?*

Respondent: *Sometimes I keep them involved in my lesson and...telling them about it.*

Interviewer: *Is there support you get from the Department of Education, maybe subject advisers. Have you been visited by subject advisers?*

Respondent: *Once. in the first term.*

Interviewer: *First term?*

Respondent: *Yes.*

Interviewer: *At school do you have workshop or staff development activities that look at the teaching on Natural Sciences and Technology – like where you share experiences with other subject teachers?*

Respondent: *In here?*

Interviewer: *Yes.*

Respondent: *No.*

Interviewer: *So how do you survive? Where do you get support?*

Respondent: *Oh maybe madam but she is not here now. Sometimes she helps me...*

Interviewer: *If you have a problem since you say you are new?*

Respondent: *Yes I'm new.*

Interviewer: *So if ever you have a problem you have a mentor?*

Respondent: *Yes I do have a mentor although she is not here.*

Interviewer: *Is there anything you would like to add or comment on?*

Respondent: *About teaching NS or about my lesson?*

Interviewer: *Anything.*

Respondent: *Maybe to ask the Department to support us by giving us resources. We don't have resources in our school. Even if you ask learners to make practical work, some practical work requires learners to go and buy resources and their parents don't buy them these things.*

Interviewer: *Are you aware of the science centre?*

Respondent: *Yes we have visits there. It was August, I'm not sure but we had a visit there.*

Interviewer: *I must thank you for your co-operation. I think this brings us to the end of the interview. Thank you so much for your participation and I know time was against you but at least you gave me a chance.*

Respondent: *Yes.*

## Appendix L: (Interview Transcript 2)

2017.11.01\_11.19\_01

Teacher B: School 2 Primary School

Transcribed audio interview

(Transcribed and edited)

Interviewer: *I am interviewing Teacher B at School B Primary School. Teacher B thanks you for participating in this interview. We are doing this interview after the in-class observation that we have done in class. So I must thank you for participating in this interview and the whole process of research conduction. I understand time is against us and I appreciate you giving this opportunity to interview you. Maybe going straight to the interview, I will be asking questions then you'll answer... What are the experiences that you have encountered in teaching Natural Sciences and Technology in grade six either good or bad?*

Respondent: *What I have encountered is that you will find learners with very little conceptual knowledge of the subject.*

Interviewer: *Yes.*

Respondent: *And it helps when maybe they would have been exposed to the language of instruction earlier. Some of the learners struggle with the language because when we teach the subject we have to use the English language, the books are written in English. So they struggle even... you find instances where they struggle even with their mother tongue. And they also have a problem of understanding that their daily experiences are somehow linked at school or what they learn from another subjects. The information learnt from subjects is connected.*

Interviewer: *Yes.*

Respondent: *Last week I was doing the subject, we were doing a comprehension passage in English. It talked about climate change and I related to it because I teach them science as well. I related to what I taught them in ecosystems on all those challenges that we talk about in climate change. We had related them earlier on; I think it was in the second term. But most of them... a very few of them were able to connect the dots that the knowledge is the same. The only difference is that the knowledge has been packaged differently but it contributes towards one ultimate...*

Interviewer: *To them it's like you are teaching a separate item...?*

Respondent: *...you teach separately, if you teach them English and talk about climate change...English is English and is Science is Science. Even if you talk about something taught in Science they can't retrieve... Yes. It's only when sometimes when you trigger them by asking questions "but you've learnt this" only then they begin to associate the knowledge we are talking about here- that it is relevant in this subject...*

Interviewer: *Thank you...*

Respondent: *But there would be two or three who easily catch up with the subject at hand...those who have the interest to read on their own...*

Interviewer: *...But most of them?*

Respondent: *...Most of them have challenges in their learning.*

Interviewer: *Then what strategies or methods are you using in teaching Natural Sciences and Technology in grade six?*

Respondent: *Most of the time in the pre-lesson I usually ask them questions about things they experience in their daily lives. In language, now that we have tight, we have got something that tells us what we would have taught from day one up to day five...*

Interviewer: *Trackers...*

Respondent: *Yes trackers but in the past I used to group them. I have a maximum of five groups in class, according to their abilities. We used to have news in the morning. Time allocated to the news where others would read the news, sport news the weather and everything so that every day they should know what the weather patterns are so that they should interpret that into their daily activities. They should know when we talk about weather patterns. That's general information that they would normally not necessarily find in the classroom. For example they should be able to identify that this programme on TV is aimed at informing, this one is aimed at entertainment, and this one is aimed at educating. Television informs, entertains and educates. They should be able to know that whenever I'm sitting in front of the TV this is the aim ...And also that helps if a child has that general understanding of life...it becomes easier in the classroom, we are merely filling in the gaps.*

Interviewer: *Do you give them group discussions?*

Respondent: *Yes group discussions where we give them work. They work as groups and they do presentations in class as members of the groups and they also do their presentations individually. Because I teach them language as well, there are instances where they go and read books and tell us what the book is all*

*about. It helps again. It beefs up their vocabulary but that also helps them in Science again if somebody is able to read. When you present them with problems they are able to work through them quicker.*

Interviewer: *Okay. What can you say are the reasons for using those strategies..?*

Respondent: *Because it's easier if you speak to someone about things that they know before you introduce new things, new information. I learnt that learners do have certain information even though they may not be confident about giving that information in class. I remember it was 2005 I once taught grade fours and while I was teaching them we were talking about medicinal plants and the information I got from them which they know. They will tell you if you have a stomach ache, this is what we normally find and it will help you with your stomach pain and if you have a headache this is what we normally use at home. If someone has an injury this is what they would normally use without actually going to the doctor....*

Interviewer: *Which shows they are not empty vessels, they do have certain...*

Respondent: *Yes they do have certain information...*

Interviewer: *That you have to build on...?*

Respondent: *Yes that we can build on. They have an understanding regarding certain ailments and certain things.*

Interviewer: *Looking at the results maybe after giving them assessment tasks, how do they do?*

Respondent: *The results vary. Some perform better...*

Interviewer: *Yes.*

Respondent: *Some perform better individually. There are those who perform better and there are those who struggle. Because we are a full service school, there are learners who fit that category of learners who struggle.*

Interviewer: *How do you help those?*

Respondent: *They are given certain tasks at their levels and there are also learner support educators who were allocated by the Department ...*

Interviewer: *They are still here...?*

Respondent: *They are still here. We have got two of them it's only the psychologist who didn't come back this year but those two teachers are there. So there are groups of learners maybe a maximum of five per class that they normally see how they are struggling...*

Interviewer: *Your strategies are they developing Active Learning, Critical Thinking and problem solving?*

Respondent: *Yes they do. Because I teach science and I teach them English Language. There is a lot of work they are supposed to do on their own... going to the library and bringing information to the class or they are given various tasks some of which they have to perform individually without being assisted and come back to the class and do presentations. So some of them may struggle and like I said their performance varies. Some perform well. Others still struggle. Those categories of learners who are struggling always receive fewer marks than the rest of the class.*

Interviewer: *Looking at your teacher training, the strategies you acquired there, if you compare them to the ones in the real field where you are teaching, is there anything you can comment on? Are they the same, what you were taught, is it the same and are you using it here in teaching?*

Respondent: *Well we were taught about teaching...learner-centred teaching, communicative teaching but once you come here face-to-face with the learners you find that some of these may not necessarily work. Sometimes it is specific to the needs of the learners.*

Interviewer: *Yes*

Respondent: *Sometimes it works with other learners sometimes it won't but also the culture of the school contributes a lot - the institutional culture. Some learners are used to articulating themselves, others are not. So those who are used to articulating themselves would acquaint themselves well with communicative teaching when you communicate with them and put them at the centre of learning where they actually participate. You only facilitate their learning. That helps. But most of what we learnt at tertiary institutions sometimes you need to adapt when you get to the field because they will tell you that a normal class size would be like this and in the real world it's not be same.*

Interviewer: *Yes*

Respondent: *Your expectation if you go to a classroom with grade six learners, your expectations are that they would know this... We call them...when we look at their knowledge levels and we go to grade six you will find a learner who may even go to grade four and still fail because their knowledge level is not the same level that you would expect in grade six.*

Interviewer: *Yes...*

Respondent: *So the challenges in the classrooms are quite different from what they teach in...*

Interviewer: *Training sessions...*

Respondent: *Yes. So the reality is quite different...*

Interviewer: *So it means the needs teacher flexible....*

Respondent: *Yes.*

Interviewer: *Looking at the workshops- are you getting support from the Department in helping in the teaching of Natural Sciences and Technology?*

Respondent: *We do get workshops. Maybe because the challenges are that there are not very many subject advisers. You have one subject advisers covering this area, maybe three of them covering maybe the whole district. So that's a challenge because you will have only one workshop at the beginning of the year...*

Interviewer: *Yes.*

Respondent: *And another challenge is that the person who workshops you may have been in the classrooms ten years ago. So he is not telling you something that he experiences on the daily basis. What we experience on a daily basis isn't what they tell you at the workshop. It's quite different.*

Interviewer: *They tell you what they used to do?*

Respondent: *Yes what they used to do and what the expectations were...*

Interviewer: *When last did you see a subject adviser visiting the school?*

Respondent: *The last time we saw a subject advisers was at the beginning of the year – those orientation workshops...*

Interviewer: *Visiting the school or?*

Respondent: *No we attended the workshop at X. Primary...*

Interviewer: *Within the school are there any programs or workshops that help – or subject –related meetings for sharing challenges and experiences and solving problems?*

Respondent: *That's a huge challenge because we don't have such. Normally the school must have a staff development team and we would have class visits and the information gathered from there must inform the SDT on how to develop teachers.*

Interviewer: *Yes*

Respondent: *But throughout my teaching career I have never seen such things. They exist on paper but practically there is very little practical assistance teachers get on the job.*

Interviewer: *One of the things I'm looking for or the focus of the study is the physical science performance at grade twelve. Looking at the pass rate, It made me think that maybe the cause for them not doing well in Physical Sciences might be the way we are teaching the background of the subject when they are introduced to Physical Sciences through Natural Sciences and Technology. One of the things I believe in is that the teacher needs to make the learning or the lesson interesting. How do you make your lessons interesting such that when the learners reach grade ten they can easily choose Physical Sciences – because of the love they would have developed from the intermediate phase...?*

Respondent: *I think it begins in the foundation phase. What I have experienced is that the government doesn't place much emphasis on what happens there because there are milestones. There are milestones - you will find that the child could be in intermediate phase but doesn't even know the basic operations in mathematics. They cannot even construct a sentence when are supposed to be able to engage in discussions when doing grade six.*

Interviewer: *Yes*

Respondent: *So the problem here is...I think the problem starts from the foundation phase. A child cannot enjoy the subject when they battle with language to understand concepts and yes when you don't understand the concepts of the subject and then you are expected to perform and achieve certain results. There are certain expectations. We may try as best as we can at intermediate phase... I remember some years ago I read an article by Musimboti Mangena, the former Minister of Technology. He said something to that effect that when a child is seven, eight years old and he has never experienced proper teaching at primary school, that child is lost without even the child reaching high school. This is how you build the love of the subject from the seven, eight year olds- the way they are being taught at school. The mere fact that you have a child who is not prepared to write home work, that being experienced at intermediate phase that means the child merely exists in the system but is already lost. So when we are dealing with that challenge at high school- of children who are not doing well in mathematics, the problem starts at the foundation phase...*

Interviewer: *They didn't get the proper background of the subject...?*

Respondent: *Yes there is no proper background. I remember I was once in a meeting where I raised an issue about these milestones. I was quickly rebuffed by somebody who was a senior manager at a school saying that we know these things and I didn't have to raise them...*

Interviewer: *Yes.*

Respondent: *But I was talking from my personal experience because when you deal with a child at an intermediate phase you are at a stage where you begin to see that the child is not able to do this...*

Interviewer: *Yes.*

Respondent: *He might not have been properly taught. They may have been neglect in the system at that level. When we look for example at language, he must be able to read at this level. He must be able to construct a sentence at this level. He must be able to engage in a conversation here. If he is unable to do all these, it means we can actually put a finger at where the problem lies... Inaudible*

*but people are uncomfortable when you raise those questions at staff meetings. When you raise those questions at staff meetings it becomes as if you are attacking people but these are the challenges. Because when you look at the behaviour of a child, the way they develop, you can be able to pinpoint that that's where the problem is. But the emphasis of the government seems to be the exit point – matric whereas they should be assigning the best people to go and have a look at what would be happening at the foundation phase.*

Interviewer: *Yes.*

Respondent: *Like I said Grade R, one, two, and three if the child has not been properly taught there...*

Interviewer: *As it says it's a foundation phase...so once the foundation....*

Respondent: *It's a foundation phase. So once they go to grade four, we have grade four here and there is a challenge because they are in a period of transition. So the problem – those who are teaching matric might be experiencing is the blowback of a problem in grade one...*

Interviewer: *That's true...*

Respondent: *So unless the system is fixed from the bottom up...I think there is no appetite to do that. There is no appetite to do that and it also means turning the system on its head. It means the Department will need to look at people who are being appointed- The HOD, the head of subject. In fact, in our education systems pays little attention to the head of subject because it's somebody who has the experience-who can look at these milestones. Who has the experience to be able to account...*

*Another problem is that we are not holding people accountable. We are appointing HODs, principals, and everybody else and we expect results. And also people have learnt how the system functions. If all the learners pass nobody questions. What those children know is another issue. So people have*

*learnt that as long as children progress to the next level then I won't have to account...*

Interviewer: *Then finally when they exit grade twelve then they get a poor result*

Respondent: *Then the problem is that the child will have to demonstrate what they know...*

Interviewer: *Then we look at grade twelve teachers as if they are the problem...*

Respondent: *So it's a problem there at the foundation phase, how people are appointed to positions of authority to monitor the work and how the work is monitored. Like I said, these milestones, if the Department would pay more attention on whether these milestones are being achieved or children are just being pushed to the next grade avoid controversy because in the past a child would be sitting in the same grade for three years if they don't meet certain standards...*

Interviewer: *But now...?*

Respondent: *But now everybody has to move, yes, that's the problem. You may try as best as you can you are trying to manage the disaster. So those who are teaching at high school especially at matric they are at an unfortunate position.*

Interviewer: *Yes.*

Respondent: *Because they have to deal with that...*

Interviewer: *They have to correct our mistakes from the foundation.*

Respondent: *And again when the child learns, and he learns wrong things from the beginning it's difficult to correct that. There are instances where in grade six you have a child when they write a sentence they don't start with a capital letter. They don't even write their own names in capital letters...*

Interviewer: *Which they should have been taught...*

Respondent: *They should have been taught. When you begin to ask where this does comes from? Can we pinpoint where this happens in the system then people become angry as if you are attacking them...*

Interviewer: *Thank you very much for your time and everything. Thank you.*

## Appendix M: (Interview Transcript 3)

2017.10.29\_08.42\_01

### Teacher C – School 3 Primary School

#### Transcribed audio interview

(Transcribed and edited)

Interviewer: *So we are starting right now the interview after observation. I'm the researcher interviewing Teacher C at School 3 Primary School. So I would like to first thank you for participating in this interview and the whole process of the research I am conducting. Starting on the first question, what are the experiences that you have encountered in teaching Natural Sciences and Technology in grade six good or bad?*

Respondent: *I will say there are some good and some bad because teaching science in foundation and intermediate phases -it's challenging because we have to try by all means to use things that are not seen by your eyes. We have to do experiments. Because now science has been fused with technology it's much more interesting because they now have to build things they have to see. It interests them when they see things they made by their own hands and the experiments as well...*

Interviewer: *What strategies or methods that you use for teaching Natural Sciences and Technology for grade six?*

Respondent: *The strategies that I'm using are very up to their level because I try to cover all the things that we would have done. For example today, like you have seen, I start with the things that we did last week then I come step by step until the day that I introduce a new lesson.*

Interviewer: *Is it helping them?*

Respondent: *Yes it is helping them because some of them forget easily and I have to accommodate them ... or there are some who catch up quickly and some of who are slow in learning but I am trying to accommodate them all. Even the question and answer method is very good...*

Interviewer: *So we have already covered why you use them as you said- it helps those who are lagging behind. And are they effective? Do you see it as effective using those teaching strategies in helping yourself in reaching the objectives your set for the lesson?*

Respondent: *Yes, it is helping a lot because in terms of procedure I have to report and produce evidence to the parents. Those activities that we would have especially with assignments and projects they make those things by their*

*hands. Some of them are very good when they are making things by themselves.*

Interviewee: *Yes....*

Respondent: *And when it comes to tests or exams some of them are not good, yes...*

Interviewee: *Yes But the projects...?*

Respondent: *Yes when you add these marks some projects are boosting them very well.*

Interviewer: *Looking at the results can you say that the strategies you are using are working in helping them pass end of year assessment?*

Respondent: *Yes they do pass. But some of them are struggling; they are battling because here in our community we've got challenged kids. Some of them are much challenged. You can see them they can't read. Some have got (inaudible) but we are accommodating them. We are trying by all means. That makes the rate of passing, some are very good some of them .....The total marks are very bad.*

Interviewer: *Do you think your teaching strategies develop Active Learning, Critical Thinking and problem solving?*

Respondent: *Yes, very well, I can say that because some of them think and are very good and they can even ...what I like about them -if I introduce a lesson today some of them can go and ask their big sisters in high school and they come up with information. Like on fossils -last week I think it was on Wednesday I gave them the topic about fossils and then they came up with different answers researched from their sisters and family. I came up with the answer though but I can see that some of them go an extra mile.....*

Interviewer: *Yes...*

Respondents: *Yes.*

Interviewer: *If you look at the strategies you acquired when you went for teacher training - the strategies you were taught in your institution do you see them working in the current field of teaching?*

Respondent: *When you look at where I come from some of the things are very different from things in the field of work. Colleagues had to help us in many ways. Of course I knew some things when I came here.*

*We were not taught for instance how to do what do the register. In our first year some teachers were even what we did there and had to tell them that we were never taught these things. so many things differ and things are also changing from ODE,NCS now....and what you call it...?*

Interviewer: *CAPS...*

- Respondent: *Yes CAPS. They keep on changing and confusing but we are learning because workshops. Workshops are helping us and we have got clusters too - we are helping each other.*
- Interviewer: *How do you make your teaching interesting to learners so that they develop the love for the subject? My study also focuses on whether the high failure rate in Natural Sciences and Technology in grade twelve maybe caused by how the background of the subject is laid at the intermediate phase.*
- Respondent: *yes the problem with ....science... its challenging at primary school because we don't have resources. Take for instance now with grade six, we are teaching about Planet Earth and Beyond. It's very difficult to tell learners that the sun is not moving and only the earth is moving. They said "aaah ....what if it falls...?". You have to try and put the picture into their minds taking all the resources that can help you try to instil that thing in their minds...*
- Interviewer: *If there were resources it would have been easy?*
- Respondent: *Yes, but it's much better in the high school because maybe they can take to children to ZCPF. We were planning go to next year to familiarise ourselves with ZCPF - to see some of the things that are not seen by the eye that You have to use even... what we call these things projectors.*
- Interviewer: *Yes.*
- Respondent: *Yes all those things. We do have some in our school they gave us laptops so we are waiting for workshop.*
- Interviewer: *Are you used to taking learners to science centre?*
- Respondent: *No . No we did not because we ran out of time. Our subject adviser told us about it but when we looked at the dates it was already late.*
- Interviewer: *Late...*
- Respondent: *Yes, but next year...*
- Interviewer: *I would suggest that maybe you can talk to them....*
- Respondent: *Yes*
- Interviewer: *Because if you talk to them... I used to do it at school. If you talk about the theme especially for Planet Earth and Beyond they have this (inaudible) where they can see exactly is happening like how are the sun the stars.. Everything. They make that specifically for the school (inaudible).*
- Respondent: *Yes it is very challenging because it had I had to use a bucket full of sand. I had to swing it and tell them , "You see if I put sand like that is not falling why, because of the force of gravity ... that's why are not falling...(inaudible).*

*All of those things and some were lost and that week it took like two lessons to explain. Once you get through it its very interesting.*

Interviewer: *Thank you...Looking at the Department of Education and like subject advisers in your school, how can or what is your comment on workshops for helping do deal with challenges?*

Respondent: *Workshops they play an important role in our teaching and learning because ...I do enjoy workshops and they are helpful especially for those who are new in the field. They teach us how to assess, how to record oral evidence and how to teach as such....*

*There is that issue of clusters. As teachers, we try clusters but teachers are not available but they are helping us though. Last year I was the co-coordinator. We had a What Sapp group and people were not always available and they also wanted me to do all the things when it came to marking. And I said to them no come on guys I must show you how to include all the cognitive levels according to their percentages. Because take for instance your paper let's say has 50marks you have to dive into lower order middle order and high order according to your percentages. Even now they don't know. But in clusters or even subject advisers they try by all means. We have workshops twice a year...*

Interviewer: *At the school level...?*

Respondent: *At the school level even HODs are there...And they even said if you got a problem you can consult...*

Interviewer: *Anything you can comment on...?*

Respondent: *Yes. I have been teaching science and technology since I came here in 2009 its very interesting. I love it and my kids even those who passed through me they do comment because I don't go into grade seven. Even the grade sevens they come to me (and say)" We've been talking about things, you've been teaching us..." Take for instance..... Electricity, even their teachers in grade seven. I love my lesson structure. When I came here I had to teach English and IsiZulu and yes I was doing well but I do like to have a touch up on other subjects but I love my lesson times....*

Interviewer: *Thank you very much for participating*

**END OF INTERVIEW**

## Appendix N: (Interview Transcript 4)

2017.10.30\_08.55\_01

Teacher D – School 4 Primary School

Transcribed audio interview

(Transcribed and edited)

Interviewer: *The interview is done at School 3 Primary School after in-class observations. Now it's an interview. Thank you for your co-operation in this study I'm conducting. What are the experiences you have encountered in teaching Natural Sciences and Technology in grade six, good or bad?*

Respondent: *A bit of both. Good Natural Sciences and Technology is a hand-on lesson.*

Interviewer: *Yes...*

Respondent: *Practical tasks are employed so learners are more enthusiastic. Then when it comes to memorising concepts and terms some learners find it difficult to do that...*

Interviewer: *Okay... Then what strategies or methods do you use when teaching Natural Sciences and Technology in grade six?*

Respondent: *Strategies: we use visual learning methods like models; we use posters; interactive Learning between the learners and the teacher; memory tools, we do have them to remember concepts and then written tasks as well to reinforce what they have learnt...*

Interviewer: *Is it working for you...?*

Respondent: *Yes it does work to a certain extent....*

Interviewer: *How have you witnessed that in your teaching and learning, in your teaching experience?*

Respondent: *Using those memory tools has helped learners seeing they now remember the concepts by using those memory tools and by using those models because those are visual so they can remember from what they saw.*

Interviewer: *Then if you look at your results after an assessment or a task that has been given to them, how do they perform? Are they passing the tests and assignments and all that?*

Respondent: *Most of the do pass but there are those who are struggling along to pass concepts and to remember some due to concentration problems.*

Interviewer: *Thank you...*

Respondent: *Yes*

Interviewer: *Do you think your teaching strategies develop Active Learning, Critical Thinking and problem solving?*

Respondent: *Yes they do if you are using a practical task and its hands-on and its Active Learning, Critical Thinking if you ask them to think out of the box and explain things and then narrate. Problem solving, yes, asking tactical questions for them to try and work out how it works and why it works that way.*

Interviewer: *Okay. If you compare you strategies or methods you learnt from the institutions you were trained at, if you look at their practicality in the current situation, are they working or maybe you have developed knowing others from the real situation?*

Respondent: *With experience you develop new strategies and new ways of dealing with...*

Interviewer: *But did it help to get those basic ones you got from training?*

Respondent: *It did help to a certain extent....*

Interviewer: *How do you make your teaching of the subject interesting? I am asking this because the focus of my study is to look at the pass rate of Physical Sciences at grade twelve – is it not maybe caused by the background they got from the intermediate phase teaching in the subject as Natural Sciences and Technology as a background of Physical Sciences. So one of the things teachers need to do is to make the lesson interesting so how do you make them interested in the subject...*

Respondent: *Well hands on one-on-one and also avoiding too much dialogue in your lesson. Allow them to be involved to interact. Keep them alert and awake and part of the lesson all times.*

Interviewer: *And I have witnessed that in your presentation, thanks a lot.*

Respondent: *Yes.*

Interviewer: *I am not sure whether you are party or fully under the Department of Education?*

Respondent: *The school...?*

Interviewer: *Yes*

Respondent: *We were partly.....but now we have been given private status.*

Interviewer: *Do you get workshops...?*

Respondents: *For Natural Sciences and Technology no I haven't been to any.*

Interviewer: *But inside the school do you have those workshops helping in subjects, meetings helping in addressing some challenges?*

Respondent: *Not really. Other than discussions between us educators....our problems to deal with...*

Interviewer: *Thank you is there anything you would like to add on or comment on.*

Respondent: *No*

Interviewer: *Thank you very much for your participation.*

## Appendix O: (Interview Transcript 5)

2017.10.29\_13.01\_01

Teacher E – School 5 Primary School

Transcribed audio interview

(Transcribed and edited)

Interviewer: *I think we can start. I'm the researcher interviewing Teacher E. We have done in class observation now we are in the part where we are doing interviews. Thank you for cooperating and accepting to work with me on this interview and research conduction. Maybe going straight to the questions, what are the experiences that you have encountered in teaching Natural Sciences and Technology in grade six either good or bad?*

Respondent: *It is good because I plan a lot. Last time I was teaching grade four and five .....but now I'm in grade six. I'm encountering a good experience in grade six.*

Interviewer: *How are your learners, how do they perform?*

Respondent: *I can say their performance is good.*

Interviewer: *Okay which strategies do you use when teaching grade six Natural Sciences and Technology?*

Respondent: *I'm using so many strategies but I will pick only two. I'm using learner-centered and also question and answer method- that's what I'm using in class.*

Interviewer: *Why are you using them?*

Respondent: *I'm using a learner-centered method because learners co-operate when they hear from other learners. Then question and answer when I want to hear the feedback from them.*

Interviewer: *Do you see them as effective?*

Respondent: *I can say it's effective for teaching and learning...*

Interviewer: *How do you see that or witness that in your teaching experience?*

Respondent: *Are the objects [inaudible] that we achieve together with the learners.*

Interviewer: *When you look at the test, maybe you said... did they all pass?*

Respondent: *They didn't all pass. Maybe only half of the learners pass....*

Interviewer: *Then what about those who would have struggled, how do you help them?*

Respondent: *I take the highflyers and get them to explain to the learners who are struggling with the teaching and learning...*

Interviewer: *So which means in your strategies maybe you forgot the group work...*

Respondent: *Yes I forgot to mention the group works because...*

Interviewer: *Because if you say you take those doing well to help each other I assume they are working in groups...*

Respondent: *Yes.*

Interviewer: *Then there are these terms: Active Learning, Critical Thinking and problem solving. Do you think your teaching strategies develop these aspects?*

Respondent: *It must be developing all of them I can say (3.05-3.08)*

Interviewer: *Then how do conduct activities where these aspects are developed?*

Respondent: *Actually I give them tasks. The first task is a practical task. Those who would be struggling in writing appear to be good in practical. So they are able to get a lot of marks from the practical.*

Interviewer: *In your assessment tasks do you cater for problem solving for example by giving them experiments then you ask them to explain how they came to the conclusions etcetera?*

Respondent: *Yes sometimes...*

Interviewer: *Can you say it depends on the topic maybe...?*

Respondent: *Yes*

Interviewer: *If you compare the strategies you learnt about when you were like a beginner teacher or when you were still a student at the university or institution where you trained, are they working in the current situation or environment you are teaching?*

Respondent: *Yes they are working because I have [inaudible] ... in different schools. So now I am taking those experiences from those different schools. Yes they are working...*

Interviewer: *The focus of this study is looking at the broader aspect of grade twelve matric pass rate in the sciences. So I was checking if it is not the way we are teaching in the intermediate phase as the background that contributes to low uptake of Natural Sciences and Technology in grade ten. One of the requirements from the teachers is that when teaching Natural Sciences and Technology in the class they must make the subject interesting - the way they are teaching... So how do you develop that love for the subject in the learners by making the way you teach interesting to learners?*

Respondent: *I take my learners to science centres and maybe lakes and show them what they learn in class...*

Interviewer: *Do you enough resources?*

Respondent: *We do not have enough resources....*

Interviewer: *Looking at the Department of Education, subject advisers and the school at large...do you get enough workshops that help in addressing challenges to those who are entering the field.*

Respondent: *No*

Interviewer: *At school level...and the...?*

Respondent: *At school level...no subject advisers...maybe I can say at school level because I used to go to another teacher who was teaching science and technology and asks questions wherever I was struggling...*

Interviewer: *Have you ever been visited by subject advisers...how many have you been at this school...?*

Respondent: *One year. The previous school I was teaching Natural Sciences and Technology and technology in grade four and five. I can say two years in grade four and grade five. in grade six teaching NSTech its one year.*

Interviewer: *Have you ever been visited by Natural Sciences and Technology subject advisers?*

Respondent: *No.*

Interviewer: *Is there anything you would like to add on or comment? Do you have anything that might be of assistance to the development of teaching on Natural Sciences and Technology in grade six?*

Respondent: *I think each and every question that I have encountered involves a practical. I think it's best to take the learners out. This could be to a lake or a science centre so that the learners can see what they learn about in class. Maybe they will be more interested in learning Natural Sciences and Technology and technology because learners have got the tendency to believe that Natural Sciences and Technology is hard....*

Interviewer: *So that can help in understanding it better...?*

Respondent: *Yes*

Interviewer: *That brings us to end of the interview. I would to thank you for the time you have given me as well as allowing me to enter your close for observing your teaching. Thank you.*

Respondent: *Thank you.*

## Appendix P: Detailed analysis of Lesson Plans

### Lesson 1:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

Document analysis (for researcher use)			
Number	1 Teacher A	Daily lesson plan	Provided
Date	2017/11/02	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<i>Strategy</i>	<i>Brief description on how the strategy was used</i>	<i>Comments (Active Learning / relevant learning)</i>	
Telling, Demonstration, Observation and Question and Answer Method	The teacher explained to the learner some of the concepts, demonstrated to them the way the earth revolves around the sun. She asked questions and the learners answered.	The lesson was content-based. The teacher tried to let the learners develop their Critical Thinking.	
Other: The lesson was user friendly and clear. Activities were clearly tabulated for the teacher, learners and for the assessment as well. Lesson presented corresponded with the Annual Teaching Plan.			

### Lesson 2:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

Document analysis (for researcher use)			
Number	2 Teacher B	Daily lesson plan	Provided
Date	2017/11/03	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<i>Strategy</i>	<i>Brief description on how the strategy was used</i>	<i>Comments (Active Learning / relevant learning)</i>	
Question and Answer, Group work.	The teacher used the strategy to lead the learners to the answers and giving them a chance to use their thinking skills.	There was no enough Active Learning. No Critical Thinking displayed during the lesson presentation. No creation of problem solving skills to learners.	
Other: The topic presented aligned with the Annual Teaching Plan. The lesson plan was clear			

to be used by anyone without having a challenge, as everything was clearly articulated in the lesson plan.

### Lesson 3:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

<b>Document analysis (for researcher use)</b>			
Number	3 Teacher C	Daily lesson plan	Provided
Date	2017/10/30	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<i>Strategy</i>	<i>Brief description on how the strategy was used</i>	<i>Comments (Active Learning / relevant learning)</i>	
Experimental Activities, Telling, Question and Answer.	The teacher balanced the strategies she used during the presentation of the lesson.	The learners were active during the learning. The teacher demonstrated to learners and they practiced what the teacher showed to them.	
Other: The lesson was taught at the correct time that corresponded with the Annual Teaching plan. The lesson was clearly written, anyone would find it easy to use even in the absence of the teacher.			

### Lesson 4:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

<b>Document analysis (for researcher use)</b>			
Number	4 Teacher D	Daily lesson plan	Not Provided
Date	2017/10/31	Annual Teaching Plan	Not Applicable
(1) Teaching strategies			
<i>Strategy</i>	<i>Brief description on how the strategy was used</i>	<i>Comments (Active Learning / relevant learning)</i>	
Interactive Learning Strategy.	The teacher made the learners to be actively involved during teaching and learning. The teacher allowed the learners to ask the questions and she would give	The lesson was interactive. Through asking questions the teacher was able to easily elicit on the information	

	answers showing that she is clear about the subject she is teaching.	provided by the learners. Making her learners involved in the classroom.
Other: The lessons cannot be told if it aligned with the teaching plan as it was not provided, but the lesson flew very well. The teacher prepared herself very well in spite of the lesson not provided.		

### Lesson 5:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

Document analysis (for researcher use)			
Number	5 Teacher E	Daily lesson plan	Not Provided
Date	2017/10/30	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<b>Strategy</b>	<b>Brief description on how the strategy was used</b>	<b>Comments (Active Learning / relevant learning)</b>	
Question and answer, Group Works.	The teacher used the strategy of asking questions more than the one for group work. The learners were at times able to answer the question, but they sometimes were unable to answer them.	The lesson was more of being passive than being active during learning. More of the information taught was said by the teacher.	
Other: The lesson was taught at the right time of the year. The teacher said she was not aware of the fact that she needed to provide the lesson plan, so she did not provide it.			

## Appendix Q: Detailed Analysis of Observations

### Lesson 1:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

Observation (for researcher use)			
Number	1 Teacher A	Daily lesson plan	Provided
Date	02/11/2017	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<b>Strategy</b>	<b>Brief description on how the strategy was used</b>		<b>Comments (Active Learning / relevant learning)</b>
Introduction of the lesson for the day.	The teacher asked the questions.		The learners answered the questions.
Strategies used during teaching and learning.	Question and answers, narrative or telling method and demonstration.		Learners were active during learning.
Centredness of the lesson.	More of teacher-centred with a little bit of learner involvement.		Learners passive
Assessment activities given to learners.	Was done through asking questions, learners answered questions.		Learners were not fully active, only answered questions.
Performance of the learners in the task given.	Most of the time, the learners answered the questions that were asked.		Learners not fully involved in the learning.
The nature of the Science Lesson; Interesting? Inspiring with wonders or exciting?	Slight interaction and involvement made the lesson not to be interesting and inspiring as well as raising excitement.		No Active Learning portrayed.
Content knowledge by the teacher during presentation.	The teacher had the sufficient content knowledge of the subject.		Not applicable.
Pedagogical skills and knowledge of the teacher.	The teacher seemed having knowledge of what she needed to do during teaching and learning, but did not apply that knowledge.		Passive classroom.
Discipline in the classroom during Teaching and Learning.	The class was disciplined. The teacher noted those who were a bit chaotic and dealt with it satisfactorily.		Passive.
Other: It was impressive the way the teacher used her LTSM during the lesson presentation. She had a chart with the content of the day, she demonstrated for the learners using the objects she provided.			

## Lesson 2:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

<b>Observation (for researcher use)</b>			
Number	2 Teacher B	Daily lesson plan	Provided
Date	03/11/2017	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<b>Strategy</b>	<b>Brief description on how the strategy was used</b>	<b>Comments (Active Learning / relevant learning)</b>	
Introduction of the lesson for the day.	The teacher reminded the learners on what they dealt with previously.	The learners listened to what the teacher told them.	
Strategies used during teaching and learning.	Question and answers, narrative or telling method.	Learners were passive during learning.	
Centredness of the lesson	The teacher is the one leading the teaching and learning.	Learners only answer the questions asked.	
Assessment activities given to learners.	Was done through asking questions, learners answered questions.	Learners were not fully active, only answered questions.	
Performance of the learners in the task given.	Most of the time, the learners answered the questions that were asked.	Learners not fully involved in the learning.	
The nature of the Science Lesson; Interesting? Inspiring with wonders or exciting?	No interaction and involvement made the lesson not to be interesting and inspiring as well as raising excitement.	No Active Learning portrayed.	
Content knowledge by the teacher during presentation.	The teacher had the sufficient content knowledge of the subject.	Not applicable.	
Pedagogical skills and knowledge of the teacher.	The teacher seemed having knowledge of what he needed to do during teaching and learning, but did not apply that knowledge.	Passive classroom.	
Discipline in the classroom during Teaching and Learning.	The class was disciplined. The teacher noted those who were misbehaving and dealt with it satisfactorily.	Passive.	
Other: The teacher tried to use his LTSM during the lesson presentation. She had an apple with a stick to show the earth's axis and used his cellular phone as a torch. He showed to the learners how the earth revolves around the sun.			

### Lesson 3:

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system

Revolution and Rotation

<b>Observation (for researcher use)</b>			
Number	3 Teacher C	Daily lesson plan	Provided
Date	02/11/2017	Annual Teaching Plan	Aligned
(1) Teaching strategies			
<b>Strategy</b>	<b>Brief description on how the strategy was used</b>	<b>Comments (Active Learning / relevant learning)</b>	
Introduction of the lesson for the day.	The teacher asked the questions.	The learners answered the questions.	
Strategies used during teaching and learning.	Question and answers, Guided discovery through questioning.	Learners were active during learning.	
Centredness of the lesson.	The lesson is mainly based on the content, more of teacher-centred.	The teacher tried to involve the learners during demonstration.	
Assessment activities given to learners.	Was done through asking questions, learners answered questions.	Learners were not fully active, only answered questions.	
Performance of the learners in the task given.	Most of the time, the learners answered the questions that were asked.	Learners not fully involved in the learning.	
The nature of the Science Lesson; Interesting? Inspiring with wonders or exciting?	Learners seem interested to the lesson presented	Active Learning portrayed.	
Content knowledge by the teacher during presentation.	The teacher had the sufficient content knowledge of the subject.	Not applicable.	
Pedagogical skills and knowledge of the teacher.	The teacher seemed having knowledge of what she needed to do during teaching and learning, but did not apply that knowledge.	Active classroom.	
Discipline in the classroom during Teaching and Learning.	The class was disciplined. The teacher had command on her class. She noted those who were a bit chaotic and dealt with it satisfactorily.	Active classroom.	
Other: It was impressive the way the teacher tried to make her lesson be enjoyable and interesting during her teaching and learning. Although the teacher had few experience, but she worked very well in making her subject be interesting to the learners.			

**Lesson 4:**

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system - Revolution and Rotation

<b>Observation (for researcher use)</b>			
Number	4 Teacher D	Daily lesson plan	Not Provided
Date	31/10/2017	Annual Teaching Plan	Not applicable
<b>(1) Teaching strategies</b>			
<b>Strategy</b>	<b>Brief description on how the strategy was used</b>	<b>Comments (Active Learning / relevant learning)</b>	
Introduction of the lesson for the day.	The teacher asked the questions and explained to them the lesson for the day.	The learners answered the questions.	
Strategies used during teaching and learning.	The teacher narrated some of the information. She demonstrated some of the concepts to learners.	Learners were active during learning.	
Centredness of the lesson.	Lesson is participative. Learners are involved in teaching and learning. It was more of discussion as they asked questions and the teacher will explain to them.	Participative nature of teaching in the classroom. Lesson is more of being content-centred.	
Assessment activities given to learners.	Was done through asking questions, learners answered questions. They were also given a task to do.	Learners were active, only answered questions, also participating in the lesson.	
Performance of the learners in the task given.	When the teacher asked the questions, learners answered with understanding. They also asked questions. When the activity was given for assessment, they participated through writing.	Learners were involved in the learning.	
The nature of the Science Lesson; Interesting? Inspiring with wonders or exciting?	The way the teacher presented the lesson, she made the lesson to be interesting and inspiring as well as raising excitement.	Active Learning portrayed.	
Content knowledge by the teacher during presentation.	The teacher had the sufficient content knowledge of the subject. The teacher seems to know the subject content knowledge she is presenting.	Not applicable.	
Pedagogical skills and knowledge of the teacher.	The teacher seemed having knowledge of what she needed to do during teaching and learning, she even demonstrated to learners to understand	Active classroom.	
Discipline in the classroom during Teaching and Learning.	The class was disciplined. They were co-operative.	Active.	
Other: The teacher seemed full of content knowledge during teaching and learning.			

**Lesson 5:**

Knowledge Strand: Planet Earth and Beyond.

Topic: The Solar system - Revolution and Rotation

<b>Observation (for researcher use)</b>			
Number	5 Teacher E	Daily lesson plan	Not Provided
Date	30/10/2017	Annual Teaching Plan	Not Applicable
<b>(1) Teaching strategies</b>			
<b>Strategy</b>	<b>Brief description on how the strategy was used</b>	<b>Comments (Active Learning / relevant learning)</b>	
Introduction of the lesson for the day.	The teacher asked the questions from the previous lesson.	The learners answered the questions.	
Strategies used during teaching and learning.	Textbook method, Question and answers, narrative (lecture) or telling method.	Learners were passive, waiting for the direction from the teacher.	
Centredness of the lesson.	Lesson was more of being teacher-centred, in most of the time the teacher read from the textbook.	Learners were passive and completing to what the teacher was saying.	
Assessment activities given to learners.	Was done through asking questions, learners answered questions.	Learners were not fully active, only answered questions.	
Performance of the learners in the task given.	Most of the time, the learners answered the questions that were asked, failing to answer others.	Learners not fully involved in the learning.	
The nature of the Science Lesson; Interesting? Inspiring with wonders or exciting?	Slight interaction and involvement made the lesson not to be interesting and inspiring as well as raising excitement. The teacher gave them notes to copy and they did.	No Active Learning portrayed.	
Content knowledge by the teacher during presentation.	The teacher showed that the teacher read the content knowledge of the subject. Relied mostly on the book.	Not applicable.	
Pedagogical skills and knowledge of the teacher.	It was not easy to see her pedagogical skills since the lesson mostly relied on the textbook read.	Passive classroom.	
Discipline in the classroom during Teaching and Learning.	It took some time for the class to be settled before the lesson started, causing the delay in the presentation of the lesson. The teacher acknowledged the misbehaving learners, but continued to talk whilst teaching.	Passive.	
Other: The lesson was based mostly on the use of textbook. The noise during the teaching and learning made it difficult to say the teacher had control over her class. No LTSM were used during the presentation of the lesson except the textbook.			

## Appendix R: Certificate of Language Editing

# Rod Taylor

Language editor & Proof Reader

Trading as

Direction Training

215 Republic Road  
Rand Park 2194

Telephone: 084 716 6588

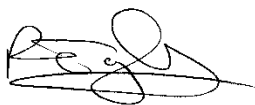
Email: [dtraining@iafrica.com](mailto:dtraining@iafrica.com)

25 September 2018

To whom it may concern

**Language Editing – Masters dissertation – B. Buthelezi**

I have reviewed chapters 1 to 5 as well as the abstract of the dissertation entitled “Exploring the strategies used by Grade 6 teachers in the teaching of Natural Sciences and Technology in the Ngwelezane Circuit schools” in terms of spelling, language and grammar and have made recommendations to the author concerning the changes necessary.



R. Taylor

MBA BSc DTM

Chief Executive: Rod Taylor MBA BSc DTM (British)

Reg No. CK 88/21843/23

CATEGORY	THEME	SUB-THEME	SUPPORTING STATEMENT	RESPONDENT
STRATEGIES USED BY THE TEACHERS	GENERAL	Demonstrations	It's very difficult to tell learners that the sun is not moving and only the earth is moving. They said "aaah ...what if it falls...?". You have to try and put the picture into their minds taking all the resources that can help you try to instil that thing in their minds...	C
		Group discussions	Yes I use group work. Yes group discussions where we give them work. They work as groups and they do presentations in class as members of the groups and they also do their presentations individually	A B
	Learner-centred	I'm using so many strategies but I will pick only two. I'm using learner-centred and also question and answer method- that's what I'm using in class.	E	
	STRATEGIES	Observation, telling, Q&A	It depends on the lesson that I'm teaching at that time. Like in today's lesson I used observing, telling and question and answer. We were planning go to next year to familiarise ourselves with ZCBF - to see some of the things that are not seen by the eye that You have to use even... what we call these things projectors This could be to a lake or a science centre so that the learners can see what they learnt about in class. Maybe they will be more interested in learning Natural Sciences and Technology and technology because learners have got the tendency to believe that Natural Sciences and Technology is hard....	A C E
		Presentations	and they also do their presentations individually	B

		Question and answer	Even the question and answer method is very good... Methods – I'm teaching using, we use question and answer methods. These are methods where we ask questions and expect answers and discussion	C
STRATEGIES USED BY THE TEACHERS	GENERAL STRATEGIES	Relating	We used to have news in the morning. Time allocated to the news where others would read the news, sport news the weather and everything so that every day they should know what the weather patterns are so that they should interpret that into their daily activities. They should know when we talk about weather patterns.	B
		Research	Like on fossils -last week I think it was on Wednesday I gave them the topic about fossils and then they came up with different answers researched from their sisters and family. I came up with the answer though but I can see that some of them go an extra mile..... going to the library and bringing information to the class or they are given various tasks some of which they have to perform individually	C B
		Revision	The strategies that I'm using are very up to their level because I try to cover all the things that we would have done. For example today, like you have seen, I start with the things that we did last week then I come step by step until the day that I introduce a new lesson.	C
	Strategies for developing an interest in the subject	Early development	I think the problem starts from the foundation phase. A child cannot enjoy the subject when they battle with language to understand concepts and	

			yes when you don't understand the concepts of the subject and then you are expected to perform and achieve certain results	B
		Learner involvement	Well hands on one-on-one and also avoiding too much dialogue in your lesson. Allow them to be involved to interact. Keep them alert and awake and part of the lesson all times.	D
		Learner involvement	Sometimes I keep them involved in my lesson and... telling them about it. Learner involvement, practical they love them.	A
		Practical - Experiments and Projects	Because now science has been fused with technology it's much more interesting because they now have to build things they have to see. It interests them when they see things they made by their own hands and the experiments as well...	C
		Science Centres	This could be to a lake or a science centre so that the learners can see what they learnt about in class. Maybe they will be more interested in learning Natural Sciences and Technology and technology because learners have got the tendency to believe that Natural Sciences and Technology is hard.... I take my learners to science centres and maybe lakes and show them what they learn in class...	E E
		Allocating more time	I try to give them more time. Buts it's not easy but I try	A
		DOE support, learner support educators, psychologists	You give them work they can do on their own while you monitor and they should also ask. You also give the fast learners work they do on their own while you help the slow learners.	B

<b>STRATEGIES USED BY THE TEACHERS</b>	<b>Strategies for Learners with challenges</b>	Learner-to-learner support	They are given certain tasks at their levels and there are also learner support educators who were allocated by the Department ...	E
		Practical	I take the highflyers and get them to explain to the learners who are struggling with the teaching and learning...	E, D
		Revision	Practical tasks are employed so learners are more enthusiastic. Then when it comes to memorising concepts and terms some learners find it difficult to do that...	C
<b>TEACHERS' VIEWS ON THE STRATEGIES THEY USE</b>	<b>Views on education system effects on strategy</b>	Educators cheating the system	We are appointing HODs, principals, and everybody else and we expect results. And also people have learnt how the system functions. If all the learners pass nobody questions	B
		Lack of educator accountability	So it's a problem there at the foundation phase, how people are appointed to positions of authority to monitor the work and how the work is monitored. Like I said, these milestones, if the Department would pay more attention on whether these milestones are being achieved or children are just being pushed to the next grade avoid controversy.	B
		Learner promotion/progression system weaknesses	So people have learnt that as long as children progress to the next level then I won't have to account...	B
		Problem identification challenges	They should have been taught. When you begin to ask where this does comes from? Can we pinpoint where this happens in the system then people	

			become angry as if you are attacking them	B
TEACHERS' VIEWS ON THE STRATEGIES THEY USE	Views on education system effects on strategy	System weaknesses in identifying learner challenges	He might not have been properly taught. They may have been neglect in the system at that level. When we look for example at language, he must be able to read at this level.	B
		Teacher shortages	I majored in English and History but we had teacher shortage problems at school so I just took NSTech.	B
	General experience - teaching strategy	General experience	It is good because I plan a lot. Last time I was teaching grade four and five .....but now I'm in grade six. I'm encountering a good experience in grade six.	E A
	Learner challenges negatively affecting strategy effectiveness	Basic literacy challenges	Yes they do pass. But some of them are struggling; they are battling because here in our community we've got challenged kids. Some of them are much challenged. You can see them they can't read. There are milestones - you will find that the child could be in intermediate phase but doesn't even know the basic operations in mathematics. They cannot even construct a sentence when are supposed to be able to engage in discussions when doing grade six.	C B
			There are milestones - you will find that the child could be in intermediate phase but doesn't even know the basic operations in mathematics. They cannot even construct a sentence when are supposed to be able to engage in discussions when doing grade six.	
	Community-oriented learning challenges	Yes they do pass. But some of them are struggling; they are battling because here in our community		

			we've got challenged kids. Some of them are much challenged. You can see them they can't read.	C
	Learner challenges negatively affecting strategy effectiveness	Conceptual knowledge	What I have encountered is that you will find learners with very little conceptual knowledge of the subject.	B
	Learner challenges negatively affecting strategy effectiveness	General learner challenges	...Most of them have challenges in their learning.	B
TEACHERS' VIEWS ON THE STRATEGIES THEY USE	Learner challenges negatively affecting strategy effectiveness	Linguistic barriers	And it helps when maybe they would have been exposed to the language of instruction earlier. Some of the learners struggle with the language because when we teach the subject we have to use the English language, the books are written in English	B
	Resources as a challenge to strategy effectiveness	General learning resource shortage	Yes the problem with ....science... its challenging at primary school because we don't have resources. And the other thing like facilities... the Department doesn't provide much of these. You find that their allocation is too little...not enough. Even if you ask learners to make practical work. Some practical work requires learners to go and buy resources and their parents don't buy them these things.	C A
TEACHERS' VIEWS ON THE STRATEGIES THEY USE	Support on implementing teaching strategy	Support within the school	Yes I do have a mentor although she is not here.	A
		Peer-to-peer support	I can say at school level because I used to go to another teacher who was teaching science and technology and asks questions wherever I was struggling There is that issue of clusters. As teachers , we try clusters but teachers are not available but they are help us though .last year I was the co-coordinator	A

			Oh maybe madam but she is not here now. Sometimes she helps me	A
		Support within the school	We do have phase meetings where phase teachers meet and talk about challenges we might be meeting. That's a huge challenge because we don't have such. Normally the school must have a staff development team and we would have class visits and the information gathered from there must inform the SDT on how to develop teachers	B
TEACHERS' VIEWS ON THE STRATEGIES THEY USE	Support on implementing teaching strategy	Subject advisors	For Natural Sciences and Technology I haven't been visited because it's not my real subject- Natural Sciences and Technology and technology ... Maybe because the challenges are that there are not very many subject advisers. You have one subject advisers covering this area, maybe three of them covering maybe the whole district	A B
		Workshops	And they do not provide the materials to use in our schools. I don't know maybe in other schools they do have enough materials. In our schools in rural areas we don't have most of the materials. So that's a challenge because you will have only one workshop at the beginning of the year... And another challenge is that the person who workshops you may have been in the classrooms ten years ago. So he is not telling you something that he experiences on the daily basis. What we experience on a daily basis isn't what they tell you at the workshop. It's quite different. Yes they do give us support but it doesn't come	B E B

			<p>that much. They invite us for workshops and explain what is on paper.  We don't get much from the workshops.  Interviewer: Looking at the Department of Education, subject advisers and the school at large...do you get enough workshops that help in addressing challenges to those who are entering the field. Respondent: No  Workshops are helping us and we have got clusters too - we are helping each other.  Workshops they play an important role in our teaching and learning because ...I do enjoy workshops and they are helpful especially for those who are new in the field. They teach us how to assess, how to record oral evidence and how to teach as such....</p>	<p>E</p> <p>C</p> <p>C</p>
<p>TEACHERS' VIEWS ON THE STRATEGIES THEY USE</p>	<p>Views on the effects of the teacher education</p>	<p>Effectiveness of teacher training</p>	<p>We were not taught for instance how to do what do the register. In our first year some teachers were even what we did there and had to tell them that we were never taught these things  Interviewer: So In other words, it helped to get that training? Respondent: Yes it helped me a lot.  So if we give a teacher science and they can't teach science then we have a problem because we don't major at primary level. So you take them all. I'm not sure now may be there are now methods for majoring.</p>	<p>C</p> <p>A</p>
<p>TEACHERS' VIEWS ON THE STRATEGIES</p>	<p>Views on the effect of the teacher</p>	<p>Many changes since tertiary</p>	<p>So many things differ and things are also changing from ODE, NCS now....and what you call it...? Yes CAPS. They keep on changing and confusing but we are learning because workshops</p>	<p>C</p>

	education	Strategies learnt at tertiary not applicable	<p>What I learnt at university on the strategies for working with learners work-some of them work. But most of them do not work at all with children in the classroom.</p> <p>At university they do not have any idea of the environment that we will end up teaching in. Maybe the person who designed at those strategies was looking at a particular school. But we are not like that school because we are in a different environment with people leaving in a different way.</p> <p>I don't think they are working in our situation as we are a multi-graded class...Yes we end up using our strategies...they don't work the way we've been trained.</p> <p>Yes they are working because I have [inaudible]... in different schools. So now I am taking those experiences from those different schools. Yes they are working...</p> <p>With experience you develop new strategies and new ways of dealing with</p> <p>It did help to a certain extent</p> <p>Well we were taught about teaching...learner-centred teaching, communicative teaching but once you come here face-to-face with the learners you find that some of these may not necessarily work. Sometimes it is specific to the needs of the learners.</p> <p>But most of what we learnt at tertiary institutions sometimes you need to adapt when you get to the field because they will tell you that a normal class size would be like this and in the real world it's not</p>	<p>B</p> <p>E</p> <p>D</p> <p>D</p> <p>B</p> <p>B</p>
--	-----------	--	--	---

			be same	
Teachers' views on the strategies they use	Views on the effects of the teacher education	Teacher experience	Interviewer: Twenty five... Respondent: I thank you very much for your time.	C
<b>STRATEGIES ALIGNMENT TO CAPS ACTIVE LEARNING AND CRITICAL THINKING</b>	<b>Active Learning, Critical Thinking and problem solving</b>	Critical Thinking and problem solving	Because now science has been fused with technology it's much more interesting because they now have to build things they have to see. It interests them when they see things they made by their own hands and the experiments as well...	C
		Critical Thinking and problem solving	Yes , very well, I can say that because some of them think and are very good	C
		Active Learning	I'm using so many strategies but I will pick only two. I'm using learner-centred and also question and answer method- that's what I'm using in class.	E
	<b>Active Learning, Critical Thinking and problem solving</b>	Active Learning, Critical Thinking and problem solving	Strategies: we use visual learning methods like models; we use posters; interactive Learning between the learners and the teacher; memory tools, we do have them to remember concepts and then written tasks as well to reinforce what they have learnt...	D
		Active Learning, Critical Thinking and problem solving	Yes they do if you are using a practical task and its hands-on and its Active Learning, Critical Thinking if you ask them to think out of the box and explain things and then narrate. Problem solving, yes, asking tactical questions for them to try and work out how it works and why it works that way.	D
		Active Learning	Yes they do. Because I teach science and I teach them English Language. There is a lot of work they are supposed to do on their own... going to the library and bringing information to the class or they are given various tasks some of which they have to perform individually without being assisted and	

			come back to the class and do presentations	B
		Critical Thinking and problem solving	Critical Thinking and problem solving, yes, they have to. In some of the topics they get some problems they have to solve and Critical Thinking is involved there and yes, I think so because we don't teach all the topics the same.	B
		Critical Thinking and problem solving	Using those memory tools has helped learners seeing they now remember the concepts by using those memory tools and by using those models because those are visual so they can remember from what they saw.	D

**Appendix T: Analysis of Interviews**

## Appendix U (Permission to Conduct Research in the KZN DoE Institution by the HOD)



education

Department:  
Education  
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma

Tel: 033 392 1041

Ref.:2/4/8/1246

Mr BW Buthelezi  
PO Box 1765  
Empangeni  
3880

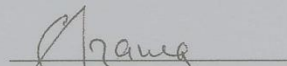
Dear Mr Buthelezi

### PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"STRATEGIES USED IN TEACHING OF NATURAL SCIENCES IN THE INTERMEDIATE PHASE SCHOOLS IN NGWELEZANE CIRCUIT"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 01 June 2017 to 07 November 2019.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

King Cetshwayo District

  
Dr. EV Nzama  
Head of Department: Education  
Date: 06 June 2017

...Championing Quality Education - Creating and Securing a Brighter Future

#### KWAZULU-NATAL DEPARTMENT OF EDUCATION

Postal Address: Private Bag X9137 • Pietermaritzburg • 3200 • Republic of South Africa

Physical Address: 247 Burger Street • Anton Lembede Building • Pietermaritzburg • 3201

Tel.: +27 33 392 1004/41 • Fax.: +27 033 392 1203 • Email: [Kehologile.Conn@kzndoe.gov.za](mailto:Kehologile.Conn@kzndoe.gov.za)/[Phindile.Duma@kzndoe.gov.za](mailto:Phindile.Duma@kzndoe.gov.za) • Web: [www.kzndoe.gov.za](http://www.kzndoe.gov.za)

Facebook: KZNDOE... Twitter: @DBE\_KZN... Instagram: kzn\_education... Youtube: kzndoe

## Appendix V (Ethical Clearance Certificate)

**UNIVERSITY OF ZULULAND  
RESEARCH ETHICS COMMITTEE**  
(Reg No: UZREC 171110-030)



**RESEARCH & INNOVATION**  
Website: <http://www.unizulu.ac.za>  
Private Bag X1001  
KwaDlangezwa 3886  
Tel: 035 902 6887  
Fax: 035 902 6222

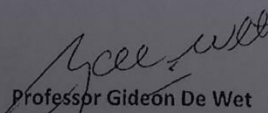
### ETHICAL CLEARANCE CERTIFICATE

Certificate Number	UZREC 171110-030 PGM 2017/402				
Project Title	Exploring the Strategies used by Grade 6 Teachers in the Teaching of Natural Science in the Ngwelezane Circuit Schools				
Principal Researcher/ Investigator	Buthelezi BW				
Supervisor and Co-supervisor	DrRP Pillay		Dr R Mosoloane		
Department	Maths Science and Technology Education				
Faculty	Education				
Type of Risk	Medium risk – Data collection from people				
Nature of Project	Honours/4 <sup>th</sup> Year	Master's	x	Doctoral	Departmental

The University of Zululand's Research Ethics Committee (UZREC) hereby gives ethical approval in respect of the undertakings contained in the above-mentioned project. The Researcher may therefore commence with data collection as from the date of this Certificate, using the certificate number indicated above.

- Special conditions:
- (1) This certificate is valid for 2 years from the date of issue.
  - (2) Principal researcher must provide an annual report to the UZREC in the prescribed format [due date-01 July 2018]
  - (3) Principal researcher must submit a report at the end of project in respect of ethical compliance.
  - (4) The UZREC must be informed immediately of any material change in the conditions or undertakings mentioned in the documents that were presented to the meeting.

The UZREC wishes the researcher well in conducting research.

  
Professor Gideon De Wet  
Chairperson: University Research Ethics Committee  
Deputy Vice-Chancellor: Research & Innovation  
20 September 2017

