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**EXAMINING THE COGNITIVE LEARNING EFFECT ON GRADE 10 STUDENTS'
PERFORMANCE IN PHYSICAL SCIENCE IN SELECTED SCHOOLS IN
UMGUNGUDLOVU EDUCATION DISTRICT**



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University of Fort Hare**

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ABSTRACT

The study employed a quantitative as well as a qualitative approach. Four public schools in the uMgungundlovu District participated in this study. The identities of all respondents were protected. The sample included 154 participants, four Physical science educators and four Heads of department selected purposefully across four secondary schools. The study found that the majority of the learners reported that they have interest and positive attitude for Physical science but most of learners indicated they understanding when English is used as a medium of instruction in teaching Physical science but some prefer other languages to be used for their understanding. It was obvious that most parents lacked knowledge about Physical Sciences and could not assist their children. It was also indicated that their teachers are approachable especially for personal explanation giving them attention whenever they ask for assistance, creating an atmosphere that makes it easy for the learner to learn. The study reveals that learners had a high rate of their teachers motivating them enough to like physical science, by using different method for them to understand the subject and majority follow their teacher's method but only few learners use their own method. The educators and the heads of departments confirmed that they do give the learners different method. Many learners understands what they are taught using diagrams and illustrations in order to make them understand in all subject study showed that the head of departments indicated that they do check the way the teachers teach for effectiveness on the part of the teachers in ,line with the curriculum assessment policy statement from the department of education .The educators said they receive their educational in- service training and done yearly at the department of education workshop and moderations. Findings from this research reveals that learners learns one way or the other through all the strategies of learning but most learners affirms that they learn more rehearsal where they have to repeat things more and that the physical sciences teacher should have more time and explain thoroughly particular term, using diagrams and illustrations in order to make them understand in all subject. The study concluded by giving general recommendations for improving learners' participation and attitudes towards learning physical Science. Recommendations for improvement in the areas identified were

provided and topics for future research on the curriculum of Grade 10 Physical Sciences were suggested in order to improve on physical science.

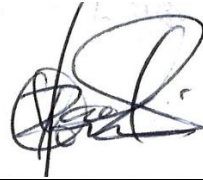
Key Terms: Academic achievement, Physical sciences, Learner Performance, Educator, Cognitive learning



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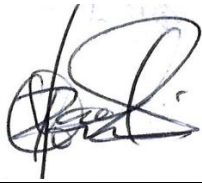
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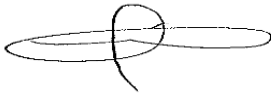
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SUPERVISOR'S STATEMENT

This dissertation has been submitted under my supervision and with my approval.



Professor E.O. Adu (Supervisor).

04/09/19

Date



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DEDICATION

This study is dedicated to my mother, Mrs Folake Rachel Olorunda who sacrifice for me and my siblings to be educated and also to my great and lovely wife, Mrs. Omobolanle Teniola Olorunda and to my wonderful son , Isaac Muyiwa Olorunda, who when I see gives me strength to forge ahead .Thanks for being there.



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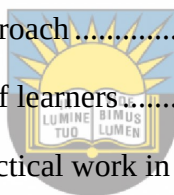
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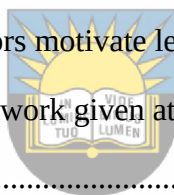
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ABBREVIATION AND ACRONYMS

ANA: Annual National Assessment

CALP : Cognitive Academic Language Proficiency

CAPS : Curriculum and Assessment Policy Statement

DBE : Department of Basic Education

DoE : Department of Education

Edr : Educator

ESL : English Second Language

FAL: First Additional Language

FET : Further Education and Training

GET : General Education and Training

LoLT : Language of Learning and Teaching

Lr : Learner

Obs : Observation

OBE : Outcome Base Education

NCR :National Curriculum Statement

NRC : National Research Council

NAS : National Academic of Sciences

SPSS : Statistical Package for Social Sciences

STM : Short Term Memory

TIMSS: Third International Mathematics and Science Study



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Chapter One

1 Introduction and Background

1.1 Introduction

This chapter serves as an introduction to the study. The chapter examines the Cognitive learning effect on Grade 10 students' performance in physical science in selected schools in uMgungundlovu Education District. The chapter also focus on the background of the study, statement of the problem, research questions, purpose of the study, research objectives, significance of the study, and the delimitations of the study. Definition of key terms and the dissertation outlines are also highlighted.

1.2 Background to the Study



In the developed and underdeveloped countries, there are concerns about the preparedness of students in participating proficiently in the global competition in technological and economic development (McCarthy, 2013). Achievement in science and mathematics is globally recognized as one of the most dependable indicators for measuring national social, geographical, economic and political development (Lancaster, 2013). Governments and educational systems around the world recognize the need for learners to be skilled, creative and be confident users of a wide range of Information Communication Technology, of which the knowledge of science is required (Salman, 2010). This therefore, implies that, for the South. Africaeconomy to be globally competitive, the government must develop a strategy for improving the poor performance in science reported in schools.

1.2.1 Performance in Physical science internationally

1.2.1.1 United States of America

The United States of America that is considered to be the leading economy as well as most powerful politically among the developed countries of the world. While it has been

expected greatly that the learner performance in the U.S. would have been equally impressive, the reverse is actually the case (Ryan, 2013). In a comparative study conducted by Ryan (2013) between the United States' learners with learners from the rest of the world concluded that, despite the high cost of education, the system failed to close the gap in academic performance in science and mathematics. The study also found that the rate of educational performance in the United States since 2000 has been fairly consistent, with little improvement. For example, the U.S. learners scored below the Organization for Economic Cooperation and Development (OECD) average in almost every subject.

1.2.1.2 Nigeria

In Nigeria research has shown that students' performance in science has not been encouraging due to some factors. In 2014 according to The Sun News, in an article titled, 'Outrage trails students poor performance', reported that out of 1.6 million learners that wrote the 2014 May/June West African Senior School Certificate examination (WASSCE), only 31.28% passed with a minimum requirement for admission into tertiary institutions (The Sun News, 2014). The table below shows percentage of students' performance in May/June Examination from 2006 to 2011 in Nigeria.

Year	Percentage of pass
2006	22
2007	20
2008	26
2009	26
2010	23
2011	30

Source (The sun news 2011). The Federal and the State governments recognized the need for good performance in school subjects particularly in Science and Mathematics, which prompted the government to make science a compulsory subject in both primary, junior secondary and senior secondary school levels. The government continues to invest a larger proportion of national budget into education sector so as to improve the teaching and learning outcomes in the subject (Federal Ministry of Education, 2013). Despite the commitments of the government and department of education, the achievement in this subject has not been encouraged.

Several factors associated with the poor performance in science have been identified by researchers, which include, unavailability of qualified teachers, poor facilities, equipment and instructional materials for effective teaching, poor teaching method, poor textbooks, students' interest, class size, teacher attitude to work and poor condition of service. In view of the above conclusion it is suggested that teachers should be more dedicated to their

duties, provision of laboratory equipment and reduction of students' number per class. (Apata, 2007) By research it is known that educators have major role to play. Idowu (2015), refers to educators as the main custodians of students because, they are expected to have the required knowledge necessary for teaching as well as ability to disseminate such knowledge appropriately; so that it will impact positively in the students' learning. Thus, the educators should be able to communicate this vital role clearly, informatively and concisely to their learners. Other significant bodies that are handy in improvement of science that physics and chemistry performances are; conferences and workshops on a regular basis by all stakeholders such as faculties of Education and some of their departments in Colleges of Education and Universities in Nigeria, Federal and State Ministries of Education among others. As custodians in education they should endeavour to equip Physics laboratories. - Workshops should be organized regularly for physics teachers in order to train those who cannot use laboratory equipment well in teaching physics.



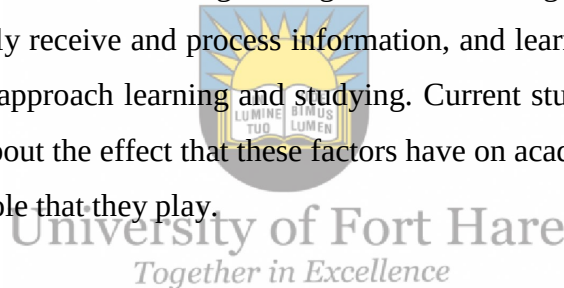
1.2.1.3 Uganda

In Uganda Science is said to be an umbrella covering many subjects including chemistry, biology, physics and mathematics. But the major challenge facing science educators in Uganda is the poor performance science subjects among the secondary school students. Indeed, the performance in some schools is still very low mainly in these subjects. In Uganda Advanced Certificate of Education (UACE) respectively from 2012 to 2014 in science subjects such as Physics 48.7%, 48.5%, 41.5% and Chemistry 32.2% 37.4%, 33.0%. The result shows that student academic performance in science subjects has deteriorated. Significant resources are spent on promoting science and technology at different levels of educational institutions in Uganda. Few students take science related subjects and those who take them continue to perform dismally. Generally, poor education outcomes have detrimental effects on individuals, performance country's economic and social development. However, the recognition of the problem of poor performance in science subjects has not translated into the development of more effective actions to improve the Grades of the students which became a concern to the government, teachers, parents, and district. As a Government of Uganda made science subjects compulsory for

secondary school because numbers of students taking Science related subjects among universities were too small, representing only 22% (Uganda National Academy of Sciences, 2010). If this general trend is not changed, Uganda may not attain the Vision 2030 for it will lack the critical mass of people needed to manage the society envisaged in that the dream (Kyoshaba, 2009).

1.2.1.4 In Botswana and Lesotho

The achievement of learners in O-level, in Botswana and Lesotho has been discovered to be below the expected level compared to their achievement in the Junior Certificate (JC) examination (Raselimo and Mahao 2015). Over the years, numerous studies have examined the multitude of factors determining academic performance, with cognitive ability arising as one of the strongest and most important factor. Numerous factors, however, affect student's performance, including among others; learning style, or the way in which students typically receive and process information, and learning strategies, or the level at which students approach learning and studying. Current studies are, however, divided in their findings about the effect that these factors have on academic performance, as well as the mediatory role that they play.



1.2.1.5 South Africa

A large percentage of South African schools are failing as institutions of learning and teaching (Johnson, 2009:461-462). For the past number of years, South Africa has seen a gradual decrease in the National Senior Certificate results for the subject Physical Sciences and this poor performance can be seen both nationally and internationally. In 2001 and 2003, the Trends in Mathematics and Science Study (TIMSS) were conducted globally and South Africa was part of this study (Howie 2003). In 2001, 38 countries participated in the study with the goal of determining learners' performance in the sciences. In 2003, fifty-eight (58) countries participated; and, in both instances, South African learners were placed last (Makgato & Mji 2006:253). The World Economic Forum Global Information Technology Report of 2013 ranked the quality of South Africa's mathematics and science education second to last in the world, ahead of Yemen. This has become a critical issue of national concern in South Africa.

From 2005 to 2007, the number of learners who passed Physical Sciences at the higher Grade level has steadily decreased and this has affected their entry into science-based programmes at universities (Kriek& Grayson 2009:185). According to Kriek and Grayson (2009: 185-186), in 2005, a total of 29 965 learners passed Physical Sciences. In 2006, this figure dropped to 29 781; and, in 2007, it dropped to 27 122. Evidently, South African learners are not performing in the science field.

In the 2009 Senior Certificate results, the national pass rate for Physical Sciences dropped from 55% to 37% (Department of Basic Education (2011). According to the Department of Basic Education (2011:7), any district that achieved a pass rate below 50% was underperforming. It is worth noting that the achievement of Physical Sciences learners gives an indication of the effectiveness and efficiency of Physical Sciences teaching and learning. This is substantiated in the Report on the 2011 National Senior Certificate Examination, National Diagnostic Report on learner performance in Physical Sciences.

Table 1.1: Overall achievement in Physical Sciences from 2008-2015 (National Matric Results (Grade 12).

YEAR	Number that wrote	30% and above (n)	30% and above (%)	40% and above (n)	40% and above (%)
2008	217 300	119 206	54.9	62 530	28.8
2009	220 882	81 356	36.8	45 452	20.6
2010	205 364	98 260	47.8	60 917	29.7
2011	180 585	96 441	53.4	61 109	33.8
2012	178 887	109 700	61.3	69 927	39.1
2013	184 383	124 206	67.4	74841	48.4
2014	169 997	103 348	61.5	64578	34.3
2015	193 189	113 121	58.6	62 456	32,6

(Report of Department of Basic Education 2015:60).

In 2009, all the nine provinces across South Africa recorded a decline in Physical Sciences. The most alarming decline was in KwaZulu-Natal where the pass rate in Physical Sciences halved compared to the previous year (Keeton 2010). The poor performance of learners in Physical Sciences is a serious cause for concern considering the fact that KwaZulu-Natal traditionally provides a high number of successful mathematics and science students.

A number of possible factors contribute to the poor performance of learners in Physical Sciences. Based on personal experience over the last six years, learning Physical Sciences is more challenging for African learners who are English second language speakers and attend English medium schools. Due to the legacy created by segregation and differentiated schooling systems, the majority of parents of Grades 10, 11, and 12 learners lack English proficiency. This makes it difficult for them to assist their children in the Physical Sciences related tasks.

Physical sciences as subject have extensive quantitative components. Cognitive requirement for physical sciences involve scientific as well as analytical thinking. Hence learners require mathematical and problem solving skills. From my own experience as a Grade 12 physical sciences educator, learners who take mathematical literacy lack the skills required to investigate physical phenomenon and conduct quantitative investigations. South Africa has shown potential for great achievement in the science and technological sectors as a developing country, and evidence of this is South African Largest Telescope (SALT) situated in Sutherland (Kelder 2008:35-110). The South African Largest Telescope is the greatest single optical telescope project in the southern hemisphere and among the largest in the world. These achievements contribute to the economic sector and are a step closer to becoming a developed country.

Physical science as a subject is important as it focuses on investigating physical and chemical phenomenon through scientific enquiry, as can be seen in SALT project above. Through the application of scientific models, theories, and laws it seeks to explain and predict events in the physical world. This subject also looks at how society can benefit from the environment, care for it and use it responsibly (Department of Education 2003).

Since 2008, the KwaZulu-Natal Senior Certificate pass rate has fluctuated between 57.8% and 61.1% in 2009. In 2010, 61.1% of Grade 12 learners passed the Senior Certificate examination; in 2011, the pass rate increased to 68.1% (Daily News 2012:2). The pass percentage in Physical Sciences in 2011 was 51.9% and in 2012 it was 53.3% (Department of Education 2012b). However, the extent which such factors affect learning has not been clearly established. In addition, such factors were established a decade ago. Basically, this means that current relevance in the South African high schools needs to be established. The

researcher argues that besides the known factors, there could be some more factors that have gone unnoticed and will keep on affecting learners' educational effectiveness, if this research is not conducted. Hence this research contributes to academic knowledge that could be used to drive policy implementation within the South African high school context.

A cognitive learning ability can be described as a mental capacity; competency or skill needed to carry out, or perform, a cognitive task(s) (Colman, 2009; Galotti, 2008). For example, working memory is a cognitive ability or capacity to actively retain information temporarily, while at the same time manipulating that information or accessing other information (Dehn, 2008; Izawa & Ohta, 2005). While there are numerous cognitive learning abilities, often they are positively correlated with each other. This positive correlation across abilities has, in turn, led to the acceptance of a general cognitive ability (Dickens, 2008). General cognitive learning ability commonly refers to one's overall cognitive ability and is often used synonymously with intelligence and measured with intelligence tests (Dickens, 2008). In this study, much will be examined on cognitive learning abilities that relates with performance.

1.3 Statement of the Problem

High rates of failure in secondary school science classes are a problem worldwide (Fonseca & Conboy, 2006). Pelloe (2009) cited in Carreira and Andre (2000) notes that in southern Portugal, the failure rate for all secondary students is most prominent in Grade 10 (Carreira & Andre, 2000). The lack of continuity and progression between primary and secondary education has been an issue for several decades in the United Kingdom (UK) (Davies, 2004). The Observational Research and Classroom Learning Evaluation (ORACLE) project (1975-1980) and its replication study (1996) found low levels of expectation by secondary teachers of learners' enquiry skills in the first year of secondary school in the UK (Galton et al., 1999).

In the Gauteng province of South Africa, the rate of repetition in Grade 10 is the highest. The Department of Education also noted in 2008 that there was a significant school dropout rate after Grade 9 (Mail & Guardian online, 2008). This seems to suggest that learners in Grade 9 may not have acquired enough content knowledge to cope with knowledge

demands of Grade 10. The question arises as to whether this high failure rate performance could be due to transition problems or couple with the cognitive learning experienced by learners from the GET to the FET phase. This study seeks to examine whether there is a strong relationship between cognitive learning ability of the learner with their academic performance and other related factors that could contribute to it.

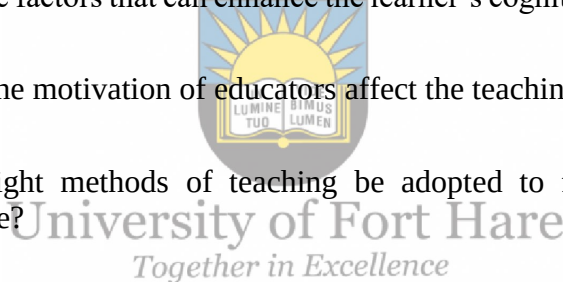
1.4 Research Questions

The main research question for this study is

How does cognitive learning impact on the academic performance of Grade 10 physical science learners in the selected schools in UMgungundlovu District, South Africa?

The sub-research questions for this are:

1. What are the factors that impede cognitive learning?
2. What are the factors that can enhance the learner's cognitive learning for performance?
3. How does the motivation of educators affect the teaching of physical science?
4. How the right methods of teaching be adopted to foster cognitive learning for performance?



1.5 Research Objectives:

The main objectives of this study are:

1. To examine the factors that impede cognitive learning?
2. To identify the factors that can enhance learners' cognitive learning for performance.
3. To identify how motivation of educators affect the teaching of physical science?
4. To identify the right method of teaching that should be adopted to foster cognitive learning for performance.

1.6 Purpose of the study

The purpose of this study is to examine the cognitive learning effects on learners' performance in Grade 10 physical science in high schools in the UMgungundlovu educational district in KwaZulu-Natal.

1.7 Significance of the study

This study is significant because it can create a greater understanding of how cognitive learning could enhance academic performance of learners in South Africa. Therefore, the specific purpose of this study is to examine how teachers go about creating and enhancing an intellectual environment for learners to perform significantly well academically.

This study will help the teachers to reflect on their practices within and outside the classrooms and provide valuable model by which learners' cognitive performance can be achieved. At the most basic level of dynamic model (Creemers and Kyriakides, 2009:294), we find the teaching and learning situation in the classrooms and, consequently, the roles of the two main actors, the teacher and the learner. The study could make direct inputs, general guidance or new insights indirectly into the decision-making process. This research study could also be an opener for further researches in educational policy making and implementation.



1.8 Delimitation of the study

The study was conducted in four secondary schools in Pietermaritzburg and Richmond Townships. In the four schools, 154 learners in Grade 10 physical science and four of their teachers participated in the research. The study focused on the learners regarding the cognitive learning effect on their academic performances.

1.9 Research Approach

The approach that this study will adopt is the mixed method approach. A Mixed methods research approach is the use of quantitative and qualitative methods as components of a research design (Caruth, 2013; Ponce, 2011; Creswell, 2009; Greene, 2007). Mason (2006: 10) argues that the use of mixed methods approach mainly allows the researcher "to access multiple perspectives and dimensions". Creswell and Plano Clark (2011: 8) and Gorman and Clayton (2005: 25) highlighted that the mixture of quantitative and qualitative approaches not only improves the sources of data but also leads to better understanding of the specific research problem. Flick (2009: 32) stated that mixed methods approach is known as a third research movement as it has merged after quantitative and qualitative

methods. A mixed methods approach has become popular in education and social science disciplines (Lichtman 2011: 209).

1.10 Research design

A mixed research design would be used. A research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby ensuring effectively address the research problem (Punch, 2011). Creswell (2014) provides three typologies of designs in mixed method research convergent parallel design (qualitative and quantitative data collection and analysis is done concurrently), explanatory sequential design and exploratory sequential design. A convergent concurrent design also referred to as concurrent triangulation, parallel study, and convergent parallel design (Creswell, 2014) will be used in this study. This design enabled the researcher to acquire an in-depth understanding on the cognitive learning for performance in physical science.



1.11 Population

Population is a group of people, objects or item which samples are taken for measurements (Okeke, 2015). The study will be conducted in four high schools in the UMgungumdlovu Education District. The population for this study will consist of learners from Grade 10 physical science learners and teachers in four high schools in Pietermaritzburg and Richmond.

1.12 Sampling

Sampling refers to the process of selecting the sample from the population in order to obtain information regarding a phenomenon in a way that presents the population (Busha, 2013). A purposeful sampling technique was used to select physical sciences learners in the four schools (McMillan & Schumacher 2007). The sample of the study consisted of a total of 154 Grade 10 physical sciences learners; four Grade 10 physical sciences teachers and four heads of department.

The reason for including Grade 10 physical sciences learners was that this sample needs to be represented of the relevant population. The selection of all Grade 10 Physical Sciences learners is aimed at selecting a heterogeneous sample, which have a variety in terms of socio-economic standing, language affiliation, age and gender. The physical science teachers and physical science head of department were included because of their expert knowledge in the subject.

1.13 Data collection and Instrument

Data collection is defined as the collection of information to be used in the investigation. This study adopted questionnaires, semi-structured interviews (primary data) and observation to collect quantitative and qualitative data for this mixed method research study.

1.13.1 Questionnaires

Questionnaires were used to get personal information (age, gender, race, home language, and years of teaching experience or attending tuition, learner participation in pure mathematics or mathematics literacy) from educators and learners. The questionnaires contain both open ended and closed ended questions (Zohrabi, 2013). Open ended questions will generate qualitative data while closed ended questions gather quantitative data. The semi-structured questionnaire aligns perfectly with this mixed research study because it facilitates data gathering from large samples of teachers and pupils increasing external validity. Responses are gathered in a standardized way making questionnaires more objective (Creswell, 2014). In this study, questionnaires were printed and distributed to all learners during a registration period or break, thus saving time and not disrupting the teaching and learning process.

1.13.2 Semi-structured interviews

Interviews were also used to collect data. An interview is a method for generating research data through a structured dialogue between the researcher (interviewer) and the participant (interviewee). Semi-structured interviews allow depth to be achieved by proving an

opportunity for the interviewer to probe using cues and prompts encouraging interviewees to provide detail and clarifications (Harris & Brown, 2010). All interviews were conducted in the lunch breaks and minutes were taken. Analysis of examination results was also done.

1.13.3 Observation

According to Creswell (2013) observation is the process of learning through exposure to or involvement in the day to day or routine activities of participants in the researcher setting. It is also the systematic process of recording the behavioural pattern of participants, object and occurrences without necessarily questioning or communication (Busha, 2013). This is why participant observation is one of the researcher adopted data collection approaches as the researcher believe it will provide first hand data on what the teacher actually does in the classroom with regards cognitive learning on the learners performance. It will provide evidence on the non-verbal responses of the teachers and show how they interact with the learners and the communication within the classroom and seating arrangement.



1.14 Data Analysis

Data analysis is about making meaning out of the data collected and interpretation of meaning of data (Creswell, 2009:183). According to Merriam (2009), data analysis is the process of bringing order, structure and meaning to the mass of data collected. Denzin (2014) contends that analysing qualitative data demands the application of content analysis, which refers to analysing the contents of the interview in order to identify the main themes emerging from the responses. Thematic content analysis was used to analyse the qualitative data (Namey et al. 2008: 138). Correlation analysis and regression analysis will be used to analyse quantitative data.

1.15 Credibility and Trustworthiness

It is very important that research study be credible and trustworthy and that the readers should be able to believe and trust the information reported. Credibility in qualitative research is defined as the extent to which the data and data analysis are believable and trustworthy (Swanson, 2011). To ensure credibility and trustworthiness; the study used

transferability, dependability and conformability. Member checking used to enable the researcher to share the information collected from participants back for verification and confirmation.

1.16 Ethical considerations

In research, data were also collected from people and about people. Ethical consideration “confers on the researcher an obligation to respect the values and interests of the participant in research and, wherever possible, to protect them from harm” (Denzin, 2014). Therefore, important issues of ethics were followed, namely, informed consent, confidentiality, anonymity, avoiding harm to participants and permission.

1.16.1 Informed Consent

To ensure informed consent in this study, the researcher shared with the participants what the study was all about and it sought to find out. Participants’ informed consent was sought before commencing the study to avoid frustrations of both parties. The participants were requested to sign forms of informed consent before data collection process.

1.16.2 Confidentiality

In this study, the participants were assured that no unprofessional ways will be used to collect information from them. Likewise, the assurance that the gathered data was only to be used for the purpose of this study was given.

1.16.3 Anonymity

Information about the participant will not be shared with any person, relative or any person who will demand to know about the participants be it an educator or parent. If shared, it should be on specific consent related to the research. Code numbers were used as the only means of identification in the study. The keys linking the code numbers to the names will only be accessible to the investigator. The educators and learners that are willing to participate as well as their parents were requested to sign consent forms.

1.16.4 Avoiding harm to participants

The benefit and risks of this investigation were explained to the principals of the schools, learners and their parents. There were no anticipated risks in this study. Participants were informed that, their decision to participate in this study would not affect their study in any form. They were also informed that they were free to withdraw from the study at any point. They were reassured about confidentiality. In order to ensure confidentiality, participants were assigned code numbers.

1.16.5 Permission

After carrying out the study, clearance certificate was sought from the Faculty Research Ethics Committee and Institutional Research Ethics Committee of the University of Fort Hare, Department of Education in Kwazulu-Natal and the principals of the schools where the study was to be carried out.



1.17 Definition of key terms

Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goal that were the focus of activities in instructional environment, specifically in school (Ryan, 2009). In a classroom academic achievement includes the role of students' engagements and participation in classroom activities.

Physical sciences

According to the Department of Education (2003), Physical Sciences focus on investigating physical and chemical phenomena through scientific inquiry. By applying scientific models, theories and laws it seeks to explain and predict events in our physical environment (Department of Education 2003:9).

Learner Performance

This refers to the learner's ability to demonstrate understanding and show that learning has taken place through an activity or task (Woolfolk 2007:562-563).

Educator:

The Department of Education (2003) refers to an educator as any person who teaches, educates, or trains other persons or who provides professional educational services, including professional therapy and education, psychological services at any public school, further education and training institution, departmental office or adult basic education centre.

Cognitive learning

A cognitive learning is ability can be described as a mental capacity; competency or skill needed to carry out, or perform, a cognitive task(s) (Colman, 2009).

1.18 Chapter Outline

The study will consist five chapters.

Chapter One

This chapter covers the background to the study, the research questions, objectives, purpose of the study, significant of the study, delimitation of the study and definition of key terms.

Chapter Two

This chapter provides the theoretical framework and review of related literature which informed the research topic.

Chapter Three

This chapter focuses on the research methodology and research design of the study.

Chapter Four

Chapter four focussed on data presentation, analysis and discussion of the findings

Chapter Five

This chapter presents the summery of findings, conclusions and recommendations.

1.19 Chapter Summary

This chapter served as introduction and orientation to the study. The statement of the problem, the research questions, the research objectives, the purpose, the significance and the delimitation of the study has been presented. The important concepts of the study were defined and the research methodology was briefly highlighted as well as demarcation of

the chapters. Chapter two will focus on the review of literature and the theoretical framework on the cognitive learning effect on performance in physical science.

Chapter Two

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction



The previous chapter dealt with the introduction and background to the study. The first part covers the review of various related literature sources on the cognitive learning effect on Grade 10 students' performance in physical science and the second section of this chapter covers the theoretical framework that guided the study. The review explored various research findings and views related to Grade 10 learners' cognitive learning on performances.

A literature review primarily sets the foundation for a study and guides the researcher through the research process (Ani, 2013). It is also relevant in the choice of theoretical framework for the study. Machi and McEvoy (2009) define a literature review as a written document that presents a comprehensive understanding of the current state of knowledge about a topic of study. The literature review, therefore, involves "summarisation, analysis, evaluation, and synthesis of the documents" (Onwuegbuzie, Collins, Leech, Dellinger and Jiao, 2010:173).

In the opinion of Creswell (2014; 2003), the purpose of the literature review is to provide a framework for establishing the importance of a study. It also serves as a benchmark for

comparing the results of a study with other findings. A literature review is important because it helps the researcher gain familiarity with previous work in an area of scholarly interest (Gastel, 2012). Moreover, a literature review reveals important unanswered questions from previous research, appropriate methods and interpretation of findings. The overarching purpose of the literature review according to Gastel (2012) is that it helps to develop firmer understanding on how to analyse, evaluate and integrate information from existing research (Gastel, 2012).

Gastel (2012) further stated that the essence of a literature review is:

- To identify important unanswered questions on which to base dissertation topics;
- To learn about approaches and methods to consider using in research work.
- To see examples of good scholarly/academic writing that can be models to follow;
- To set the context for the description of your research work
- To help readers understand your research work
- To help show why your research work is important, and
- To lay the groundwork for presenting the methods of your research, findings and interpretation of your findings.

From the above points the essence of a literature review is to show that the review of related literature gives room for a more in-depth understanding, wisdom and knowledge. In addition, the review shows the gaps and the loopholes of other researchers in the subject area or discipline, so that the current researcher can improve on previous studies. This review of related literature helps the researcher to be more focused and to contribute to new knowledge in the area. Without a literature review, the research work is incomplete since there is no existing knowledge to build on

2.2 Factors impeding learner's cognitive learning for academic performance

The issue of barrier to learning has been of a major concern to educational practitioners. Many reports have identified factors that in one way or the other affect learning. These are infrastructure, facilities, and resources, fractured and adversarial relationship between

principals, teachers, students and parents. Before the mention of the factors that the researcher would like to stress on the role of cognitive learning ability as it relate to academic performance.

Cognitive learning ability is one of the major factors that contribute to performance of learners. But then the word academic performances have to be clearly defined. Academic performance is referred to as academic achievement, has been defined as “the specified level of attainment of proficiency in academic work designated by test scores” (Shamashuddin, Reddy, & Rao, 2008, p. 75). Similarly, Robertson (2012) cited Good (1973) defining academic performance as the knowledge that is gained, or the skill developed, in subjects or courses and is usually determined by test scores, marks assigned by teachers, or both. Academic performance, for the purpose of this study, refers to a student’s level of academic achievement or how well they have done in their studies. A review of the literature concerning academic performance reveals that predicting and understanding individual differences in academic performance have long been a central issue for, educators, policy makers, researcher’s parents and students alike. Many factors have since been associated with academic performance and the list of factors has become large and diverse. The numerous factors, however, typically fall into two general categories namely; intellectual factors and non-intellectual factors (Crede’ &Kuncel, 2008). Intellectual factors include intelligence, tests of general cognitive ability and tests of specific cognitive abilities (Crede’ &Kuncel, 2008;).Robertson (2012)referred to non-intellectual factors include, among others; personality factors, demographics, socio-economic factors, psychosocial factors, historical and familial factors, environmental factors, cultural factors, behavioural, attitude and motivational factors as well as the mental and physical health of individuals (McKenzie & Schweitzer, 2001). While there are numerous factors involved, cognitive ability is a factor that has, over the years, emerged as one of the strongest predictors of academic performance (Crede’ &Kuncel, 2008; Deary, Strand, Smith & Fernandes, 2007). This strong predictor of performance is defined and discussed below.

The most common factors that are contributing to being barriers to their performance are as follows:

2.2.1 The area of learners ‘attitude towards physical science

Investigating the attitude of learners towards science was the other factor that TIMSS (1999) explored. TIMSS reported that the generation of a positive attitude towards science, is an important and integral goal of science education. Many learners tend to avoid physical sciences because of their fear of the subject and a lack of self-confidence. This negative attitude can lead to learner underperformance and as a result being unable to get the required results for university entrance (Mullins 2005). The fear of physical sciences has resulted in a decrease in the number of learners taking the subject both at the secondary and tertiary level (Gough 2009: 183). As a physical sciences teacher at a public school in the UMgungumdlovu District in KwaZulu-Natal, a discouraged Grade 9 pupil described physical sciences as “a hard subject”. Okoye (2002:562) notes that learners who come from a higher socio-economic status family are more motivated to study and show a positive attitude towards their studies.



2.2.2 Non-involvement parental in learning

This has way of influencing the learner’s performance especially in a negative way. According to Emerson, Fear, Fox and Sanders (2012), who conducted research in partnership with the Australian Government, positive parental engagement in learning improves academic achievement, well-being and productivity. They sought to identify common practices amongst teachers and school leaders that catalyse and sustain effective parental engagement in students’ learning. They state that there is strong consensus, supported by a variety of evidence dating from over 40 years that positive parental engagement can and definitely have significantly influence on student academic attainment and a greater likelihood of commencing post-secondary education. Cheung & Pomerantz (2012) consented that the involvement of parents in their children school work has direct impact on children’s academic performance (Cheung & Pomerantz, 2012). Further, Quilliams and Beran (2009) indicated that the more parents involvement in their children’s school work and actively promote learning at home, the higher the performance of the child. Akerman (2012) in her study on the selection of subject choices in Kwazulu-Natal discovers that greater preparation was required pre FET level to assist

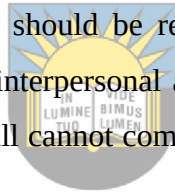
decision making about selection of subjects which should involve parents, educators and input from the business world.

2.2.3 Language problems

According to the Department of Basic Education (2011:14), language is defined as a tool for thought and communication. It is also a cultural and aesthetic means commonly shared among people to make better sense of the world they live in. Learning to use language effectively enables learners to acquire knowledge, to express their identity, feelings and ideas, to interact with others, and to manage their world. It also provides learners with a rich, powerful and deeply rooted set of images and ideas that can be used to make their world other than it is; better and clearer than it is. It is through language that cultural diversity and social relations are expressed and constructed, and it is through language that such constructions can be altered, broadened and refined. The implication of the above is that acquiring language skills gives learners an opportunity to learn how to learn.

When learners learn in a language that is not of their mother tongue, learning then becomes more difficult. The Trends in Mathematics and Science Study (TIMSS) indicates a correlation between lower achievement levels in science and home language which is different to school language (Baker & Jones 2005: 149). When learners are required to learn content in a second language, they are faced with the problem of content literacy (Van der Poll & Van der Poll 2007). When learners have to use a language that they are not proficient in, then mastering content (both practical and theoretical) of a subject becomes very difficult (Van der Poll & Van der Poll 2007). This in turns affects the learners' performance in physical sciences because language plays an important role in the understanding of technical terms in a subject (Van der Poll & Van der Poll 2007). For learners who are not taught in their mother tongue, the practical aspects of physical science become important. With the availability of the right resources educators are able to demonstrate experiments which can help these learners as well as those who are being taught in their mother tongue to gain a visual experience of the events that are taking place, and thereby improve their understanding.

The DBE (2011:14) further suggests that First Additional Language level assumes that learners do not necessarily have any knowledge of the language when they arrive at school. The focus in the first few years of school is on developing learners' ability to understand and speak the language-basic interpersonal communication skills. In Grades 2 and 3 learners start to build literacy on this oral foundation. They also apply the literacy skills they have already learned in their Home Language in the Intermediate and Senior Phases, learners continue to strengthen their listening, speaking, reading and writing skills. At this stage majority of children are learning through the medium of their first additional language, English and should be getting more exposure to it. Greater emphasis is therefore placed on using the first additional language for the purposes of thinking and reasoning. This enables learners to develop their cognitive academic skills, which they need to study subjects like science in English. They also engage more with literary texts and begin to develop aesthetic and imaginative ability in their Additional Language. By the time learners enter Grade 10, they should be reasonably proficient in their first additional language with regard to both interpersonal and cognitive academic skills. However, the reality is that many learners still cannot communicate well in their additional language at this stage.



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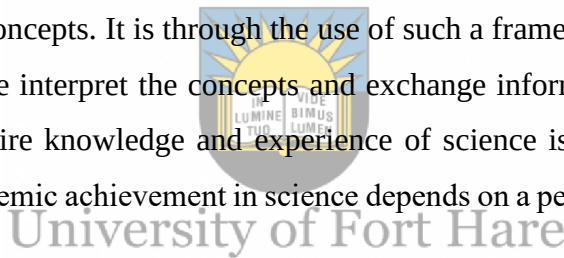
Together in Excellence

The above implications indicate that if learners have problems with the language of teaching and learning, then learning in other disciplines will be difficult since they are not proficient in the language of learning and Teaching. This means that for learners who are learning science in the second language, it will be like learning two languages since science is a discipline with its own language.

Proponents of second language pedagogy concur with the Department of Basic Education insofar as proficiency in second language is a two-way process: “face to face communication known as basic contextual language skills and academic uses of language such as reading and writing about school subject known as academic English” (Woolfolk, 2007:185). However, secondary school English teaching mainly focuses on teaching learners contextual basic English language skills; learning English for academic use is not emphasised. As a result, most learners underperform due to lack of proficiency in academic language skills.

Hlabane (2014) cited Probyn (2005:6) who argues that “for many township and rural learners in South Africa, the oral language of the school classroom beyond the first three Grades is frequently their home language whereas the language of reading and writing and assessment at school is English”. Bridging the gap and acquiring not only the proficiency required for academic learning and meaningful engagement with the curriculum is difficult for many learners. The learning of English only for basic contextual use is insufficient; there is a need to learn English for the purposes of understanding academic subjects like physical sciences. It is known that most important concept to critical thinking is language ability. Grosser and Nel(2013) argue that good language is crucial to accomplish critical thinking. The researcher asserts that language proficiency linked to the ability to understand receptive and use expressive language in academic context is essential for execution of critical thinking. Setati (2011) also contents that language makes it possible for us to understand and make sense of the world of Science by providing a cognitive framework of concepts. It is through the use of such a framework consisting of words and meaning that we interpret the concepts and exchange information about them with other people. The entire knowledge and experience of science is mediated by language. This means that academic achievement in science depends on a person’s ability to use language.

The report of Third International Mathematics and Science Study (TIMSS) conducted in 1999 confirm these challenges in which the findings show that the majority of South African pupils could not communicate scientific conclusions in the language used for tests (i.e. English and Afrikaans which were the mediums of instructions and also the languages currently used for matriculation examinations). In particular, pupils who study mathematics and science in a second language tend to have difficulties articulating answers to open- ended questions and apparently have trouble comprehending several of the questions (Probyn, 2005:1857). This indicates that lack of proficiency in the language of learning and teaching is one of the contributing factors for poor performance in mathematics and science in South Africa.



2.2.4 Teacher-learner relationship

Aside from their families, learners spend the majority of their time in the presence of their teachers. The relationship between a learner and a teacher can thus play a pivotal role in academic achievement. Teachers who cultivate positive relationships with their learners create classroom environments that contribute to academic achievement as well as meeting learners' developmental and emotional needs. Positive teacher-learner relationships are characterized by positive discourse, sensitivity to learner individuality, meaningful feedback, respectful interactions and a cooperative climate.

Positive relationships with teachers support learners' adjustment to school, contribute to their social skills, promote academic performance, and promote learners' resiliency in academic performance (Battistich, Schaps & Wilson, 2004:243-262; Hamre & Pianta, 2001:949-967). The role of the teacher learner relationship is especially influential during adolescence. However, as the learner gets older, parental support and teacher-learner relationships become more complementary. During adolescence both parent and teacher supportiveness (in combination with parent and teacher monitoring and high expectations) play critical roles in predicting academic achievement (Gregory & Ripski, 2008:337-353). Learners' relationships with their teachers have positive implications for their academic and social development. A positive learner-teacher relationship cannot predict academic achievement in itself. However, the learners who have close, positive and supportive relationships with their teachers will attain higher levels of achievement than those learners in more conflictual relationships with their teachers (Rimm-Kauffman, 2013:1).

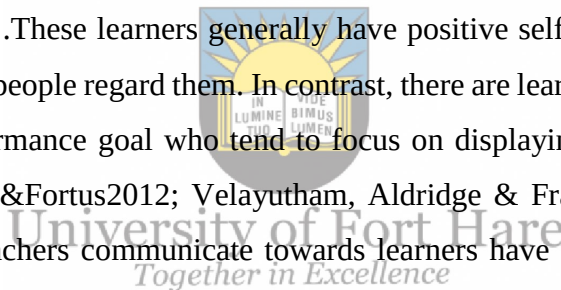
2.3 Factors that can enhance the learner's cognitive learning for performance

2.3.1 The motivation of the learners

Motivation to learn science is an internal state that arouses, directs and sustain science learning behaviour (Schunk 2008). Learners' motivation is an essential element that is necessary for enhancing their cognitive learning for quality education and includes intrinsic

and extrinsic. Intrinsic motivation includes involvement, curiosity challenge and social interaction (Cadzen, 2009). Extrinsic motivation includes compliance, recognition, and competition and work avoidance. Individually who are motivated intrinsically develop high regard of learning. Where the learners learn to trust caring teachers, he or she began to take chances, find the will to invest effort in a task and receive the guidance needed to improve skills. Students with mastery goals are link intrinsic value of learning. Such intrinsic motivation is the motivation to engage in activity for its own sake and for the pleasure and satisfaction derived from its performance (Verdder-Weiss & Fortus, 2012:1065). They are motivated to strive to develop competence by learning as much as they about a subject, focusing on their development competence relative to tasks (Kombus, 2009). Student who exhibits a mastery goals focus especially in the area of science for the sake of acquiring new knowledge and skill involving a broad range of emotional, cognitive, adaptive and behavioural outcomes (Freedman, 2004; Vedder-Weiss & Fortus, 2011). These learners generally have positive self-efficacies and are unconcern with how other people regard them. In contrast, there are learners who are oriented towards academic performance goal who tend to focus on displaying their competence to others (Vedder-Weiss & Fortus 2012; Velayutham, Aldridge & Fraser, 2011). Furthermore, the expectations teachers communicate towards learners have a major influence of how the learners see their abilities and achievements. When teachers are motivating learners in a classroom they are building the learners' confidence and this develops an intellectually safe classroom.

The quality of the environment contributes to the motivation of learners. If the environment is not safe, it is difficult to put all attention in learning and hence affect their ability to acquire and retain any subject been taught. On the other hand, an environment of openness and freedom to learn from mistakes can foster motivation to learn. The classroom environment can be physical as well as emotionally and intellectually safe the students can be motivated to learn and participate (Erwin, 2009).



2.3.2 Teaching approaches

Physical science as a subject requires an active learning strategy instead of a passive learning. Active learning involves students and teachers; education becomes a two-way process with both the teacher and the child learning from each other. Outcomes Based Education (OBE) placed tremendous emphasis on making learning a two-way process. But learner performance cannot solely depend on active learning, for those that have taught Physical sciences and are aware of the content of the subject will agree that at times the educator is required to adopt a more passive strategy. However, the educator must be aware and deliver the information in a manner that is still able to capture the attention of the learner.

According to the cone of learning principal, active learning will take place when the learner is directly and actively involved in his/her learning process (Dale, 1969). During this process of active learning the learner not only takes in the information, but also actively engages with the learning material in some way. According to Woolfolk (2007:487), active teaching is teaching characterised by high levels of teacher explanation, together with demonstrations and student interaction.

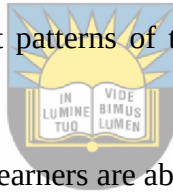
The advantages of active learning are that a larger quantity of information is assimilated by learners at one time, interaction amongst learners is improved, learners' academic performance improves, it allows for stimulation of higher order thought as well as developing respect for the views and opinions of others (University of South Africa) study Guide for Physical Science SDPSCO-8 2007). Active learning requires not only a hands-on approach but it also needs for learners to have an inquiring mind and engage in the process of inquiry learning. Inquiry learning is defined as an approach in which the educator presents the learner with a rather puzzling situation and the learner then attempts to solve the problem by collecting data and then testing his/her conclusion (Woolfolk 2007: 351).

In many schools worldwide, science education is practiced in a traditional age-old manner, that is, dictative, and authoritarian which has eliminated all forms of imagination. Dhurumraj (2013) refers to Christensen (1995), when this form of teaching approach was

used in American schools, critical analysis of the results of learners indicated clearly that this system had failed. Christensen (1995) points out that for there to be transformation of science learning, there must be change in the strategies and methods used in the classroom.

2.3.3 Cognitive levels of learners

A lot of learners in the FET phase are currently not even at the formal operational stage as described by Piaget, a theorist who shaped the understanding of how a child's cognition changes in a predictable manner (Genovese 2003:128). Piaget believed that children have the ability to solve different types of problems; these problems are categorised into developmental sequences and it is these sequences that define the discrete stages of cognitive development (Genovese 2003:128-129). He identified four stages of cognitive development in children, with the formal operation stage being the last. This stage occurs from the ages of 11 years to adulthood. According to Piaget (1952), the formal operational stage is characterised by adult patterns of thought which involves logical, rational and abstract thinking.



Thus, during the formal stage learners are able to think logically about tangible situations; they are able to demonstrate, conserve, classify, and reverse (e.g. they can solve hands-on problem in logical forms; understand reversibility; and understand the laws of conservation) (Woolfolk 2007:29-31). At this stage learner develop the ability to reason by hypotheses based on logic; the learner has the ability to construct theories and make logical deductions about their consequences without having had any direct experience on the subject being dealt with (Simatwa 2010:369-370).

The slow cognitive developments of learners are contributory factors to the poor performance displayed by learners in physical sciences As explained by Giannakopoulos and Buckley (2009:327-328), the cognitive skills (critical thinking, creativity and problem solving) of learners are of vital importance for learners to succeed as they are used in the creation and application of knowledge in real life situations. Mokoena (2014) purport that “critical thinking implies a process where information is sifted.it involves an intellectually disciplined process of active and skilled conceptualization, application analysis, synthesis and evaluation of information that is collected by means of investigating, observation,

experience, reflection, reasoning or communication and the use of the results to make progress in the field in which one works". The above indicate that physical sciences learning will require critical thinking skills as is indicated in the CAPS document that purpose of physical science is to make learners aware of their environment and equip learners with investigating skills relating to physical and chemical phenomena, for example lightning and solubility. Examples of some of the skills that are relevant for the study of physical sciences are classifying, communicating, formulating models, measuring, designing an investigation, evaluating, conclusions, hypothesising, identifying and controlling, variables, inferring, observing and comparing, interpreting, predicting, problem-solving and reflective skills (DBE, 2011: 8-9). Pudi (2007:142) supports the above statements that "critical thinking involves more than assessing isolated arguments in respect of clearly defined criteria using specifiable techniques. It is a unique kind of purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon his or her own thinking. The thinker takes charge of the construction of thinking by guiding the construction of his or her thinking according to the standards, and assessing the effectiveness of the thinking according to the purpose, the criteria and standards". Physical sciences lessons should be learner-centred, and allow for the active participation of learners. By developing lessons that are demonstrative and investigative the cognitive ability of learners is enhanced. Also the different views and ideas of each learner can be developed through sharing of ideas, allowing for constructivism. Through this type of lessons, the convergent and divergent skills of learners are shared with each other, advancing into effective teaching and learning of physical sciences

2.3.4 The inclusiveness of practical work in Physical science

Practical work is defined as "...learning experiences in which students interact with materials or with secondary sources of data to observe and understand the natural world." (Lunetta, Hoffstein & Clough, 2007 p.393). Practical work in literature has been referred to in different ways: 'experimental work; scientific investigations (Ramnarain, (2011); 'practical and investigative activities' (SCORE 2008), and 'laboratory investigations' (Kibirige & Tsomago, 2013). The broad perspective of 'learning experiences' will be

understood to include the wide range of practical skills, thought and processes that constitute doing science as ‘what scientists do’ (Benner, 2011). Some authors in science education contend that practical work in science has many purposes (Woodley, 2009; Vilaythong, 2011). For instance, Watts (2013, p.4) lists some of these purposes required by the General Certificate of Education as:

"motivation for students –the excitement of discovery, consolidation of theory, development of manipulative skills, knowledge of standard techniques, general understanding of data handling, development of other skills (e.g. analytic, evaluative, planning, applied, mathematical) and understanding of how science works: concepts of scientific process, collaborative working, reproducible results, fair testing."

Another purpose for practical work is the understanding of errors and how to design practical procedures in order to improve precision and accuracy. Students acquire skills for safety; risk and precaution against hazards in the laboratory (SCORE, 2008). Practical work also provides learners with evidence to support their understanding and to concretise scientific principles (Jormanainen, 2006). Thus, learners are exposed to basic processes of science through practical work. Practical work has traditionally been a 'recipe-like' activity that had minimal cognitive engagement and did not inspire originality in students (Bigelow, 2012). Research by The National Research Council ([NRC], 2003) and (National Academy of Sciences ([NAS], 2010) have recommended that during practical work learners should be investigative, design their own experiments, record and analyse as well as find their own answers. Driver (1983) suggested that instead of learners dealing with already known answers, such as determining known constants, they need to investigate novel problems. In this way practical work supports development of scientific skills, thinking skills and how scientists work. However, other researchers found that the inquiry approach in practical work requires much time and a session of one hour is never enough (Abraham & Millar, 2008). Practical work caters for learning in different ways such as experiential, independent, team and peer dialogue (Zimbardi, Bugarcic, Colthorpe, Good & Lluika, 2013).

Different learning styles have the pedagogic benefit of enabling correct concept development. They underscore the empirical nature of science, measurement, repeatability

of experiment and learners may enquire as real scientists do. While these pedagogic benefits have yielded encouraging results in science classrooms elsewhere, this has not been the case in South Africa (Buthelezi, 2012). Onwu&Stoffels (2005: 79) using mixed methods research with 53 practicing teachers in Venda, Limpopo established that most teachers had ‘little experience, meagre training, and operated in large and poorly resourced science classrooms’. Consequently teachers resort to chalk-and-talk, lecturing and demonstrations when teaching Physical Sciences.

Many weaknesses are inherent in the South African science teacher education enterprise. Bradley and Smith (1994) reported that teachers themselves emerged from an education system that did not groom them to do experiments or practical work. The lecturers in pre-service training lacked the knowledge and experiences in conducting practical work. Schools were also found to lack equipment and laboratories (Onwu&Stoffels, 2005) as well as laboratory technicians to support teachers. Muwanga-Zake (2008) further established that even headmasters kept science equipment for display in their offices and were never used in the science classrooms! This further confirms that principals lack understanding of the purpose of practical work and its role in the CAPS science curriculum. One of the major requirements of CAPS is that teachers should do at least one practical in physics per term, for the purpose of formal assessment (CAPS, 2012). The combined effect of the poor resources in schools and the CAPS requirement results in an observable lack of practical work in science classes.

Literature is awash with the observation that practical work produces good performance in science (Kerr, 1963; Muwanga-Zake, 2008; Watts, 2009). Despite such observations, Kahle (1999, p2) noted that “Schools are only as good as their teachers, regardless of how high their standards, how up-to-date their technology, or how innovative their programs”. Similarly, low level content, lack of practical skills and negative attitudes towards innovative science teaching are the problems besetting teachers and consequently teachers do not use practical work in their science classes (Onwu&Stoffels, 2005; Lubben et. al., 2010; Kibirige&Tsomago, 2013).

2.4 How does the motivation of educators affect the teaching of Physical Science?

The motivation educators also could affect the teaching of physical science. Teaching is a profession in which the educator should have confidence in what he/she is doing. Educators' role in education system is vitally important. The educator is the custodian of knowledge and instructor of instruction. Teachers have been known to have important influence on learners' academic achievement and they play a crucial role in educational attainment. According to Akiri (2013) speaking that the educator is ultimately responsible for translating educational policies and principles into actions which is based on practice during interaction with the students. The educator, as an agent of change, should recognize that his/her major purpose is to helping learners gain the knowledge, skills, feelings and values that learner need to function effectively in the society. In other words, both teaching and learning depend on the role of the teacher and thereby influence the learners' performance (Adu & Olatodun 2007). According to Leone et al. (2010) and Reddy (2007), desirable teacher qualities are reportedly linked to good subject knowledge, teaching skills and classroom management, relationships with learners, dedication, accessibility, and hard work. Studies have shown researchers, the influence of the role of educators' teaching on learners' academic performance as measured by learners' learning outcomes (Adediwura & Tayo, 2007; Adu & Olatodun, 2007; Leone, Wilson, & Mulcahy, 2010; Owolabi & Adedayo, 2012). The educator is therefore, the main manpower saddled with the responsibility of impacting the fundamental concepts to technology through the teaching of such basic physical science concepts in schools. An educator of physical sciences must possess an interest in his/her subject, commitment and dedication. He/she should be able to eradicate the fear that many learners have about the subject and encourage learners to look at the subject with confidence. Very few students graduating with mathematics and science choose teaching as a career. As a result of this there is a shortage of mathematics and science educators and out of desperation educators of basic sciences such as natural sciences, life sciences could be forced to teach physical Sciences. As a result, some schools do not even offer mathematics and physical sciences as school subjects (Makgato & Mji 2007:254).

The motivation of teachers shows when they are able to understand and implement the curriculum for the field of specialization effectively and efficiently (Msila 2007). Thus, teachers need development along three dimensions simultaneously: content knowledge, teaching approaches and professional attitudes (Kriek& Grayson 2009:199). When educators possess a negative attitude, it reflects not only in their teaching but also in the learning environment. A stimulating environment awakens a learner to learn especially in science (Okoye 2002:562).

2.4.1 Supervision of teachers

It is important that the teachers to be supervised especially by either the heads of departments or principal ,checking whether they understand and are implementing theNCS effectively and efficiently.It is important that teachers are able to understand and implement the NCS for the field of specialization effectively and efficiently (Msila 2007). The other factor that plays a role in underperformance of learners in schools has to do with strategies that science teachers use to teach Physical Sciences. For a science learner to engage in observation as a science skill, a learner needs to see a practical situation which illustrates the lesson. The strategy of teaching Physical Sciences cannot be a text book one only. Supervision of lessons that needs to be demonstrated andthe use of chemical reactions should be an integral part of the teaching and learning process in a Physical Sciences classroom. Testing of ideas is not confined to pen and paper, but rather active involvement of learners in investigative lessons (Vhurumuku 2010)

2.4.2 Encouraging Teachers Effectiveness

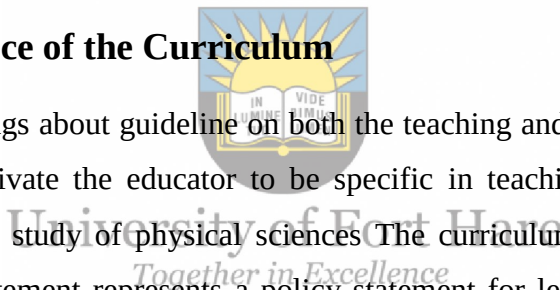
The effectiveness of teachers is very paramount in teaching of Physical science . effectiveness of teachers should especially involve being familiar with the subject content to be taught. Dhurumraj (2013)cited Appleton (2003:2) that the research conducted in many primary schools in Australia has shown that despite a lack of resources, many primary schools teachers did not teach Physical Sciences because of a poor understanding and thus lacked confidence to teach the subject . Many teachers use out-dated teaching practices and lack basic content knowledge (Makgato & Mli 2006:254). This has contributed to the poor performance of learners.

Limited resources are a factor that may affect underperformance in schools. According to Goodrum, Hackling and Rennie (2001:11), in Australia resource limitations are a significant constraint on the quality of teaching and learning. Dhurumraj refers to Naidoo and Lewis(1998:729) that Learner performance is not solely dependent on the availability of resources but also on the effective use of the available resources by the educators. South Africa has implemented many post-apartheid policies to address the issues surrounding science education. Dhurumraj stresses further citing Naidoo and Lewin (1998),that the focus of these policies have been on increasing investment in science education through educating more science teachers, providing more access to students to study science at schools, and supplying more science equipment to schools.

However, after their research in Kwazulu-Natal schools, they concluded that each of these policy initiatives could be questionable.

2.4.2 The Place of the Curriculum

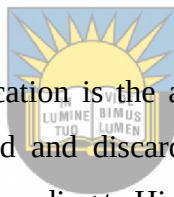
Curriculum brings about guideline on both the teaching and learning. In physical science curriculum motivate the educator to be specific in teaching with some skills that are relevant for the study of physical sciences. The curriculum which starts with National Curriculum Statement represents a policy statement for learning and teaching in South African schools and comprises of what is known as Curriculum and Assessment Policy Statements (CAPS) for all approved subjects (Department of Education 2011:3-4). CAPS is actually a single policy document that is present for every subject. It replaces Subject Statements, Learning programme Guidelines, and Subject Assessment Guidelines in Grades R-12. Although CAPS was implemented in Grade 12 in the academic year of 2014, the principles for physical sciences are the same as the National Curriculum Statement Grades 10-12 (general) for physical sciences (Department of Education 2011: 4-6). It is important that teachers are able to understand and implement the NCS for the field of specialisation effectively and efficiently (Msila 2007). Thus, teachers need development along three dimensions simultaneously: content knowledge, teaching approaches and professional attitudes (Kriek& Grayson 2009:199).Dhurumraj (2013) cited Okoye that when educators possess a negative attitude, it reflects not only in their teaching but also in



the learning environment. A stimulating environment awakens a learner to learn especially in science (Okoye 2002:562).

2.5 How the right methods should be adopted to foster cognitive learning for performance

The other factor that plays a role in underperformance of learners in schools has to do with strategies that science teachers use to teach physical sciences. For a science learner to engage in observation as a science skill, a learner needs to see a practical situation which illustrates the lesson. The strategy of teaching physical sciences cannot be a text book one only. Demonstration of lessons and chemical reactions should be an integral part of the teaching and learning process in a physical sciences classroom. Testing of ideas is not confined to pen and paper, but rather active involvement of learners in investigative lessons (Vhurumuku 2010).



A key feature of science education is the ability of the learner to select that which is important for the task at hand and discard that which is not required (Hindal, Reid & Badgaish 2009: 199-189). According to Hindal et al (2009:189), the idea of convergency-divergency is central to science education and its learners; learners who are more divergent are able to take a concept or ideas and relate it to various other concepts and ideas, while the more convergent learner tends to bring ideas together to form some form of conclusion. Research shows that learners who think divergently perform better at chemistry (Hindal et al 2009:189). The researcher understands that the right method involves the right strategy to teach and to learn. There are categories of learning strategies and their roles in promoting effective learning. For learners to process information optimally when they learn, a good knowledge of different types of learning strategies is required. In the following section the various categories of learning strategies and their roles will be explored. Learning strategies are categorized into cognitive learning strategies, metacognitive strategies and resource and the affective-motivational management strategies (Hawley 2006: 84-85).

2.5.1 Cognitive learning strategies

Cognitive learning strategies are those that work directly on the incoming information while it is being transformed into knowledge. They affect the manner in which learners select, acquire, integrate or organize new information so that it can become meaningful and applicable as knowledge. At the required time the strategies ensure the retrieval of knowledge from where it was stored as long-term memory, so that it can be applied in an individual's life. Examples of cognitive learning strategies where the learner can engage in the stimulus-to-knowledge transformation include attention, rehearsal, elaboration and organisation (Kruger & Adams 2010:97; Mayer 2008:390-426)

2.5.2 Attention

At the onset of the learning process, learners have to pay attention to relevant environmental stimuli. Attention means screening out some external stimuli and becoming focused on the information one has selected for processing. It also refers to the “concentration of mental resources on a particular process” (Woolfolk 2010:239). Examples of strategies that help learners to focus their attention on appropriate features of the learning tasks include the creation of expectation, or making prediction, underlining, or highlighting the relevant information in a different colour or boldface (Woolfolk 2010:240). Once attention has been paid to the relevant features of the task, the learner must encode the material to ensure that the information is retained and later retrieved. Matseke (2011:49) cited Lopez saying the simplest strategies for the restructuring of information are the repetition strategies or rehearsal strategies (Lopez 2001:50)

2.5.3 Rehearsal

According to Matseke (2011) referring to Kellogg (2003: 156), rehearsal is a strategy used for deliberately trying to keep information in the memory by repeating it. Kellogg distinguishes between maintenance rehearsal and elaborative rehearsal. Alderman (1999:126) differentiates between basic rehearsal and complex rehearsal. On the one hand, maintenance rehearsal, like basic rehearsal for tasks, is conceptualised as the recycling or repetition and recitation of information in order to keep it within the memory for later

recall. It is associated with rote-learning and often with no understanding of the learning content, because it is ineffective in encoding and storing information. Nonetheless, it helps learners to acquire the basic knowledge on which more advanced knowledge is built (e.g., sequencing events and items, multiplication tables, and letters of the alphabet). Matseke (2011:50) referred to VanderVvver that maintenance rehearsal strategies are copying verbatim notes, and repeating or reciting information (Van der Vyver 2000:39).

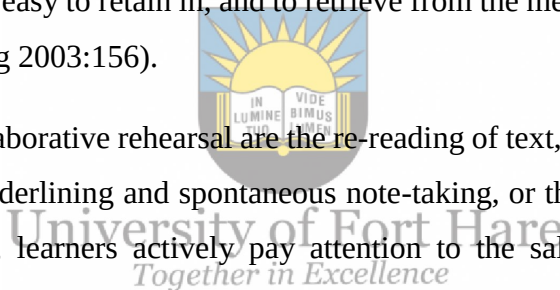
On the other hand, elaborative rehearsal is regarded as a relatively more effective strategy for the facilitation of maintenance, and for the understanding of acquired information. What is implied is that in the latter strategy, the learner participates more actively by making internal connections between the information being processed and their prior knowledge which exists in the memory as he/she is rehearsing. As a result of the linkage, the newly gained information acquires a deeper meaning and becomes more understandable, easy to retain in, and to retrieve from the memory through this elaboration process (Kellogg 2003:156).

Examples of elaborative rehearsal are the re-reading of text, using mnemonic devices, and highlighting, underlining and spontaneous note-taking, or the summary of notes. In all of these examples, learners actively pay attention to the salient features of the learning material before transferring it to the STM to be analysed.

2.5.4 Elaboration strategies

The previous paragraph outlined the rationale behind the employment of elaboration strategies on rehearsal tasks to link the new information to pre-existing knowledge. Matseke(2011:50) quoted Eysenck saying that elaboration-strategies can also be used for basic tasks in the form of imagery and paired associate learning (Eysenck 2001:176).

Kellogg (2007) said that the Elaboration for complex tasks or deeper-level processing, diagrams, paraphrasing, summarising, generative note-taking, analogies, comparing and contrasting, as well as problem-solving are some of the elaboration strategies teachers can use to integrate the new information with knowledge already stored in the learners' memory so that they can gain a deeper level of understanding of the information (Kellogg 2007:453).



2.6 Theoretical Framework

This section discusses the theoretical framework of the study and the following educational theories: behavioural theories of learning and, cognitive learning theories, and constructivist theories and how it can be related to this study.

A theoretical framework is the “conceptual underpinning of a research study which could be based on theory or on a specific conceptual model” (Pickard, 2007:298) It provides direction to the research study, and situates the research in the discipline or subject so as to reveal the research goals (Henning, van Rensburg and Smit, 2004). Babbie (2011: 33) indicates that “theories make sense of observed patterns in ways that can suggest other possibilitiesKrishnaswamand Ranganatham (2010:16) define a model as a simplified systematic conceptual structure of the theories, models and conceptual frameworks have been developed to describe, explain, analyse and generally make meaning of information seeking behaviour in general and library user behaviour in particular.This study adopts the Cognitivism,behaviourism and constructivism



2.6.1 Cognitivism

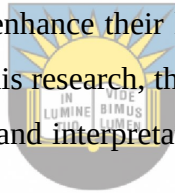
Cognitive psychology is a branch of psychology that is concerned largely with how people think, learn and remember (Galotti, 2008). Cognitivism is a scientific approach to studying human beings that stresses a focus on the human mind (Schuh&Barab, 2008). The central idea of the cognitive approach is that of information processing. The human mind is regarded as an information processor, or as a data processing system, analogous to a computer (Gardner, 1987; Schuh&Barab, 2008). Individuals are seen as information processors that represent, transform, act on and manipulate information. Cognitivism accordingly seeks an understanding of this information processing, in which the reception, organisation, encoding, and retrieval of knowledge in individuals is a focus (Schuh&Barab, 2008).Robertson (2012) refers as noted that cognitivism has its roots in objectivist ontology, where the world is real and external to the individual and can be studied objectively. Thus, an objective, material reality exists, independent of human beings and their understanding of it. Phenomena such as perception and attention are seen as real and

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have properties and causes. Cognitive abilities, learning styles and strategies are thus seen as real phenomena that can be studied objectively and scientifically.

Having an objectivist ontological base presupposes an objectivist epistemological perspective, wherein the mind creates representations of the world and the real. The external world is mirrored in the mind and, to know is thus to have correct representations of the world (Schuh&Barab, 2008). Cognitivism has rationalist epistemological roots. Rationalism views reason as the principle source of knowledge (Schuh&Barab, 2008). Cognitivism therefore prescribes that knowledge of the world and reality is gained through representation and reason.

Cognitivism's rationalist perspective furthermore purports that human subjects are independent and autonomous entities. Cognitivist assumptions place the individual as autonomous and proactive. Students are, as such, proactive participants in the learning process and can develop and enhance their learning. Cognitivism provided the theoretical framework that would guide this research, the research question and methodology chosen to investigate it. The analysis and interpretation would be directed by this framework as well.

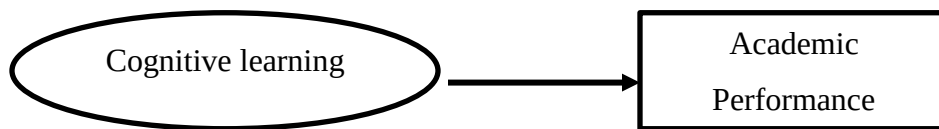


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2.6.1.1 Cognitivism with performance

Looking at the relationship between cognitive ability and academic performance, cognitive ability is considered a powerful predictor of academic performance as there is a vast amount of empirical evidence for a strong relationship between the two (Chamorro-Premuzic, 2007; Rohde & Thompson, 2007). As measures of cognitive ability have a rich history of accounting for meaningful levels of variance in academic performance (Yen, Konold& McDermott, 2004) they have, as such, become known as relatively reliable predictors of academic performance. The relationship between cognitive ability and academic performance (see figure 2.1) is said to be so strong that some authors do not believe that non-intellectual factors would have any significance in predicting academic performance (Hlabane 2012).

FIGURE 2.1: The relationship between cognitive ability and academic performance



NOTE: Arrow represents relation. This figure illustrates the relationship between cognitive ability and academic performance. This relationship has been evidenced in many studies.

In general, as ability increases so too does performance, however in reality a higher level of cognitive ability does not automatically equate to higher academic performance. This is because cognitive ability alone cannot account for all of the variation in academic performance and much of the variance in academic performance is yet to be explained (Kaplan & Saccuzzo, 2009; Rohde & Thompson, 2007). While measures of cognitive ability can provide an indication of whether students have the ability to learn and understand complex material, they cannot for example, indicate whether students have the patterns of studying behaviours necessary to process, integrate, and recall the material (Crede' & Kuncel, 2008, p. 427). Scores of cognitive ability alone cannot provide an understanding of why students with suitable levels of cognitive ability do not perform well. A lot of researchers have thus begun to look beyond intellectual predictors (Mattern & Shaw, 2010; Sanford, 2009) and examine multiple factors and their relations to academic performance (Crede' & Kuncel, 2008).

2.6.2 Constructivism

Constructivism is one of the theories that had been neglected in the teaching of Physical Sciences. In their criticism on how science is taught in the classroom. Dhurumra (2013:17) cited Driel, Beijaard and Verloop (2001) who argue that teachers usually present science as a rigid body of facts, rules to be memorised and practised by students and theories which they regard as absolute. Constructivists believe that emphasis should be on designing activities which provide active knowledge, instead of traditional knowledge transmission. Dhurumraj (2013) still relate to what Kennedy (1998) said concerning teachers who are encouraged to investigate students' knowledge. In order to assign appropriate methods for teaching science, learners' misconceptions need to be identified (Kennedy 1998). The core

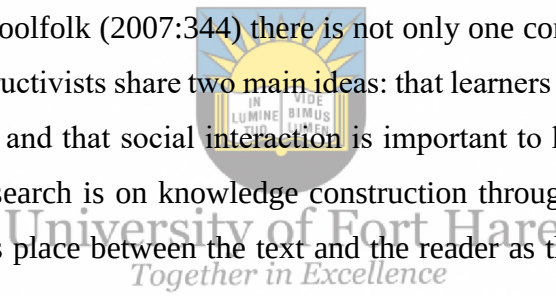
of constructivism is the belief that learning is an active process in which learners construct new ideas and knowledge based upon their current and past experiences. Hlabane (2014:39) cited Bruner that the learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so (Brunner, 1986). This view replaces the more traditional view that knowing a subject is a pure entity unaffected by biological, psychological, and sociological contingencies (Setati, 2011: 47).

Constructivist theorists hold the view that teachers should deal not only with learners having high abilities or high motivation for science, but they should also consider the learners' cognitive and affective dimensions. By giving attention also to these dimensions, teachers will be shifting towards critical inquiry skills (Driel, Beijaard&Verloop 2001).

Constructivist perspectives are grounded in the research of Piaget, Vygotsky, and the Gestalt psychologists Bartlett and Bruner, as well as the philosophy of John Dewey. According to Woolfolk (2007:344) there is not only one constructivist theory of learning, but "most constructivists share two main ideas: that learners are active in constructing their own knowledge and that social interaction is important to knowledge construction." The focus of this research is on knowledge construction through the reading of texts. Social interaction takes place between the text and the reader as the reader tries to comprehend what is read.

Madileng (2007) cited Day and Brumfit (1982) who define reading as "the construction of meaning from printed or written messages". Dhurumraj (2013) quoted Coleman (2003:65) who further emphasises that when learners read, they are able to relate what they see on paper to what is already in their minds. The learner in other words, tries to predict lines of thought, interrogates the author on his position, and evaluates the work for its usefulness and importance in his own life (Setati: 2011:49).

Therefore, as an example learner cannot apply Newton's first law unless he/she has read and understood the law. Although the teacher may teach the learner about this law, but the learner will still need to read about it when preparing for exams and tests. Engaging learners in reading strategies is therefore important in science learning.



Hlabane(2014) refers to Windschitl, (2002) onconstructivist view which embraces psychological and social constructions. Social constructivism sees learning as increasing our abilities to psychologicalconstructivism focuses on how individuals use information, resources, and even help from others to build and improve their own mental models and problem-solving strategies(Woolfolk, 2007: 345).The focus of the research is on psychological constructivism as the studywhich deals with the interaction between the learner and science text.

According to Yore et al (sine anno:3-4) reading is not simply a uni-dimensional bottom-up or top-down process involving printed symbols. Rather, reading is an interactive-constructive process that involves making meaning by negotiating understanding between the text and the reader's concurrent experiences and memories of a topic, and recognises the importance of prior knowledge, strategies, metacognition (awareness and executive control of meaning making), and the socio-cultural context. In other words when learners read science texts, they construct meaning according to their own understanding and prior knowledge.

In Newton's first law forexample, different learners, may interpret it differently depending on their own circumstances because reading is an active not a passive learning process. By reading science text, there is a social interaction between the learner and the text, which means that the learner will be engaged in constructivism.

Science text, unlike familiar content and predictable story lines in children's literature, contains unfamiliar content and text structures, heavy conceptual demands, and unique vocabulary. The purpose of scientific text is to assist misinformed and uninformed readers to construct meaning about specific science ideas using an expository approach, words (concept labels) with specific meanings, complex and interconnected sentences, and specific text structures (description, collection, compare/contrast, problem/solution, causation) (Yore et al, sine anno: 3-4). Incorporating reading strategies will therefore help learners to construct scientific knowledge rather than ordinary decoding and comprehending specialised words.

Physical sciences lessons can take on several forms. They include the theoretical lesson, the practical lesson, the demonstration lesson, which is supported by well-defined activities and the problem-solving lesson (practice lesson). For optimum learner performance, the academic year of a learner should comprise of all the above type of lessons. This would allow learners to take a hands-on approach to their learning process as well as to think critically and creatively through the process of stimulation and communication with other learners and as a result build on their existing knowledge through the process of constructivism.

Physical sciences as a subject needs educator to have a good understanding of the subject and to be able to display foundation competence, reflexive competence and practical competence in the subject. Gough (2009: 183), argues that there is a shortage of qualified science educators and this is expected to worsen over the years as very few students are taking up careers in science teaching. When there is inadequate preparation on the part of the teacher and a limited academic background, the result is poor teaching and in schools (Van der Westhuizen, Mosoge, Niewoudt & Steyn 2002:115). Research shows that although educators can sometimes master the theory of physical sciences putting the theory into practice is a major problem. Hlabane (2014) refers to Appleton (2003:) that the pedagogical knowledge that teachers gain through their qualifications must be applied to their teaching of science, thereby narrowing the gap between theory and practice (Appleton 2003:2-4).

2.6.3 Behaviorism

Learning according to Woolfolk (2007:206) is a process through which experience causes permanent changes in knowledge or behaviour. To qualify as learning, a change must be brought about by experience; and experience can be brought about by the reading of science texts. This permanent change in knowledge is emphasised by behavioural learning theories of learning which assume that learning focuses on external events as the cause of changes in observable behaviour. The implication of the above is that if learning is brought about by experience, incorporating reading in science can bring about permanent changes in

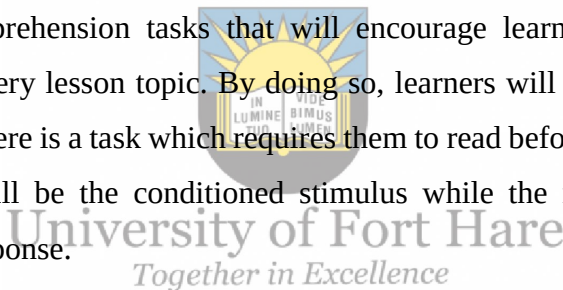
behaviour. If learners are exposed to reading strategies in science classrooms, they will benefit from it.

Woolfolk (2007: 208): further suggests that one of the theories of behavioural view of learning was classical conditioning. Classical conditioning was discovered in the 1920's by Ivan Pavlov, a Russian psychologist trying to determine how long it took a dog to secrete digestive juices after it had been fed. At first the dog salivated as it was being fed and later salivated when they saw the food. Then dogs started to salivate once they heard the scientists walking. Then Pavlov discovered later that the dog could be conditioned to salivate after hearing the sound of the turning fork.

The above indicates that science teachers can condition learners by introducing reading strategies in science lessons. For every lesson topic, educators can allow learners an opportunity to read their textbook for about twenty minutes before introducing the topic. Language comprehension tasks that will encourage learners to read the task can be designed for every lesson topic. By doing so, learners will be conditioned that for every new subtopic there is a task which requires them to read before the topic is introduced. The reading task will be the conditioned stimulus while the response to the task will be conditioned response.

Trowbridge et al (2004: 25) emphasise that in the classroom situation, the behaviourist approach emphasises cause and effect (stimulus-responses) which are measurable. In other words, it stresses that learning results in desirable changes in a learner's behaviour if the teaching methods and learning materials chosen by the science educator have great impact on the learner.

To be more precise, science educators should first ask themselves which kind of behaviours they expect in their learners from a science learning experience and then determine the reinforces and stimuli such as the environment, subject content, teaching methods, apparatus, motivation, rewards, and experiments and how these reinforces can be best used to contribute in the best way to the behavioural changes which the educator has in mind. In the case of the study, the kind of behaviour that is expected from learners is to be



proficient in reading in the context of science and this is done by engaging learners in reading in science classroom.

According to Zenda (2016) who cited Mwamwenda, (2004:171) quoting that behaviour is shaped by consequences, and the role of conditioning in the teaching process is stressed. This implies that behaviourism attaches both classical conditioning and operant conditioning as the prototype of a large proportion of what the child learns daily such as learning the periodic table of elements or the multiplication table. Every time the learner does so successfully, the learner receives a reward for the successful recitation (Morrison, 2009:113). However, classical conditioning and operant conditioning have been criticised, since both are believed to promote rote learning whereby learners recite the concepts over and over again (Trowbridge et al, 2004:4). The teaching becomes teacher-centred and emphasised on knowing rather than the process of knowing. The teacher is regarded as an expert in both scientific knowledge and scientific activities, who pours facts, information, concepts and demonstrates to learners how the world works rather than learners discovering on their own (Marx and Soloway, 2012:411). Such lower level of learning results in memorisation of scientific facts, rules, laws, principles and cramming of formulae without understanding Physical Sciences (Harlen, 2000:17). It is crucial for educators to realise that Physical Sciences learning occurs when the learner is actively engaged in operating on, or mentally processing incoming stimulus, and that the interpretation of the stimulus depends upon previously constructed learning (Berk, 2006:239)

2.7 Chapter Summary

This chapter provides the reader with a literature overview that provides the theoretical background for the study. The researcher has discussed several factors that contribute to the cognitive effect on performance in physical sciences. In the following chapter, the research design, the data collection methods and procedures (i.e. the collection instruments used), population sampling techniques, location and demographics are described. Also included are the issues around ethical considerations and informed consent.

Chapter Three

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

This chapter discusses the research methodologies on examining the cognitive learning effect on Grade 10 students' performance in physical science. This chapter is organized into different thematic sections which include the research approaches, research paradigm and design of the study, the choice of methodological triangulation, population, sampling techniques, data collection methods and instruments used for data analysis. The research instruments adopted for data collection were that of a questionnaire, and interview due to the nature of the problem under investigation. This is followed by a description of the implementation of the pilot study including measures taken to ensure validity and reliability. Lastly the chapter discusses ethical considerations and the data analysis methods.



3.2 RESEARCH METHODOLOGIES AND DESIGN

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3.2.1 Research methodologies

Research method is an approach of enquiry which ranges from the underlying assumptions, research design to data collection (Myers 2009). Research methodology according to Creswell (2014) is defined as describing research approaches and paradigms. Further, research methodology can also be defined as the process of choosing, reflecting, evaluating and justifying how the researcher intends to carry out and accomplish a particular research study (Okeke, Adu, Drake, & Duku, 2014). Majyambere (2014:135) quoted Leedy and Omrod (2005:12) who consider research methodology to be the general approach a researcher follows when carrying out a research project. Schensul (2012: 71) noted that research methodology is typically regarded as research design. Lapan, Quartaroli, and Riemer (2012:1) noted that methodologies consist of complete designs and frameworks utilised for the study. Paltridge and Starfield (2007: 119) observed that methodology informs the choice of research methods. Blaikie (2010: 8) maintained that research methods

are based on the procedures preferred for gathering data and analysis. Similarly, Walliman (2011:7) underlined that research methods are essentially techniques applied to undertake research studies. Lapan, Quartaroli, and Riemer (2012: 10) and Silverman (2013: 124) highlighted that research methods commonly mean data collection tools or techniques.

Kalof, Dan, and Dietz (2008: 34) noted that research methodologies primarily revolve around two major approaches, namely quantitative and qualitative. Quinlan (2011: 308) initially indicated that graduate students need to understand and have the ability to use both qualitative and quantitative methodologies for the purpose of their academic research projects. However, Bergman (2008: 19) underlined the lack of a clear distinction between quantitative and qualitative approaches. Researchers such Creswell and Plano-Clark (2007: 29) have simply distinguished a quantitative approach from a qualitative approach based on the use of numerical or statistical data. In this text, Kalof, Dan, and Dietz (2008: 14-15) and Babbie (2011: 24) explained that quantitative research basically uses numbers whereas qualitative research does not primarily apply numerical data. Sandelowski, Voils, and Knafl (2009: 210) pointed out that a qualitative inquiry may also use some sort of numerical data “to facilitate pattern recognition or otherwise to extract meaning from qualitative data”.



Majyambere(2014:136) cited Onwuegbuzie (2003: 394) who expressed that numerous research debates have led to divisions among educational researchers. Creswell and Plano Clark (2011: 171) argued that the difference between qualitative and quantitative approaches influences the choice of method for data collection and analysis. Quantitative research measures a phenomenon using numbers in conjunction with statistical procedures to process data and summarise results (Locke, Silverman and Spirduso 2010). Hittleman and Simons (2001: 27) indicate that quantitative research represents variables which are numerically measured and they may be scientifically verified. On the other hand, Ryan and Bernard (2000: 777) acknowledged the value of revolving qualitative records with quantitative figures. Onwuegbuzie and Leech (2005: 379) and Maxwell (2010: 480) further acknowledged that this revolving process can lead to the complementarity of overall research data. Smith and Bowers-Brown (2010: 112) indeed argued that it is common to

find researchers using both approaches. Both quantitative and qualitative approaches were applied for the purpose of the current study.

3.3 Research Approaches

The three common approaches to conducting research are quantitative, qualitative, and mixed methods. Quantitative research approach involves the collection of data so that information can be quantified and subjected to statistical treatment in order to support or refute “alternate knowledge claims” (Creswell, 2003:153). Alabi (2016: 86) cited Leedy and Ormond (2001) that there are three broad classifications of quantitative research: descriptive, experimental and comparative. According to Williams (2007), descriptive research approach is a basic research method that examines the situation as it exists in its current state, either by observation or the exploration of correlation between two or more phenomena. Creswell (2003:18) reports that quantitative research “employs strategies of inquiry such as experimental and surveys and collect data on predetermined instruments to yield statistical data”. In qualitative approach, the researcher understands the phenomenon from the meaning individuals or groups attribute to a phenomenon (Cresswell, 2007). This study adopted the mixed methods approach to provide answers to the research questions raised in this thesis. Mixed methods research is defined as “the class of research that combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study” (Johnson and Onwuegbuzie, 2004:20). The mixed methods approach was chosen because it is holistic in nature and capable of providing more certainty in the results (Giddings, 2006). The adoption of mixed methods approach for the current study was to provide complementarity in terms of elaboration, enhancement and clarification (Creswell, 2003). Overall, data collection involving both quantitative and qualitative data allows for deductive and inductive investigation in the same study and enable the researcher to investigate, predict, explore, describe and understand the phenomenon (Johnson and Onwuegbuzie, 2004; Creswell, 2003).

The choice of the mixed methods approach bears similarities with previous studies (such as Oshinaike and Adekunmisi, 2012; Becking, 2011; Mushi, 2010). According to Punch (2005), a combination of both qualitative and quantitative methods is valid and often used

in social science research. Johnson and Onwuegbuzie (2004) posit that mixed methods approach is an extension and not a surrogate for the quantitative or qualitative approaches to research. The overarching aim of using the mixed methods approach for this current study is to draw from the strength of both approaches, and minimise the weaknesses of quantitative and qualitative research (Johnson and Onwuegbuzie, 2004).

3.4 Distinction between quantitative and qualitative approaches

Locke, Silverman and Spirduso (2010: 182) argued that quantitative and qualitative methodologies reflect different paradigms. Tashakkori and Creswell (2007: 4); Creswell and Plano Clark (2011: 8) and Babbie (2011: 276) discussed and concluded that when a researcher is deciding to use a combination of both quantitative and qualitative approaches within a single survey research, the researcher should carefully consider their strengths and weaknesses for the purpose of the study. Kumar (2011: 103-104) discussed differences that exist between qualitative and quantitative approaches in case they are combined in a single study. As a result, the study considered the usability of both qualitative and quantitative approaches within a single study because their main features justify the purpose of using both approaches for the present study.



3.4.1 Qualitative approach

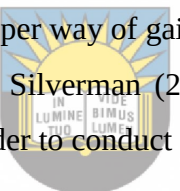
Denzin and Lincoln (2005: 3) argued that qualitative research enables researchers to understand the world surrounding them. Barbour (2008: 15) also noted that the qualitative approach provides more explanations than quantitative research. Particularly, Rubin (2008) and Silverman (2013: 11) acknowledged that qualitative research is appropriate for investigating human behaviour, which was a major objective of the present study. Kumar (2011: 104) explained that qualitative research tends to become more flexible during the research process and its primary focus is on understanding “value, beliefs and experience of people”. Merriam (2009: 21-22) initially outlined six general methods used while doing qualitative research and these include: □ Basic qualitative research seeks to understand how people make sense about the world surrounding them (Sanders 2010); Phenomenology focuses on the underlying structure of the phenomenon (Edmonds and Kennedy 2013: 136;

Starks and Trinidad 2007: 1373-74; as well as Collingridge and Gannet 2008: 393); □ Grounded theory was first traced to Glaser and Strauss (1967) according to Charmaz (2010: 183). It seeks to form a functional theory about the phenomenon of interest (Eich 2008: 176 and Charmaz 2000: 509); □ Ethnography focuses on understanding human society and cultural groups (Creswell 2007: 218; McNeill and Chapman 2005: 89; and Werner 2004: 73), it comprehends social meanings (Brewer 2000: 6) and it comprises flexibility opinions (Delamont and Atkinson 2004: 667); Narrative analysis stands for “the oldest and the most natural form of sense making” (Jonassen and Hernandez-Serrano 2002: 66); it is often based on storytelling in a literary way (Edmonds and Kennedy 2013: 129; Pinnegar and Daynes 2007: 4, and Riessman 2002: 218) and every group of people have stories to tell (Atkinson 2007: 224 and Czarniawaska 2004: 649). This method is applied more in the qualitative social sciences (Chase 2010: 208 and Elliott 2005: 4); and □ Critical qualitative research seeks “to critique and change society” (Patton 2002: 131).

Plano Clark and Badiie (2011: 288) and Kumar (2011: 57) noted that qualitative inquiry often uses inductive reasoning. Patton (2002: 253) asserts that “the extent to which a qualitative approach is inductive or deductive varies along a continuum”. The purpose of using a qualitative approach was to contextualise and interpret results using induction to derive possible explanations based on observed phenomena (Lapan, Quartaroli, and Riemer 2012: 12). To corroborate this view, Denzin and Lincoln (2000: 5) argued that qualitative methodology becomes a more appropriate approach especially where the nature of the research problem has complex features. For instance, Lapan, Quartaroli, and Riemer (2012: 1) maintained that qualitative research has the quality to remain flexible for relevant changes. Therefore, the qualitative approach has assisted the researcher to be flexible during the data collection process and the researcher is then able to timely adapt for any change that could take place during the research period. Merriam (2009: 23) also outlined three major interests of basic qualitative research for understanding:

- How people (students) interpret their experiences;
- How they construct their world; and
- What meaning they attribute to their experiences.

Silverman (2013: 122) argued that the “qualitative research is more than one thing”. For instance, Braun and Clarke (2013: 25) noted that qualitative research serves as an umbrella word covering an array of interpretive practices. In this regard, interpretive research has been supported recently by many scholars such as Marshall and Rossman (2006); Creswell (2007, 2009); Silverman (2011, 2013); Maxwell (2010, 2012) and Seidman (2013) among others. Locke, Silverman and Spirduso (2010: 183) indicated that the main purpose of interpretive research is “to understand a situation from the perspective of the participant”. Merriam (2009: 5) pointed out that qualitative research assists researchers to understand “how people interpret their experience, how they construct their worlds, and what meaning they attribute to their experience”. This means that qualitative research may generally reflect an open approach to accommodate many disciplines (Fielding and Lee 1998: 3). In this context, Kalof, Dan, and Dietz (2008: 20) indicated that “the best approach to understand the world is to examine how people see and define it”. Mauthner et al. (2012: 176) acknowledged that the proper way of gaining this understanding commonly involves applying a qualitative inquiry. Silverman (2013: 324) outlined five major rules which researchers should follow in order to conduct effective qualitative research and these rules are:

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- Keep research simple; it needs to focus only on one specific or narrow research problem using a relevant theoretical model;
 - Do not assume that people are simply concerned with subjective experience;
 - Take advantage of using qualitative research, for example, the researcher has the ability to remain flexible during the research process;
 - Avoid drowning in data and this means that the researcher should timely plan data analysis without any delay; and
 - Avoid ‘journalistic’ questions and answers and this means that students need to apply acquired skills in order to successfully follow academic guidelines when they are carrying out their research projects (Silverman 2013: 324-328).

3.4.2 Quantitative approach

Kumar (2011: 103) discussed that quantitative research designs have some particular features and they “are specific, well structured, have been tested for their validity and reliability, and can be explicitly defined and recognised”. Corbin and Strauss (2008: 301-302) also supported that validity and reliability concepts are often associated with quantitative implications. Kalof, Dan, and Dietz (2008: 34) noted that a quantitative approach usually involves conducting a survey and asking the same kind of questions of every respondent. Parker (2011: 36) pointed out that a quantitative approach involves quantifiable data. To corroborate this view, Payne (2011: 13) noted that quantification generally occurs “in a wide range of research and analysis”. According to Creswell (2009), quantitative research methods are designed to study variables that are measurable and they give answers to questions about the relationships among variables that the researcher seeks to know. For instance, Johnson and Christensen (2012: 39) noted that “a quantitative variable is a variable that varies in degree or amount. It usually involves numbers”. Kalof, Dan, and Dietz (2008: 59) further indicated that independent variables represent the ‘cause’ and the dependent variables reflect the ‘effect’. Babbie (2011: 15) initially refers to a variable as “a logical set of attributes”, whereas attributes in turn, reflect qualities that define a person or an object. Kumar (2011: 63) explained that the basic difference between a variable and a concept is based on ‘measurability’.

Harwell (2011: 149) noted that a quantitative method often adopts a deductive approach during the data analysis process. DePoy and Gitlin (2011: 8) explained that deductive reasoning includes “moving from a general principle to understanding a specific case”, while inductive reasoning is the opposite. Importantly, during research process, Eriksson and Kovalainen (2008: 23) noted that many researchers apply both inductive and deductive reasoning in support of each other. On the other hand, Saunders, Lewis and Thornhill (2009: 91) highlighted that an inductive approach is more expensive than a deductive approach. Lodico, Spaulding, and Voegtler (2006: 12) indicated that the quantitative approach mostly involves collecting numerical data that can be counted. Onwuegbuzie and Leech (2005: 380) underlined that data deduction is relevant for the quantitative data

analysis process. Although, Patton (2002: 13-14) noted that the key features of quantitative data analysis differ from those of qualitative data analysis, Merriam (2009: 18) presented a clear comparative table of the common characteristics of qualitative and quantitative approaches, presented in Table 3.3.2.1 below.

Table 3.3.2.1: Characteristics of qualitative and quantitative research

Point of comparison	Qualitative research	Quantitative research
Focus of research	Quality (nature and essence).	Quantity (how much, how many).
Philosophical roots	Phenomenology, symbolic interactionism, constructivism.	Positivism, logical empiricism, realism.
Associated phrases	Fieldwork, ethnographic, naturalistic, grounded, constructivism.	Experimental, empirical, statistical.
Goal of investigation	Understanding, description, discovery, meaning, hypothesis generating.	Prediction, control, description, confirmation, hypothesis testing.
Design characteristics	Flexible, evolving, emergent.	Predetermined, structured.
Sample	Small, non-random, purposeful, theoretical.	Large, random, representative.
Data collection	Research as primary instrument, interviews, observations, documents	Inanimate instruments: scales, tests, survey, questionnaires, computers.
Primary mode of analysis	Inductive, constant comparative method.	Deductive, numerical.
Findings	Comprehensive, holistic, expansive, richly descriptive.	Precise, numerical.

Source: Merriam (2009: 18)

Saunders, Lewis and Thornhill (2009) depict the step to follow in research by the research onion (see Figure 3.3.2.2). The entire research process as illustrated by the research onion, suggest that the outer layer of the onion is the philosophical underpinning of the research and that decision making in research is driven by the philosophy or paradigm on which the study is premised. The outer layer of the research onion is the most important in any scholarly endeavour because it determines the data collection techniques and analysis procedures. With this in mind, the researcher presents the research paradigm that guided the study in section 3.4.

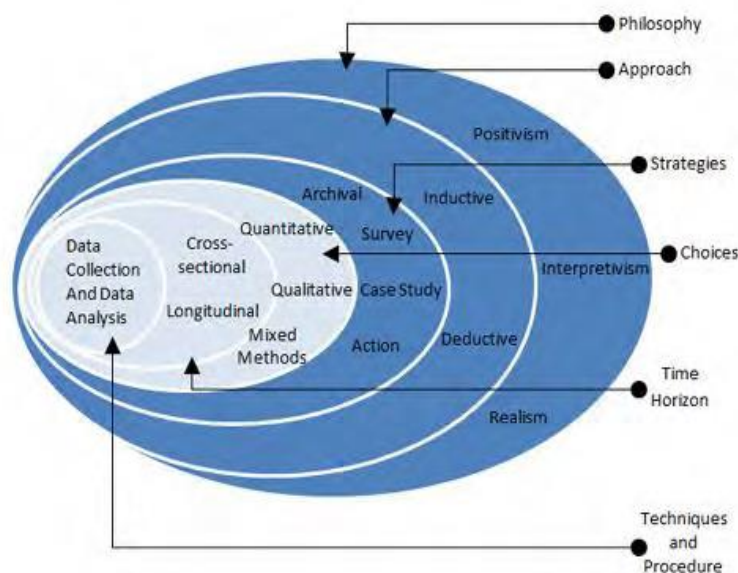


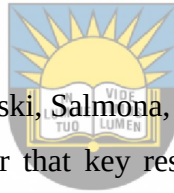
Figure 3.3.2.2: Research Onion (Source: Saunders, Lewis and Thornhill, 2009)

3.5 Research paradigm

Lapan, Quartaroli, and Riemer (2012: 7) and Schensul (2012: 76) indicated that the term ‘paradigm’ gained its root from the work of Kuhn (1962 revised 1970) commenting on the structure of scientific revolutions. Jackson (2003: 37) defined a paradigm as a “set of ideas, assumptions and beliefs that shaped and guided the activity of a particular scientific community”. Babbie (2011: 32) refers to a paradigm as a fundamental model which mirrors an in-depth understanding of what people see and the way people comprehend the model. Somekh and Lewin (2011: xx) argued that “paradigms provided important frameworks of

ideas for thinking about research methodology”. Kuhn (1996: 10-11) further contributed more ideas towards a better understanding of the use of paradigms by students during their academic journey. Blaikie (2010: 20) noted that in the early 1990s research paradigms were to some extent referred to as traditions or assumptions.

Grix and Watkins (2010: 17) and Morgan (2007: 53) argued that the term ‘paradigm’ has become a more popular concept within academic research. Babbie (2011: 32) particularly highlighted that “social scientists have developed several paradigms for understanding social behaviour”. Creswell and Plano Clark (2011: 40-41) and Creswell (2007: 19) provided four main paradigms or worldviews that might be applied to social science research and these are: post-positivism, social constructivism, participatory and pragmatism. The social science inquiry basically investigates people and observes their interaction with the environment (Lapan, Quartaroli, and Riemer 2012: 5).



Blaikie (2010: 62) and Kaczynski, Salmona, and Smith (2014: 127) noted that researchers in the social sciences consider that key research questions have to define the suitable paradigm for a particular study. Neuman (2000: 114) advised that questions should not be vague, rather, more specific and understandable. Creswell and Plano Clark (2011: 40) initially noted that the post-positivism paradigm is more associated with quantitative research. Punch (2006: 36) further recommended that a researcher should explicitly clarify the significance of a selected paradigm for the purpose of the research study. DeCuir-Gunby (2008: 127) considered post-positivism as a fresh version of positivism. Patton (2002: 92-93) explained that the post-positivism paradigm considers that some appropriate theories may be successfully used to interpret the possible observable reality.

Sale and Brazil (2004: 353) noted that the positivists suggest that quantitatively “all phenomena can be reduced to empirical indicators which represent the truth”. Von Glasersfeld (2005: 33) mentioned that positivism naturally has some links with the behaviourism approach from an educational perspective. Turner (1992: 157) states that positivism initially involves the process of collecting data, observing regularities, and extracting laws. From a positivism viewpoint, McNeill and Chapman (2005: 15) indicate

that people's life experiences are governed by laws. Grix and Watkins (2010: 146) indicated that at some point, positivist researchers typically tend to determine predictions of human behaviour in order to gain the truth. Patton (2002: 93) noted that positivists believe that knowledge is relative instead of being absolute.

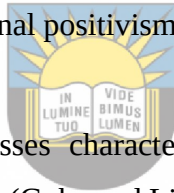
Poland and Pedersen (1998: 301) argued that some researchers expect a good respondent to be a person "who offers appropriately thoughtful rationales or explanations for behaviour and experiences". Nonetheless, Barbour (2008: 27) expressed that in most cases it is difficult to certify that participants were telling the researcher the truth and she then suggested the use of cross-checking questions to reduce the degree of uncertainty about the gathered research information. Corbetta (2003: 20) noted that post-positivism is more appropriate than the constructivism paradigm based on the nature of the study. Grix and Watkins (2010: 23) suggested using cross-checking questions with the aim of improving the level of understanding of the research outcomes. Majyambere (2014) quoted Fischer (1998: 136-137) describing the post-positivism paradigm as a useful approach which can facilitate accurate interpretation and in-depth analysis of empirical research which was considered relevant for the purpose of the present study.

The post-positivism paradigm can apply combinations of both quantitative and qualitative approaches for the purpose of a study (Nieuwenhuis 2010: 65), as this study does. Dzurec and Abraham (1993: 75) indicated that "the objectives, scopes, and nature of inquiry are consistent across methods and across paradigms". The post-positivism paradigm provides two main advantages, namely data collection can appropriately be completed in a short time and statistical analysis can be accurately applied (Creswell 2009: 7). The post-positivism paradigm is regarded as a suitable approach to investigate the behaviour of individuals (Creswell 2009: 7). The study adopted a post-positivism paradigm and it then combined quantitative and qualitative methodologies.

3.6 Post-positivism

Post-positivism, though derived from positivism, recognises that the researcher should be 'open' to other means of inquiry (Clark, 1998). This presupposes that there is no room for positive claims of knowledge when studying human subjects (Creswell, 2009). This

paradigm has the same principles as positivism, but allows more interaction between the researcher and the participants (Willis, 2007) by using additional methods. Positivism, therefore, involves the use of both the quantitative and qualitative methods for data collection (Creswell, 2008). According to Taylor and Medina (2013), post-positivism is a modified scientific method for social scientists. They acknowledge that this paradigm produces objective and generalizable knowledge about any social phenomenon, and also ascertain the relationships amongst pre-defined variables. The strength of this paradigm in social science research is that rational inferences about an occurrence can be made from both empirical observations and logical reasoning. The post-positivist researcher either belong to the subjective, objective or critical realism. Post-positivists are often driven by the belief that there is an external reality that is independent of a person's thinking, but such reality cannot be known with any degree of certainty. To the post-positivists, "any perception of reality is drawn from empirical observation and existing theory and generalisation taken from original positivism remaining predominant" (Pickard, 2007:10).



Post-positivist research possesses characteristics such as modified dualist/objectivist philosophy as the epistemology (Guba and Lincoln, 1994:110). The ontological belief that drives post-positivist research is critical realism (Guba, 1990). Critical realism is the belief that reality exists outside the individual's mind, but this can be discovered within "a certain realm of probability" (Mertens, 2010:14). The ethical behaviour (axiology) of positivists is based on respecting privacy of respondents through the use of informed consent in research. Mertens (2010) observes that to the post-positivist researcher, ethics is intertwined with methodology. The researcher, therefore, is under an ethical obligation and must follow moral standards in ensuring the integrity of the research (Howe and Moses 1999). In line with this submission, Nolen and Putten (2007), advised that post-positivist researchers should follow the three ethical standards published by American Educational Research Association (AERA), (2011): informed consent, respect as well as confidentiality and autonomy of the participants.

The post-positivist's methodology is usually "modified, experimental or manipulative" in nature, and the research can be done in natural setting (i.e. quasi experiments). The methodology could also involve the use of qualitative methods (Guba, 1990), therefore, the

methodology is both quantitative and qualitative (Letourneau and Allen, 1999). A combination of these two methods is informed by the deterministic philosophy “that quantitative research cannot successfully evaluate the full range of human behaviour (Taylor, 2000:68), and the fact that neither quantitative nor qualitative approach can proffer solution to every social behaviour”, hence the mixed methods research addresses the inherent weaknesses of the two research approaches (Yin, 2011; Bryman, 2008).

The justification for the choice of post-positivism paradigm for this present study is that it allows a combination of both quantitative and qualitative methods (Olasina, 2014; Lather, 2006). The combination of both quantitative and qualitative methods has been described as a key element in the improvement of social science research (Gorard, 2004:7). This submission is also underscored by other scholars (Gorard, 2004). Also, post-positivists identify and assess causes that influence outcomes in any research with the aim of testing, verifying and refining a theory (Creswell, 2009:7). Post-positivists also recognise the intricate relationship between individual behaviour, attitudes, external structures and socio-cultural issues (Crossan, 2003). The current study was informed by the post-positivist paradigm to test the influence of independent variables such as performance expectancy, effort expectancy, social influence, facilitating condition, etc on the cognitive learning effect on Grade 10 students’ performance in physical science. For this present study, the post-positivist paradigm will be used to gather data relevant to the research problem.

3.7 Research design

Bogdan and Biklen (2007: 234) and Kumar (2011: 4) argued that research design enables a researcher to objectively answer the identified questions. The research becomes objective in a situation in which the personal opinions of a researcher do not influence the study findings (Mertens 2012: 23). Durrheim (2006b: 34), Blaikie (2010: 19), maintained that a research design is a plan or blueprint of how a researcher systematically deals with the data required for answering the research questions.

Speaking on the elements of a good research design, Bickman and Rog (2009:11) submit that there must be connection between the research questions, objectives and how the research design aligns with the relevant data sources, research methods, sampling methods,

reliability and validity of the findings. Bryman (2008: 30) asserts that “validity is concerned with the integrity of the conclusions that are generated from a piece of research”. McMillan and Schumacher (2001: 31) and Patton (2002: 10) highlighted that research design assists the researcher to identify and use appropriate data collection methods. Interestingly, Kumar (2011: 94) mentioned that the appropriate research design allows the study to reach valid and reliable results. May (2011: 98) further highlighted that design should accurately provide the framework for data collection and suitable data analysis. Durrheim (2006b: 35) argued that research design allows the researcher to appropriately achieve the research objectives.

Research designs include archival research; survey; case study and action research (Saunders, et al., 2009). Archival research makes use of administrative records and documents as the principal source of data (Saunders et al., 2009), however, data can also be obtained from historical documents (Bryman 1989). Case study research is an empirical investigation of a single unit in order to establish its key features and draw generalisations within real life context (Bryman, 2012). The data collection techniques for case study research are a combination of interviews, observation and documentary analysis. Action research involves a practical approach to a specific research problem within a community of practice (Bryman, 2012). Survey research is described as “assessment of the current status, opinions, beliefs and attitudes through the use of questionnaires or interviews on a known population” (McMillan and Schumacher, 2001:602). Survey helps the researcher to ascertain opinions or characteristics of a population of interest (Slavin, 2007). The survey research design was chosen for this study.

According to Saunders, Lewis and Thornhill (2012), there are two types of survey: cross-sectional surveys and longitudinal surveys. Saunders, Lewis and Thornhill (2012) explain that cross-sectional surveys study a particular phenomenon at a particular time. Longitudinal survey studies a particular phenomenon over a period of time and it is sometimes referred to as the “diary” perspective (Saunders, Lewis and Thornhill, 2012:190). This study is cross sectional in nature because data would be collected from schools over a period of time. The time horizon for the survey was set at 10 weeks.

The survey research design was chosen for this study because survey is one of the primary research methods in research and has been found useful for exploring subjects ranging from

attitudes and intentions to motivations and behaviours (Reio, 2007). Moreover, survey is well suited to descriptive studies (Maree, 2010), and allows the researcher to look at relationships between variables which occur in real-life contexts. Additionally, survey research is associated with the philosophical paradigm of post-positivism and is capable of providing estimates as precisely as possible on the nature of existing conditions or attributes of a population in order to quantify objective reality (Burns 2000). Survey research design allows numeric description of opinion of a population by studying a sample of that population (Cresswell, 2009). Lastly, the survey research design was chosen for this study because it has the capacity to generate quantifiable data on a large population group that is representative of a wider population for the purpose of testing theories (Leedy and Ormrod, 2001). Previous studies such as Oshinaike and Adekunmisi (2012) and Zayim, Yildirim and Saka (2006) have employed survey research design. Oshinaike and Adekunmisi (2012) used survey method to examine use of multimedia in teaching in a Nigerian university. Similarly, in Turkey, Zayim, Yildirim and Saka (2006) surveyed faculty members from basic and clinical science disciplines at a faculty of medicine in a state university.



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3.8 Justification of methodological triangulation

Flick (2011: 187) noted that the combination of multiple approaches refers to a triangulation method. Teddlie and Tashakkori (2009: 31) revealed that the mixed methods style initially sketched its origin from Campbell and Fiske's (1959) multiple method approach. There are generally two fundamental purposes for using mixed methodologies in a single study and these are triangulation of multiple methods and complementarity of research data from multiple sources (Babbie 2011 and Creswell 2009). According to Yin (2014), multiple sources of evidence are basically essential in research. Kalof, Dan, and Dietz (2008: 25) maintained that triangulation is seen as the best technique to understand the social world. Bryman and Bell (2011: 630-31) further mentioned other motives for using triangulation and these include: to obtain a variety of information on the same issues; to use the strengths of each method in order to overcome the deficiencies of the other; and to achieve a higher degree of validity and reliability. McNeill and Chapman (2005: 23)

reinforced that triangulation helps to “verify the reliability of a particular research tool and the validity of the data collected”. Pietersen and Maree (2010: 216) argued that “the validity of an instrument refers to the extent to which it measures what it is supposed to measure”.

Babbie (2011: 25) noted that “both qualitative and quantitative methods are useful and legitimate in social research”. Thompson (2004: 238-239) discussed that the strengths multiplied through combining both fundamental social research approaches, such as qualitative and quantitative methods within a single research study. Mayring (2007: 1) described mixed methods in a single survey as a new popular research system adopted by many researchers particularly in education and the social sciences but this system helps to confirm research data from multiple methods (Edmonds and Kennedy 2013: 173).

When used in combination, both qualitative and quantitative data yield a more complete data analysis (Nieuwenhuis 2010: 66), and they complement each other (Onwuegbuzie and Leech 2006: 483). The combination of both quantitative and qualitative methodologies within the single survey research was considered more relevant for the current study (Creswell and Plano Clark 2007: 5), due to the fact that these approaches were regarded as compatible for yielding meaningful outcomes of the study (Kumar 2011: 105). In this regard, Sharpe and Koperwas (2003: 32) acknowledged that the combination of quantitative and qualitative approaches promotes the compatibility of behavioural data analysis studies. In terms of their similarities, Maiyambere (2016:149) refers to Sechrest and Sidani (1995: 78) highlighting that both approaches help researchers “describe their data, construct explanatory arguments from their data, and speculate about why outcomes they observed happened as they did”. Parker (2011: 33) then acknowledged that quantitative methods are frequently associated with other methods in the research study. Creswell and Plano Clark (2011: 12-13) discussed the fundamental advantages of applying combined methods in research and these were:

- It provides strengths that offset the weaknesses of both these two approaches;
- It provides more evidence for investigating a research problem than it could if only one method is being used;
- It enables the researcher to correctly answer the key research questions that could not readily be answered by one research method alone;

- It assists in bridging the research gap that could likely take place between multiple disciplines as some researchers may prefer either qualitative or quantitative research;
- It represents a practical or free feature which enables the researcher to become more flexible in the research field based on having different options to deal with actual situations.

Greene, Kreider, and Mayer (2004: 277) underlined that “flexibility, creativity, and resourcefulness” represent key benefits of using a combination of qualitative and quantitative approaches. Maxwell (2012: 106) noted that the use of triangulation in a single survey study basically allows the researcher to deal with validity challenges. This view makes sense because many researchers triangulate their research data using multiple methods

McCaig (2010: 37) noted that throughout the use of triangulation, survey findings from a questionnaire and an interview schedule assist the researcher to inform and support concrete conclusions and recommendations. Smith and Bowers-Brown (2010: 117) highlighted that the use of triangulation increases the validity of the research in a way that one method compliments and serves as a check-up point of another method. Barbour (2008: 155) also recognised the importance of applying complementary methods within a single study. Greene (2007: 20) further notes that triangulation provides several means of understanding circumstances.

However, Barbour (2008: 160) maintained that the main challenge of mixed method design lies in the many requirements that are involved in that kind of triangulation research process. In terms of key requirements involved in the use of combination of both approaches, Creswell and Plano Clark (2011: 13-14) underlined that a researcher needs knowledge and skills of the qualitative and quantitative approaches, enough time and sufficient resources to guarantee appropriate data collection and accurate data analysis. For example, Terre Blanche, Kelly, and Durrheim (2006: 276) maintained that proper listening and interpreting of qualitative interviews are not simple tasks and they require special skills. It was important to note that the present study considered all these factors and it then used the combination of qualitative and quantitative approaches within a single survey method.

3.9 Research population and sampling techniques

This section presents the population of the study and sampling frame. It further explained sampling techniques applied in the study and these involved both probability (stratified random) and non-probability (snowball) sampling techniques.

3.9.1 Research population

Population is the entire group of persons or objects of interest to a researcher (Burns and Grove, 2011; Polit and Beck, 2008). Population also refers to the target group that the researcher considers to be the subjects of the study (Punch, 2009). According to De Vos (2005), a prior knowledge of the population enables the researcher to set boundaries with regard to the participants. The entire set of participants about whom the researcher would like to make generalisations is described by scholars such as Polit and Beck (2012); LoBiondo-Wood and Haber (2010); Muijs (2004) and Babbie and Mouton (2002) as the “target population”. Brink, Van der Walt and Van Rensburg (2012) advise that researchers should carefully define and describe the population and specifically stipulate the criteria for decision making on whether an individual or object would or would not be classified as a member of the population. These criteria are described as eligibility, inclusion and distinguishing descriptors (Polit and Beck, 2008:228).

The population for this study includes academics from the four selected high schools in the UMgungumdlovu Education District. This comprised of learners from Grade 10 physical science in four High schools in Pietermaritzburg and Richmond.

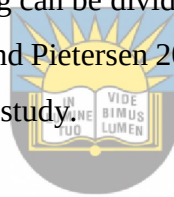
Table 1: Numbers of registered learners Grade10 highschoools

School	Number of registered learners
A	55
B	9
C	35
D	55

In addition to the 154 learners, there would be also four subject teachers of physical sciences. This includes four heads of department of Science and one subject adviser to be interviewed as well.

3.10 Research sampling techniques

Gravetter and Forzano (2009: 144) define sampling as “the process of selecting individuals to participate in a research study”. Robson (2002: 260) argued that sampling is a fundamental element of a research project because it guides the study when determining the specific group of aspects to be observed. The aim of sampling was to obtain a representative sample or small collection of units from a much larger population for the purpose of this study. Sampling can be divided into two types, namely probability or non-probability sampling (Maree and Pietersen 2010b: 172) and both sampling methods would be used for the purpose of this study.



3.11 Sampling

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De Vos et al. (2011:223-224) describe a sample as comprising elements or a subset which is selected from the population and used for the actual study. The selection of a sample is solely based on the judgment of the researcher, which is the reason this sampling strategy is also known as judgmental sampling (De Vos et al., 2011:392). Purposeful sampling is important if a researcher wants to use a few cases in order to gain many insights about a specific topic (McMillan & Schumacher, 2006:319). Purposive sampling was used to select physical sciences learners in the four schools. The sample comprised of a total of 154 Grade 10 physical sciences learners; four Grade 10 Physical Sciences teachers and four physical sciences Heads of Department. Since there are a variety of purposeful sampling strategies, depending on the case under study, the researcher will select the maximum variation sampling. This also allowed researcher to select the sample which had the potential to give maximum differences of perceptions about the topic under study (McMillan & Schumacher, 2006:320). McMillan and Schumacher (2006:321) argue that the size of the

sample in qualitative studies is dynamic, adhoc and phasic rather than static, and therefore can range between 1 to 40 or more participants. The composition of my actual sample would:

- 154 Learners from each of the schools selected
- Four HoDs taken from physical science department.
- Four physical science teachers from the FET phase.

3.12 Pilot study

Pilot study was carried out in the nearest school with Grade 10 Physical Sciences learners. The questionnaire was administered to the 110 respondents in groups of no more than 15 at a time and the interview question was administered to 16 participants. Each participant was randomly placed at a separate table. The questionnaire were conducted in the classroom setting since this was deemed less anxiety-provoking than the school hall. The tests were administered during the school morning to avoid fatigue arising from the long testing time required. The researcher was assisted by an educator from each of the respective schools. The aim was to pilot the workbook and the test to be used in the main study. In addition, the researchers determine how much time the learners needed to complete the workbook.

3.13 Data collection techniques

Data can be described as the various types of information which researchers gather on the subject matter (Fraenkel and Wallen 2009). Ayooluwa (2016) defining data as “information obtained in a course of a study”. Instruments, on the other hand, are mechanisms or tools used for gathering data needed for a study. Fraenkel and Wallen (2009) defined “instrument” as a device used to collect data. The practise of preparing and using instrument(s) to collect data in research is termed “instrumentation” (Fraenkel and Wallen 2009 and Fraenkel, Wallen and Hyun 2012). This practise provides suitable and relevant means of gathering data that can better explain a research problem. This section describes the instruments used to gather data and the nature of data collected from

respondents. Data in research can be collected using four main techniques: questionnaire, interview, observation and examination of documented records (Onyango, 2002). The administration of research instruments or tools of data collection on the respondents is described as data collection (Bhandarkar and Wilkinson, 2010). The study utilised structured questionnaire and interview (semi structured) schedule in capturing views, opinions, and responses from participants.

3.13.1 Questionnaire

Questionnaire describes all methods of data collection in which individuals respond to the same set of questions in a predetermined manner (deVaus, 2002). According to Saunders et al. (2012), the design of a questionnaire usually depends on how it will be delivered, returned and collected. There are two types of questionnaire: self-completed questionnaires, which are usually completed by the respondents, and interviewer completed questionnaires (Saunders et al., 2012). Questionnaires can be sent electronically (web based), by post (mail questionnaire) or delivered by hand to each respondent (Saunders et al., 2012).

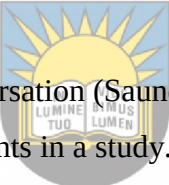
Questionnaires can also be open ended or closed ended in nature. The open ended questionnaire allows researchers to give answers in their own way (Fink, 2009) while the closed ended questionnaire provides a list of multiple answers for respondents to choose from (Saunders et al., 2012). Due to the nature of job of the respondents for this present study, the closed ended questionnaire was chosen as minimal writing is required (Saunders et al., 2012) and respondents are able to answer questions quickly and easily. Moreover, questionnaires are usually inexpensive to administer; very little training is needed to develop them, and they can be analysed easily and quickly once completed (Birmingham and Wilkinson, 2003:8).

The questionnaire will included structured questions, which were closed-ended in nature and derived from standardised instruments to measure the variables in the study. For this study questionnaires would be of great value for a variety of reasons. They are economical, the questions are standardized and uniform procedures were used. One sets of questionnaire were distributed to learners in four schools. The questionnaire for learners comprised of

closed-ended questions and one open ended question. The questions ranged from the challenges that learners experienced with the subject, the activities that learners engage with and the role that subjects such as physical science play in ensuring that they acquire problem-solving skills.

The questionnaires were taken to Grade 10 physical sciences learners to complete. The initial sample group acted as a pilot study to identify ambiguities in the questionnaire. After pilot testing, the questionnaires were refined which led the researcher to edit and amend any sections for clarity. The questionnaires were completed anonymously and participants were allowed an hour to complete it. The covering letter, which is part of the questionnaire, explains the purpose of the research and does give assurance of confidentiality. The researcher, after introduction, explained the instructions and some of the terminology used in the questionnaire to the participants. Participants were also encouraged to ask questions.

3.13.2 Interview



Interview is a purposeful conversation (Saunders, Lewis and Thornhill, 2012) between the researcher and the participants in a study. Interviews can be classified as structured, semi structured or unstructured. In a situation where the interview is formalised and the respondents hear the questions in the same manner, it is referred to as structured interview. The authors caution that the researcher should ask concise and unambiguous questions but the questions must be consistent with the research questions.

A semi structured interview was used to collect qualitative data for the study. The semi-structured interview technique is described as standardised open-ended interview (Patton, 1990) where questions are prepared beforehand (Berg, 1998). The semi structured interview allows the researcher to obtain responses from participant(s) either through face to face encounter, telephone or by using the internet. Interviews have been described as the most direct method of obtaining facts from respondents. The benefits of using interviews in research lies in the fact that they are useful in ascertaining values, preferences, interests, task, attitudes, belief and experience. The purpose of the interview schedule was to gather open-ended information (Creswell and Plano Clark, 2007; Creswell, 2009; Creswell and Zhang, 2009) from some of the management staff in the university with a view to

complement the quantitative method and have a better understanding of the problem (Creswell and Plano Clark, 2007:7). Overall, data collection will both quantitative data and qualitative data allows for deductive and inductive investigation in the same research study to investigate, predict, explore, describe and understand the phenomenon Alabi (2016:95)

The interview questions for the learners were divided into three sections and comprised of 41 questions. Section A (8 questions) was focused on the biographical data of the respondent. Section B (32 questions) investigated the attitude of learners towards the learning of Physical Sciences and how learners could enhance their cognitive learning of Physical Sciences for their performance. Section C provided a space for learners to add any additional information.

The interviews that the researcher will conduct with the teachers and the HODs would give the opportunity to explore the feelings and views of Grade 10 Physical Sciences teachers about the teaching of Physical Sciences including challenges and difficulties they face. The literature dealt with in the previous chapter, which shed light on the cognitive learning effect on Grade 10 students' performance in physical science, would help the researcher to prepare appropriate questions for the purpose of the study.

Physical sciences teachers were asked to participate in the interview after they are given information about the study. Probes were used by the researcher to provide a better understanding and obtain deeper information about challenges that Physical Sciences learners and teachers experienced. Probe questions were not included in the interview schedule. In the interview schedule teachers were asked about challenges that physical sciences teachers experience. The HODs were interviewed in order to get broader view by the researcher. The questions link the research project to a clearer understanding of the issues raised in the research questions. This dealt firstly with the methodological, pedagogical and general experiences teachers have when teaching physical sciences interviews with teachers was carried over a period of two weeks. Teachers were invited for interviews and was conducted with each teacher in their free time. Teachers were assured that their confidentiality would be kept through the study. Tape recorder was used with the interviewees' permission during the sessions. The interview by the researcher to lasted from 30 to 60 minutes.

3.13.3 Observation

This research collected data from observing the four (4) teachers in the classroom. According to Creswell (2013) observation is the process of learning through exposure to or involvement in the day to day or routine activities of participants in the researcher setting. It is also the systematic process of recording the behavioural pattern of participants, object and occurrences without necessarily questioning or communication (Busha, 2013). This is why participant observation is one of the researcher's adopted data collection approaches as the researcher believe it will provide first hand data on what the teacher actually does in the classroom with regards to cognitive learning on the learner's performance. It will provide evidence on the non-verbal responses of the teachers and show how they interact with the learners and the communication within the classroom and seating arrangement. Observation requires the observer to be as unobtrusive as possible and to not disturb the research situation (Creswell, 2013).

Hahn (2009) believe that "the ultimate goal for design of research using participant observation is to develop a holistic understanding of the phenomena under study that is objective and accurate as possible given the limitations of the method"(p.92). For this study the researcher observed it for the period of two months two days per week during tuition time. The researcher observed physical science Grade 10 teachers and Grade 10 learners. The researcher observed the physical resources at the four schools. Observation allows for the natural behaviour of subjects in the study and is relatively unobtrusive (McMillan & Schumacher 2006). The researcher also took time to observe learner's behaviour during the teaching time; the focus was placed on their attention span during the lesson. With this in mind, observations were conducted in two groups that would be taught by the four teachers in the schools where focus would be placed on how physical sciences is taught at the schools. Researcher observed resources available at the four schools. Permission were sought from both the Department of Education and the principals to do those observations.

3.14 Data analysis

This section discusses the fundamental process followed during data analysis. It also highlights the type of quantitative and qualitative analysis within the present study. Merriam (2009: 175) indicates that “data analysis is the process of making sense out of the data”. Gardner (2009:260) explains that data analysis refers to the process of inspecting, cleaning, transforming and modelling data with the goal of highlighting useful information, suggesting conclusions and supporting decision-making. Blaikie (2010: 161) notes that there are two main forms of research data, such as numbers and words.

3.14.1 Data analysis process

Research data were first coded before being systematically analysed. Terre Blanche, Durrheim, and Kelly (2006: 324) indicated that “coding means breaking up the data in analytically relevant ways”. Vidovich (2003: 89) stated that coding was the first reliable stage of data analysis as it involves giving communicative labels to data chunks. Kalof, Dan, and Dietz (2008: 95) noted that coding refers to the process of organising and logically interpreting research data. Bryman and Bell (2011: 249) agreed that the core purpose of coding is to render the data in a form in which they may easily be presented and analysed. Furthermore, Thornberg and Charmaz (2012: 44) suggested that coding data could take place simultaneously with the data collection process.

3.14.2 Analysis of qualitative data

According to Smith and Bowers-Brown (2010), observations and content analysis are some of the research methods that are frequently used in both quantitative and qualitative studies. In many cases, observational studies reflect qualitative research and they often analyse existing activities (Fink 2010: 64). Furthermore, Flick (2011: 133) noted that content analysis may apply to both quantitative and qualitative data analysis. Franzosi (2004: 548) noted that in the early days of content analysis, scholar such as Kaplan (1943: 230) indicated that content analysis encompasses a quantitative description of a communicated message.

Kalof, Dan, and Dietz (2008: 105) argued that “the main goal of content analysis is to systematically classify words, phrases, and other units of text into a series of meaningful categories”. Struwig and Stead (2001: 14) state that content analysis focusses mainly on gathering and analysing of data textually. Similarly, Krippendorff (1980: 21) had noted that content analysis develops valid inferences from text. Weine et al. (2005: 560) expressed that content analysis contributes to gaining an in-depth insight. Franzosi (2004: 550) noted that thematic analysis has become a popular method of content analysis. Neuendorf (2002: 24-25) also describes content analysis as the best approach to adopt in qualitative analysis. Research data were qualitatively analysed using content analysis and it led to the development of relevant themes within the present study.

Majyambere (2016:173) cited Krippendorff (1980: 60-63) who discussed some common methods of content analysis and these include elementary syntactical analysis, referential analysis, prepositional analysis, and thematic analysis. The data generated from interviews, group discussions and open-ended questions in the questionnaire were specifically analysed through thematic content analysis (Nieuwenhuis 2010: 101). This action was positively accomplished because the words or gathered explanations with common meanings were grouped within the same category before being systematically analysed (Connaway and Powell 2010: 223). This technique had made the data analysis journey more accurate and understandable.

Namey et al. (2008: 138) highlighted that qualitative data analysis often involves two categories such as content and theme analysis. The main idea was that qualitative content analysis involved creating “themes and recurring patterns of meanings” (Merriam 2009: 205). Thus, this qualitative analysis technique assisted the researcher in correctly analysing textual data (Lee and Fielding 2004: 530). The analysis journey was effectively accomplished since the themes were comprehensively identified. Patton (1990: 371-372) revealed that qualitative data analysis and interpretation allowed the researcher to deal with the following research challenges:

- Make sense of a huge volume of data;
- Reduce the large quantity of information;
- Identify important patterns; and
- Build a reliable framework that guides discussion of findings (Patton 1990: 372).

3.14.3 Analysis of quantitative data

SPSS was used to systematically capture and analyse quantitative research data. Quantitative data was collected via the questionnaire administered to learners. Durrheim (2006a: 189) provided three main stages involved in preparation of data for ensuring accuracy analysis and these include “coding, entering, and cleaning”. Charmaz (2006: 43) defines coding as “naming segments of data with a label that simultaneously categorises, summarises, and account for each piece of data”. All questions would be assigned numerical codes. Importantly, each questionnaire would be numbered at the time it is returned from the respondent before being entered into SPSS in order to detect any missing questionnaires. As a result, Flick (2011: 142) noted that during the data cleaning process, the researcher can positively detect possible coding errors and correct these mistakes.

Majyambere (2016: 173) cited Durrheim (2006a: 191) who expressed that the use of a statistical computer package basically assists the researchers to quantitatively organise data and effectively analyse research findings. In this regard, Kostagiolas (2013) used a questionnaire as a data collection tool and SPSS for analysis for information seeking behaviour study carried out in Greece. The researcher applied the latest version of SPSS at the time of data capturing and data analysis (21st version) as this package keeps on being updated from time to time. Burton and Bartlett (2009: 80) revealed that SPSS is very useful when “dealing with large-scale samples”. Bryman and Bell (2011: 360) indicated that SPSS should be useful for generating descriptive and frequency tables as a form of data presentation in which the researcher will also use in this current study for presenting results.

Schutt (2006: 447) indicated that frequency distribution allows the study to present the important number (statistical data) and relatively percentages for further interpretation of research findings. Paltridge and Starfield (2007: 138) argued that researchers from different disciplines prefer to use tables and figures to visually represent findings but they further advised to sequentially assigning numbers to tables or figures based on the actual chapter in a report as well as each item. It was important to take into account this advice and the present study did assigned numbers to tables and figures throughout this research accordingly.

Moreover, Nicol and Pexman (2010: 4) discussed that “a good figure is one that is easy to understand, presents findings in a clear manner, summarises information, and requires little interpretation”. Walker (2010: 86) recommended the simultaneous use of figures, graphs and tables for presenting research findings based on each type of data. Similarly, in this study the use both tables and figures with the aim of making the research findings more understandable and easier to interpret will be implored. Figures were used for clarification of the relevant information behaviour models and also use for presentation of results to maintain consistency in this study. This was done because figures will bring clear, meaningful and understandable data analysis and could make discussion of findings easier.

3.15 Validity and reliability

Boudah (2011: 64) indicated that “reliability is integral to both validity and trustworthiness”. Tourangeau (2004: 211) commented on the fact that pre-testing research instruments does not automatically certify the reliability and validity of research responses. McMillan and Schumacher (2001: 428-429) rather explained that the use of multiple research instruments increases the validity and credibility of the research. This means that credibility of results is based on the fact that the researcher had accurately presented data findings in a valid way. Similarly, Mertens (2012: 29) highlighted that credibility of research can be achieved through using multiple data sources, so this study also used different sources of information. Burton and Bartlett (2009: 25) pointed out that validity and reliability of instruments should always be considered as compulsory elements that yield very rich data.

3.15.1 Validity

Hammersley (2008: 42) indicated that it is important to assess validity in social research. Tourangeau (2004: 211) expressed that “validity of data is often a challenge to get, especially with attitude questions”. De Vaus (2002: 53) argued that “in fact, it is not the measure that is valid or invalid, but the use to which the measure is put”. Burton and Bartlett 2009: 25) noted that validity powers the choice of methods to use in the study. Pre-testing data collection tools primarily improves the validity of the research data (Punch 2003: 42). Fowler (2002: 76) believed that “good questions maximise the relationship

between the answers recorded and what the researcher is trying to measure”. In terms of content validation, the study has ensured that the instruments' items reflected the key research questions. Wield et al. (2002: 47) highlighted that “the core research question needs to be convertible into tasks for a research project”.

Tredoux and Smith (2006: 163-164) divided validity into two forms namely internal and external validity. Edmonds and Kennedy (2013: 4-5) recently discussed that internal validity largely applies to experimental research because it naturally deals with causal inferences; while, external validity involves choosing the proper probability sampling technique. Tredoux and Smith (2006: 167) further noted that external validity is effective in describing the social world. Perakyla (2011: 365) explained that “the validity of research concerns the interpretation of observations”. Onwuegbuzie and Leech (2005: 377) maintained that the useful integration of both qualitative and quantitative approaches within a research study increases the validity. Johnson and Christensen (2012: 245) noted that validity involves inference that gains its origin from all kinds of research findings. Ercikan and Toth (2011: 221) argued that the validity of instruments involves two major components including the development and the identification of measurement instruments. The validity of the study would be achieved through the use of triangulated instrument data within a single survey. Research instruments were pre-tested in order to minimise errors. Validity of the data would depend on the construction of questionnaire items, and how accurately learners understand and responded to these items.

3.15.2 Reliability

Reliability refers to whether scores to items on an instrument are internally consistent, stable over time (test-retest correlations) or whether there was consistency in test administration and scoring (Creswell, 2009). Johnson and Christensen (2012: 245) indicated that research reliability embraces the stability of research outcomes. Pole and Lampard (2002) observed that it is based on consistency of a repeatable method. Fink (2010: 114) stated that “a reliable data collection method is one that is relatively free from measurement error”. Fowler (2002) highlighted three common strategies to increase the reliability of the research instruments and they were considered for the purpose of this study. These three strategies contain the following:

- The researcher will identify the suitable process to follow while directing questions and also guiding the participants during the data collection period;
- The researcher will be focused on maintaining the same meaning of every research question asked to each respondent and this was done in order to avoid any confusion; and
- The researcher also takes into account the importance of framing the research questions in a manner that each respondent could easily understand the question asked and then answer it properly.

3.16 Ethical issues

Ethics for evaluation and research are "norms for conduct that distinguish between acceptable and unacceptable behaviour" (Resnik 2007:1). Ethical issues arise out of our interaction with other people, and the environment, especially where there is potential for, or where there exists a conflict of interest (Babbie and Mouton 2001). Therefore, research should be conducted in accordance with ethical guidelines and must be justifiable on the basis of scientific, educational, or applied value (American Psychological Association 1992). Research ethics help to promote trust, mutual respect and accountability, so as to make the researcher accountable to the public (Resnik 2011). As it was necessary to obtain "permission from several individuals and groups" (Creswell 2008:157), prior to engaging in the research, a letter was sent to the KwaZulu-Natal Department of Education and the schools involved for informed consent. Informed consent is achieved by providing subjects with an explanation of the research (McMillan & Schumacher 2006:143). Before the researcher moved into the field, consent was obtained from the relevant Education Department and the schools. School principals were contacted and a preliminary meeting was held with them to discuss how and when the research was to be conducted. All respondents and the location of the research sites remained anonymous and the privacy and confidentiality of all subjects in this study were protected. The specific ethical issues considered in this study are discussed below.

3.16.1. Permission

Permission to visit schools was sought from and granted by the Department of Education. The researcher took the letter collected from the University of Fort Hare Ethic Committee (UFEC) as ethic clearance certificate to the Department of Education, so as to ask for permission to conduct research in schools alongside with the letter written by the researcher (See appendix C and E).

According to Bless, Dessemontet, and Morin (2014), permission is to gain access to research participants by means of the gatekeepers. This means that sometimes it may be necessary for the researcher to approach the gatekeeper like school or educational authorities before approaching the participants directly to participate in the study. Wanat (2008) argued that gatekeepers are those who give access to a research field. Their role may be in allowing investigators into a given physical space, or it may go further in granting permission for research to be conducted in a particular way.

3.16.2 Informed consent



Johnson and Christensen (2008) pointed out that informed consent can be referred to as agreeing to participate in a research after being informed of its purpose, procedures, alternate procedures, benefits, risks, and limits of confidentiality. Before a person can participate in a research study, the researcher must give the prospective participant a description of all features of the study that might reasonably influence his or her willingness to participate (see appendix F).

Participants in research need to be informed about what they are about to enter into before they make a decision to participate. Individuals participating in a research study should be informed of the nature of the study and may choose whether or not to participate (Lichtman, 2013), and they should not be forced into participation. However, in some cases, it may be difficult to obtain informed consent. It becomes a challenge to obtain consent from minors or individuals who do not have a clear understanding of written English or those who are mentally disabled or emotionally fragile (Lichtman, 2013).

Where minors are not able to make decisions on their own and cannot give consent, consent is to be obtained from the parents (or minor's legal guardian) after they have been informed of all features of the study that could influence their interest to permit their children to take part (see Appendix G). Assent must be obtained from the minor after consent has been obtained from the minor's parent or guardian (Johnson & Christensen, 2008). This means that the minor must also agree to partake in the study after being informed of all the conditions that could affect his/her willingness to partake. Informed consent is one of the critical issues to be sure the participants are duly informed, to the extent possible, about the nature of the research (Lichtman, 2013).

Getting informed consent implies that necessary information is given about the purpose of the study and procedures to be followed during the research work. The possible advantages, disadvantages and risks the participants may be exposed to, as well as credibility of the researcher, according to Babbie (2006), are to be communicated to the participants or their legal representatives. The researcher sought informed consent from participants in this study. A consent form was designed and participants were asked to complete it after the purpose of the study and conditions of participation were explained to them.

The researcher gave the details of the study that it was for academic purposes and that the findings are important in the improvement of curriculum planning and development. All participants signed the consent form and were made to realize that they could withdraw from the study at any time since participation was voluntary.

Johnson and Christensen (2008) identified some other forms of consents apart from informed consent, namely; passive and active consent, additional consent and something on deception.

3.16.3 Rights of participants

The ESRC ethical standards clearly state that research participants have the right to withdraw from a study at any time, unless otherwise constrained by their official capacity (Johnson & Christensen, 2008) and that special consideration should be given to the minors and their freedom to dissent. The Ethical Standards for Research in Child Development states that, the child's freedom to choose not to participate should be respected. No research

work must violate participants' legal and human rights when participants are recruited. A crucial area of protecting the dignity of the people is in understanding and respecting their culture (Bless et al., 2014). Participants have a right to take part or to withdraw anytime they want to do so. In this study, the participants were provided with an explanation that they had the opportunity to terminate their participation at any time with no penalty.

3.16.4 Confidentiality and anonymity

Obtained information particularly from the participants has to be treated with confidentiality. There should be no access to personal data or the names of participants by any third party except the researcher. A system to link names to data, if used, can be destroyed. The researcher met with participants in order to communicate the purpose of the study to them, reasons and benefits for their participation and the right to participate or not.

Any individual, group or organization participating in the research study has a reasonable expectation that its identity will not be revealed (Lichtman, 2013). Identifying information should be removed from researcher's records. Permission from the participants to make public information that might reveal who they are or who the organization is should be asked from the participants. Importantly, caution must be taken in publishing long verbatim quotes.

According to the AERA ethical standards, the research participants have the right to remain anonymous and the confidentiality of both the participants and the data obtained must be protected (Johnson & Christensen, 2008). Privacy is defined according to Johnson and Christensen (2008), as controlling other people's access to information about a person. Respecting the privacy of research participants is at the heart of conducting ethical research. Further, anonymity, according to Johnson and Christensen (2008) is an excellent way of protecting privacy because anonymity means that the identity of the participants is not known to the researcher. Confidentiality is the other means that researchers use to protect the privacy of the research participants. Confidentiality also refers to an agreement with the research investigators about what may be done with the information obtained about a research participant (Johnson & Christensen, 2008).

The participant is entitled to expect that any information given to the researcher will not be made available to anyone else and will be treated in a confidential manner (Lichtman, 2013). The researcher needs to be very sensitive to the information collected from minors and others who may be in a vulnerable condition.

3.16.5 Harm to participants

The main challenge the researcher is confronted with is the treatment of the research participants (Johnson & Christensen, 2008). Qualitative research is an on-going and evolving procedure, with the process of data gathering which is more like friendship connection between the researcher and the respondent.

There should be a reasonable expectation by those participating in a research study that they will not be involved in any situation in which they might be harmed (Lichtman, 2013). It is best to safeguard against doing anything that will harm the participants in a study.

Non-maleficence is a basic principle of research by which the participants suggest that participants must not be harmed by participating in the study (Bless et al., 2014). These researchers further indicated that it should be noted that harm may happen intentionally or unintentionally during the course of the study. If a certain research process results to unpleasant effects for participants, the researcher must have got the firmest scientific grounds for carrying it out.

3.16.6 Rapport and Friendship

Researcher must develop rapport with the participants once they have agreed to take part in the study so as to attract them to disclose information (Lichtman, 2013). Likewise, the researchers should make sure that they provide an environment that is trustworthy; and at the same time, they need to be sensitive to the power that they hold over participants (Lichtman, 2013). Researchers need to avoid setting up a situation in which participants think that they are friends with a researcher.

3.15.7 Intrusiveness

Intrusiveness, according to Lichtman (2013) means intruding on participant's time, space, and personal lives. As the researcher designs a research study, he or she has to be able to make a reasonable estimate of the length of time for participation. In the case of this study, the researcher had to specify how much time to spend with each participant in the letter requesting permission to carry out a research from the Department of Education and likewise time for visit per school. So, the researcher had to arrange for relevant time with the principals of the schools to consult with the teachers and learners.

3.15.8 Inappropriate behavior

The researcher did not engage in conduct of a personal or sexual nature. Researchers might find themselves getting too close to the participants and blurring boundaries between themselves and others (Lichtman, 2013). If a researcher thinks he or she is getting too close to the participants, he or she has to bow out and remember that he or she is a researcher and is bound by the code of conduct to treat participants with respect

3.15.9 Data Interpretation

Misleading statements should be avoided. Researchers should bear in mind of admonitions to interpret data conservatively and go beyond what numbers or facts show (Lichtman, 2013). Lichtman further asserts that a researcher required to analyze data in a way to avoid misinterpretations, misstatements or fraudulent analysis and that a researcher has a responsibility to interpret his or her data and present evidence so as to enable others to decide the extent to believe the interpretation. Bless et al. (2014) indicated that researchers are not allowed to change their data or observations as a matter of ethics in analysis and reporting; and that the fabrication or falsification of data is a very serious ethical transgression.

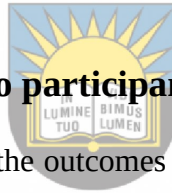
3.16.10 Data ownership and rewards

The work generated is owned by the researcher (Lichtman, 2013). Many researchers decided to acquire data and make them available through data banks. Bless et al. (2014)

suggested that when research outcomes are published, it is crucial for participants not to be identified by name or in any other manner that will make it possible to identify them Parry and Mauthner 2004 as cited in Lichtman (2013) suggested that there are unique issues about confidentiality, anonymity and consent because qualitative data might be a joint construction between researcher and participant.

3.16.11 Appropriate referral

The researcher must always anticipate the case that the well-being of research participants (psychological, physical, emotional and/or social) may be compromised, after a traumatic experience like social turbulence or displacement. Procedures are required to be employed in order to control any negative results should they happen. This is mainly done by arranging appropriate referral to a counselling center, medical facility or social work agency.



3.16.12 Reporting back to participants

The researcher needs to show the outcomes of every study to the participants in the form that will be easily understandable. Consideration must be given to factors like participant's home language, culture and education level (Bless et al., 2014). These authors also suggest the following principles of ethical research:

- **Non- maleficence:** The most basic principle of research is that participation must not harm the participants. It is crucially important to remember that harm may happen intentionally or unintentionally during the study. If a certain research process results to unpleasant effects for participants, the researcher must have got the firmest scientific grounds for carrying it out.
- **Beneficence:** The principle of beneficence entails social and behavioral research that is effective and considerable in promoting the welfare of people.
- **Autonomy:** The principle of autonomy entails the freedom of peoples' actions and choices to decide whether to participate or not in research. The principle of informed consent is crucially important. Notwithstanding, the principle of autonomy can affect the generalizability of the outcomes such a way that people who consent to participate

in a study may differ from the many others who do not volunteer. This can be referred to as volunteer effect.

- **Justice:** The principle of justice is based on the belief that every individual must be treated equally. Discrimination on the basis of gender, race, disability, income level or any other characteristic should be discouraged.
- **Fidelity:** The principle of fidelity implies truthfulness and promise or agreement keeping, particularly between researcher and participants. Thence, it is ethical violation to engage in deception or breaching confidentiality, which infringes on the right of the participants. Respect for the right and dignity of the participants is important to assure that the participants' dignity and self-respect is always preserved. A crucial aspect of people's dignity is privacy and respect of their rights.

3.17 Summary of the chapter

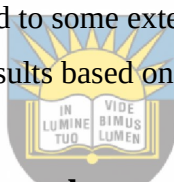
This chapter described the research design that will be used in examining the cognitive learning effect on Grade 10 students' performance in physical science. It was done by giving a detailed description and justification of the selection as well as use of the various data collection methods. The researcher highlighted the differences between qualitative and quantitative approaches and explained why opting to use both approaches instead of just one. The population of the study, sampling techniques, data collection instruments, and data analysis methods were comprehensively discussed in this chapter. Research instruments were triangulated with the aim of obtaining richer data. Pre-testing of research instruments, evaluation of research methods, and consideration of ethical issues were coherently discussed to ensure validity and reliability of research findings. The next chapter will focus on presentation of results (Chapter Four), while findings will be discussed in Chapter Five.

Chapter Four

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

4.0 INTRODUCTION

This chapter presents the summaries of the findings with reference to the problem statement, research question and aims. In this chapter, the researcher analyses, interprets and presents the data collected on the cognitive learning effect on Grade 10 students' performance in physical in UMgungundlovu Education District in KwaZulu-Natal Province. Data collection tools included learner interview questionnaires, teacher interviews, observation and a non-standardised test. These tools are supplied in Annexure A, B, C and D. A mixed method approach was used during this investigation. The findings of this research were categorised according to the initial aim of the research. Although categories overlapped to some extent, in summary they provided a comprehensive report of the results based on the quantitative and qualitative research.



4.1 Revisiting the key research questions of the study

The following sub-research questions were raised and these formed the themes and sub-themes that emerged from the data analysis.

- 1- What are the factors that impede cognitive learning for performance?
- 2- What are the factors that can enhance the learner's cognitive learning for performance?
- 3- 3-How the right methods of teaching should be adopted to foster cognitive learning for improved performance?
- 4- How does the motivation of educators affect the teaching of Physical Science?

4.2 The Sample

The sample consisted of 16 Grade 10 learners, 4 Grade 10 physical science educators and 4 Head of Departments across the four selected secondary schools in Richmond and

Pietermaritzburg under UMgungundlovu Education District in Kwazulu-Natal (see table 4.2 below).

Table 4.2 The participants across the four selected schools

Participants	School A	School B	School C	School D	Total
Learners	4	4	4	4	16
Teachers	1	1	1	1	4
HOD's	1	1	1	1	4
Total	6	6	6	6	24

For the purpose of this study, the researcher refers to the participants by codes with respect to their schools.

4.2.1 Learners Codes

The Grade 10 physical sciencelearners were coded with Lr (1- 4) A, Lr (1- 4) B, Lr (1- 4) C and Lr (1-4) D. Where Lr1A, Lr2A, Lr3A, Lr4A, indicate Grade 10 learners in school A; Lr1B, Lr2B, Lr3B and Lr4B indicate Grade 10 learners in school B; Lr1 C , Lr2C, Lr3C and Lr4C indicate Grade 10 learners in school C , while Lr1 D, Lr2 D , Lr3D and Lr4D indicate Grade 10learners in school D.

4.2.2Educators code.

The educators are coded with EdrA, EdrB, EdrC and Edr D. Where EdrA represents interview with physical science educator in school A; EdrB represent interview with Physicals science educator in school B; EdrC represent interview with Physicals



scienceeducator in school C. While Edr D represent interview with Physicals science educator in school D

4.2.3 Head of departments codes

The head of departments are coded with HoD A, HoD B, HoD C, and HoD D. Where HoD A represent interview with physical science head of department in School A ;HoD B represent interview with physical science head of department in School B ;HoD C represent interview with physical science head of department in School C ;HoD D represent interview with physical science head of department in School D

4.2.4 Observations

ObsA, ObsB and ObsC, Obs D. Where ObsA represents the class observation in Grade 10 physical science class in school A, while ObB, ObCand Obs D represents the class observation in 10 physical science class in school B, C and D respectively.

The data collected is analysed using some themes and sub-themes from the responses given by the participants to bring out the main issues on examining the cognitive learning effect on Grade 10 students' performance in physical science.

4.3 Demographic Information of Participants

The participants' personal information was presented according to the codes given to participating learners' educators and heads of department with respect to their school locations as illustrated above. Table 4-3 and table 4-4 illustrate the demographic characteristics of the participants across the four selected schools in UMgungundlovu Education District.

4.3.1 Demographic Characteristics of Participating Learners

Table 4.3.1 (a) and (b) show the distribution of participating learners according to age, gender and performance in last examination.

Table 4.3.1 (a)

Learner	School A				School B			
	Lr1A	Lr2A	Lr3A	Lr4A	Lr1B	Lr2B	Lr3B	Lr4B
Age	15	15	16	16	15	15	16	15
Gender	F	F	M	M	F	M	F	F
Grade	10	10	10	10	10	10	10	10
Score	35%	27%	80%	50%	35%	41%	73%	61%

Table 4.3.1(a) Demographic characteristics of participants (Learners)**Table 4.3.1 (a)**

Learner	School C				School D			
	Lr1C	Lr2C	Lr3C	Lr4C	Lr1D	Lr2D	Lr3D	Lr4D
Age	15	15	17	16	15	15	16	15
Gender	F	M	F	M	F	M	F	F
Grade	10	10	10	10	10	10	10	10
Score	31%	22%	60%	55%	50%	42%	75%	56%

Table 4-3.1(a) Demographic characteristics of participants (Learners)

The table above shows that all the learners who participated in the research are in Grade 10 and aged between 14 and 17 years across the four selected schools. The number of male participants was not equal to the number of female participants. Likewise nine of the learners scored above 50% (29 – 75%) in their previous test, while the other seven scored less than 50% (27 – 45%).

4.3.2 Demographic Characteristics of Participants (Educators)

Table 4.4 show the distribution of participating educators according to age, gender, marital status, qualification, years of teaching Physical science in the case study schools and overall teaching experience.

Table 4.4: Distribution of participating educators

Participant	Age Range	Male or female	Married Or Single	Qualification	Permanent or Temporary	Teaching Experience	Number Of Learner Grade 10
EdrA	25-30	Male	Single	Bachelor of Science(Bsc)	Temporary	2months	9
Edr B	25-35	Female	Married	Bachelor of Education (B.Ed)	Permanent	4 years	55
Edr C	40-50	Male	Married	Bachelor of Science (Bsc) PGCE	Permanent	22years	53
Edr D	35-45	Male	Married	National Diploma in Education, Bachelor of Science (B.sc)	Permanent	24years	35

The two educator's age range who participated in the study falls between 25 and 35 years while the other falls within the range of 40 and 50 years. Among the four educators, three were males and one female. Similarly, three of the participants were married. All the educators were professional teachers and they qualified to teach Physical sciences as revealed by their qualification. Thus, this information helps the researcher to determine the nature of the educators' experiences in teaching physical science, and to ascertain whether their varying experiences is related to their understanding of the physical science curriculum design, and how this affects the learners' performance in physical science.

4.3.3 Demographic characteristics of participating Head of Departments

Table 4.5 show the distribution of participating Head of Departments according to age, gender, marital status, qualification, years of teachings science in the case study schools and overall teaching experience.

Table 4.5: Distribution of participating Head of Department.

Participant	Age Range	Qualification	Employment Status	Years of teaching Physical Science	Teaching Experience
HoDA,	30-40	Bachelor of Science(B.sc)	Permanent	12years	12years
HoDB	40-50	S.P.E.O (ACE)	Permanent	20years	20years
HoDC	40-45	Bachelor of Science (B.sc)	Permanent	25years	25years
HoD D	45-55	National Diploma in Education, Bachelor of Science (Bsc)	Permanent	35years	35years

The age range of the heads of department who participated in the study falls between 30 and 55 years. Among the four heads of department three were males and one female. Similarly, all of the participants were married. All participants were professional teachers and they qualified to teach Physical sciences as shown by their qualification. Thus, this information helps the researcher to determine the nature of the participants experiences in teaching and as Heads of Department, and to ascertain whether their varying experiences is related to their understanding of the Physical science curriculum design, and how this affects the learners' performance in Physical science..

4.4 Qualitative findings

4.4.1 Findings from interviews with the Grade 10 learners

The interview was conducted with learners from the four selected schools in the area of learning of physical sciences. In addition, the interview was aimed at examining their experiences and finding out what they think about science in general. This section is discussed below according to the questions asked.

4.4.3 Findings from the qualitative and quantitative data with the Grade 10 learners, teacher and educators

The interview conducted was with learners teachers and educators from the four selected schools in the area of learning of physical sciences. In addition, this study was aimed at examining their experiences and finding out what they think about science in general. This section is discussed below according to the questions asked.

4.4.3 What are the factors that impede cognitive learning?

This research question encompasses the overall purpose of the study. In this study the followings are the findings that are found to impede the cognitive learning for performance



4.4.4 Learners Attitude towards physical science

Majority of the respondents reported that they have interest and positive attitude for Physical science, while out of 154 learner in the overall 95% indicated that their interest and positive attitude towards physical science. However, the remaining 5% shows lack of interest and low form of attitude toward the subject. From the interview two respondents indicated that they have a fair attitude towards the subject. One respondent reveals that physical science is too tough and the reason was not specified by the learner. The respondents had these to say:

Lr1D :Well , my attitude is fair, because as usual people , they take physical science as a hard , you know , subject but I intend to change that by proving that it is an easier thing. You just need to study hard.

Lr4B: My attitude I can say it's fair, because sometimes I pass it and sometimes I fail it.

Lr3B: My Physical science seem too tough, aaaah, although some reasons may be valid but it seems too tough for me.

4.4.5 Non parental involvement

The data gathered from the respondents showed the evidence of weak parent involvement seen in the learners' responses to question 16 and 19 (see Annexure A and B) which stated: "Do you get assistance from your parents /guardian to do your homework? If no then why? /How do you rate your parents/guardians' assistance or supervision at home?

" Most (71%) learners responded that they were not assisted. The following were also mentioned:

Lr1A: No, because they don't know about the subject.

Lr2A: No. if I asked them to help me, they say they do not know anything about science. And this is the only me I know.

Lr4A: Eeeeh.. No because they don't know anything in physical science.

Lr2B: No because they don't go to school and I don't have somebody who learnt physical science subject.

Lr3B: I do not get assistance, because most of our parent are parent who did not study about physical science. So, when you tell them about physical science, they tend not to understand what is going on and they just leave it like that.

Lr4B: No, because aaah.. My mother, my mother never went for physical science. She went in for accounting that is why she didn't help me.

Lr1C: I don't get assistance from my parent sir, and that is because they do not know physical science subject, yes.

Learners, who were living with their parents, said that they were never available to assist them in the Physical Sciences, as they were always working. These are some of the statements they made:

Lr2C: My parent did physical sciences, so I mean they can help me but then they do show support in the sense of it because most times they are not always around because of work.

Lr2 D: Not at all because of their busy schedules

A Learner also mentioned that the only time the parent gets involved was when their report card arrived and it shows bad results. Learners from School D were in a similar situation with no help from parents. Obviously, most parents lacked knowledge about Physical Sciences and could not assist their children. A learner responded by saying:

Lr4 D: Not all the time but they get involved especially when I get my report and it shows bad results

Those learners (29%) who were able to get assistance at home with Physical Sciences had a brother or sister who had done the subject at school. Few learners thus had received assistance in Physical Sciences from their parents or legal guardians

4.4.6 Language Problem

When learners are required to learn content in a second language, they are faced with the problem of content literacy (Van der Poll & Van der Poll 2007). When learners have to use a language that they are not proficient in, then mastering content (both practical and theoretical) of a subject becomes very difficult (Van der Poll & Van der Poll 2007). This in turn affects the learners' performance in Physical Sciences because language plays an important role in the understanding of technical terms in a subject. From the findings of the present study it was discovered that most of respondents indicated the level of understanding when English is used as a medium of instruction in teaching Physical science is good. From the interview 50% of the learners responded to this question saying that they prefer both languages to be used by the teacher to teach them. The reason for both languages is for their understanding. These are some statements made by the respondents

Lr4B: Combination of Zulu and English, because it makes me to understand.

Lr3A: It is the mixture of Zulu and English because Zulu is our home language so, so it may be easy to fast understand if it is Zulu.

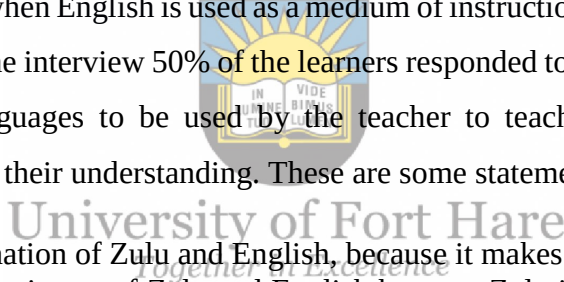
Lr4A: A mixture of English and Zulu because some where they're quite difficult for us to understand they need to be elaborate in Zulu.

Seven (44%) of these learners prefer to be taught in English. But majority of learners confirmed that there is no way they can learn Physical Sciences in their own language and prefer learning the subject in English rather than in their mother tongue. The were some of the statements made;

Lr3C: English because it's the most simplest and common form of communication.

Lr4C: English because English is aaah , is a language that every school been taught and if, it's much easy to learn with it.

Lr1D: Well, for me it's English because for me, it's about been fair. There are learners which does not understand IsiZulu. So apart from me English is a better one for me to use.



Like for instance our teacher does not understand isiZulu, so by learning about English it's much easy.

Lr3D: It's English, yes because it is a better language to understand.

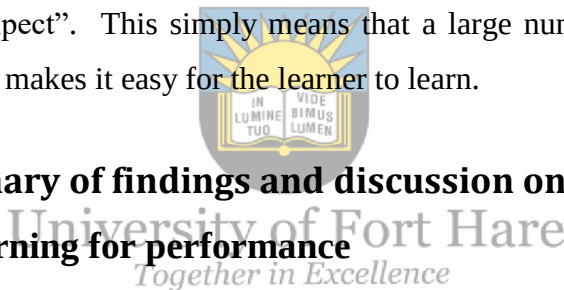
4.4.7 Teachers-learners relationship

All the respondents agreed that their teachers are approachable especially for personal explanation on a particular topic. This is a major determinant of teacher-learner relationship. This implies also that they were free to relate their problem to them especially when it comes to the subject. They also confirmed that their educators always give them attention whenever they ask for assistance. From the interview 94% of the respondents indicated that their teachers are approachable. One out of the fifteen respondent said “sometimes he does sometimes he does not”

Learner Lr3C respond saying “He responds “meaning the teacher is approachable but “not in a way we expect”. This simply means that a large number of the teacher create an atmosphere that makes it easy for the learner to learn.

4.4.8. Summary of findings and discussion on the factors that impede cognitive learning for performance

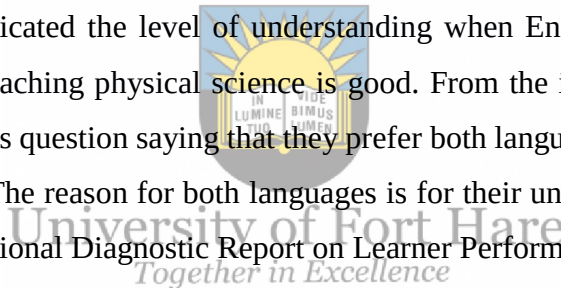
Some factor that are linked with the impediment of cognitive learning in the area of performance were highlighted according to the overview of the information from the participant. Looking at the response of the respondents many concur apart from some few, their interest and positive attitude they have towards physical science. As it is known that interest is a form of attitude portrayed in any subject especially when it comes to a subject like physical science. Interest especially in learning according according to Woolfolk (2007:206) is a process through which experience causes permanent changes in knowledge or behaviour. Interest breeds learning and the discovery learning calls for active participation of the learner with interest (Zenda, 2016), Zenda (2016) cited Kramer that the learner is viewed as an active explorer and is capable of discovering new information independently (Kramer, 2002:6-7). Positive Attitude could help learners to discover scientific concepts and principles for themselves rather than through other social groups, such as educators (Department of Basic Education, 2011:9).Dhrurumraj (2013) referred to



the department of education saying that physical sciences encourages a responsible and ethical attitude towards learning, constructing and applying science, and it allows for reflection and debates on theories and scientific models (Department of Education 2003). Therefore, the researcher is of the view that negative attitude hamper the cognitive learning of the learners for their performance.

Despite their acknowledgement of their interest and positive attitude for physical science many participants in this research reported that parental involvement in their subject is lacking. Approximately 71% of learners were unable to get assistance from their parents in Physical Sciences. Many learners were living with grand-parents or with parents who have never studied Physical Sciences as a school subject. The Department of Basic Education (2010:5) indicates that when parents participate in the school work of their children they develop and improve the learning of their children.

From the findings of the present study it was discovered separately that these words of the respondents indicated the level of understanding when English is used as a medium of instruction in teaching physical science is good. From the interview 50% of the learners responded to this question saying that they prefer both languages to be used by the teacher to teach them. The reason for both languages is for their understanding. Also, it has been noted in the National Diagnostic Report on Learner Performance 2012, many learners had problems with interpretation of questions in Physical Sciences (Department of Education 2012:165-198). A plausible reason is the language problem. In the aspect of educator – learner relationship, the respondents indicated that having a relationship that is not tense, but friendly is necessary for learning. They also indicated that teachers had a good and friendly relationship with the learners to develop their confidence, interest and participation in the classroom. This agrees with Agah et al. (2016) who revealed that learners would develop a more positive attitude towards their subject when the educators are supportive, equitable, friendly and helpful to them.



4.5.0 Factors that can enhance the learner's cognitive learning for performance

4.5.1 The motivation of the learners

On the aspect of motivation, the respondents identified that the teacher get them motivated them enough to like physical science. From the 154 of the respondents many of the learners indicated that their teachers do motivate them in physical science. Almost 70% of the learners had a high rate of their teachers motivating them. The remaining 30% actually score low of their teachers in the area of motivation. One of the learners at the interview said that the teacher does not really get time to motivate. This is what the respondent had to say;

Lr2B: Not really because aaaah... he, he doesn't motivate us sometimes. We don't get much time to be motivated. We just get to the subject and learn.

4.5.2 The teaching approach

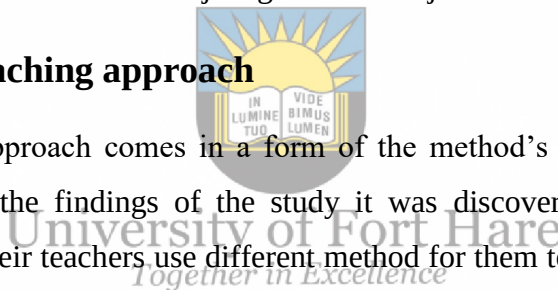
The teaching approach comes in a form of the method's the teacher uses to teach the learners. From the findings of the study it was discovered that most of respondents indicated that their teachers use different method for them to understand the subject. 75% of the overall respondents actually responded that the approach of their teachers that are used in teaching is good. A respondent said this

Lr2A agreed in using the teacher's method but use my own method. Respondent Lr1B response to not using the teacher's method. 18% of the learners said "No" to the question. This means that their teacher does not use different method of approach to teach them.

A respondent was not really specific in statement but said that the teacher does a little bit of demonstration

Lr2C said *"not really but not really a lot, but he does have a little bit of demonstration here and there."*

Looking at the question that related to the above question which says whether they use their teacher's method in solving physical science problems. Many respondents that they use their teacher's method. The findings from the interview shows that 13 respondents



revealed that they use their teachers' method. There are some that says that though they use their teacher's method but they also use their own. A respondent said this

Lr2A agreed in using the teacher's method but use my own method.

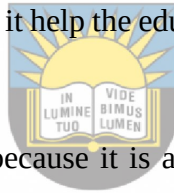
This was also confirmed by the educators that they do give the learners different method for their understanding. Finding from the interview of the educators shows that all four (100%) responded to the question to be given different method of teaching for the learners understanding. Two of the respondents indicated that the learners were taught using the group work. The two respondents made the following statement;

EdrA: Yes, for example in Grade 10 as a small class, I set them in groups and provide what I gave them to put it in summary.

EdrB: mhmhm. Mostly group work. Using group methods, grouping them and giving them what to work as a group

A respondents clearly stated that the learners were given lecture method, group work and demonstration, because of how it help the educator to cover a lot of lesson. The respondent made the following statement;

EdrC: The lecture method because it is a, it makes me cover a lot of things within a lesson. Another method I also use is group work as well as aaah yeah demonstration.



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The heads of department confirmed from the finding that many of the learners enjoy their method of teaching. Three respondents revealed from the question that was asked whether the teachers give the learners different method of teaching for their understanding. The heads of department revealed that the teacher gives the learners different methods which include group work, lecture method and practicals. These following were said;

HoD A: Yes. Group work and lecture method.

HoD B: Yes they do understand that learners have different learning styles. Those who are so, who need more of the practical side, they do so. Mhmhm, those who can take the abstract things, they also accommodate them in that line.

HoD C: Yes we try different approaches and eeeh try to relate things to everyday life. Eeeh so that it's not just theoretical and aaaah, we do, we try whatever method to get them understand the work, yes.

4.5.3 Cognitive level of learners

The way in which learners typically receive and process information was revealed to have relation to academic performance and cognitive ability of the learner. A finding from the respondent shows how the learners were able to process information that they receive when been taught. Most of the respondents who were asked to indicate when they think about what they did yesterday are they most likely to get a picture. The overall response of the learners shows that they do get picture and a word of what they were taught a day before. Looking at the percentage responses to the question, it was clear that both respondents who tend to understand the overall structure but fuzzy about detail did respond to the question were equal. Evidence of these responses are below show

Figure 4.8.19 shows the response of the respondents. 33 (33.3%) indicated “good”, 21 (21.3%) indicated “very good”, and 18 (18.7%) said “fair”. However, sixteen (16.7%) responded “excellent” while respondents of about 10 % did respond “poor” to the question. Question 20 asked respondents when they think about what they did yesterday are they most likely to get a word. 31 (31.8%) indicated they most likely get a word, 27 (27.9%) responded “fair”, 19 (19.5%) responded “very good”. However, respondents responding to “excellent” and “poor” did have 10(10.4%) each. Thus, a majority of the respondents will most likely get a word.

Question 23 of the 154 respondents, 37. (37.3%) indicated “good”, 37 (37.3%) indicated “fair”, 11 (11.3%) did respond “very good”. Eight (8.7%) responded “poor” and 5((5.3%) respond “excellent” to the question. Looking at the percentage responses to the question, it was clear that both respondents who tend to understand the overall structure but fuzzy about detail did respond to the question were equal.

4.5.4 The inclusive of practical work in physical science

Practical work is known to supports development of scientific skills, thinking skills and how scientists work. It helps, learners to be exposed to basic processes of science. From the open ended question the respondents stated how they wanted physical science to be handled in order to improve their performance. It was revealed that 19.5% indicated the

educator should make the lessons more and more experiments. Other respondents asked for more lab and the stuff that is used or important in science. The following were the statements the respondents made:

Bring things that we don't have for e.g. lab so that we can do practicals

We need lab to do our practicals

I want physical science to be handled by doing everything in practicals and the teacher may try to explain. We need to be involved by a teacher in order to improve and we need to participate.

I think we must have a teacher that we will understand and we must have more

Have less verbal explanation by the teacher and more practical.....

I want it to be taught in such a way that if we are learning about experiments we do each and every experiment based on that topic so that it will be easier to remember

I want it to be taught in such a way that if we are learning about experiments, we do each and every experiment based on that topic so that it will be easier to remember

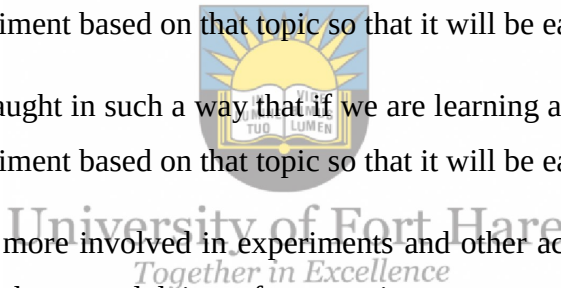
I want us to be more involved in experiments and other actual practices rather than just learning a lot of theory and doing a few experiments

Finding also shows that both the teacher and the support of the HoD's use practical to help the learners to have more understanding. One of the educators responded by saying that one of the different teaching methods used for their understanding is practicals. The responded made this statement

EdrC: *The lecture method because it is a, it makes me cover a lot of things within a lesson. Another method I also use is group work as well as aaah yeah demonstration.*

Three (75%) of the four HoD's responded that practical side will enhance the studies of the learners. This is statement made.

HoD B: *The best method are those that involve eeeehm...the practical side, yeah, doing thing and learners see things been done, instead of telling learners, learners see themselves. Yeah*



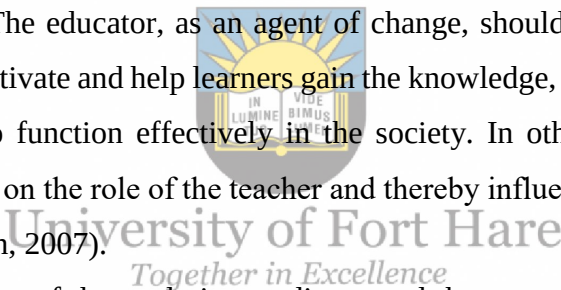
HoD C: *Eeeh, it involves not too much of explaining but a lot of practice*

HoD D: *There is chalkboard method and demonstration because physical science is about demonstration and you have to do a practical work just to, to, to put more light in the subject. In other word it can be called a process skill.*

4.5.5. Summary of findings and discussion on factors that can enhance the learner's cognitive learning for performance

Some factors that enhance cognitive learning in the area of performance were highlighted according to the overview of the information from the respondents. On the aspect of motivation, the respondents identified that the teachers get them motivated enough to like physical science. On the other hand there are those few who say that the teacher, does not really get time to motivate. The role of the educator is much paramount in the motivation of the learner. The educator, as an agent of change, should recognize that his/her major purpose is to motivate and help learners gain the knowledge, skills, feelings and values that learners need to function effectively in the society. In other words, both teaching and learning depend on the role of the teacher and thereby influence the learners' performance (Adu& Olatodun, 2007).

From the findings of the study it was discovered that most of respondents indicated that their teachers use different method for them to understand the subject and the approach of their teachers that are used in teaching is good. . Many of the learner interviewed revealed that they use their teacher's method. There are some that says that though they use their teacher's method but they also use their own. In this way the researcher believes that most of the learners are involve in the active learning. Teaching approach is a two way process which is uses as active learning outcome based education (OBE) placed tremendous emphasis on making learning a two-way process. Learner performance cannot solely depend on active learning, for those that have taught physical sciences and are aware of the content of the subject will agree that at times the educator is required to adopt a more passive strategy. During this process of active learning the learner not only takes in the information, but also actively engages with the learning material in some way. According



to Woolfolk (2007:487), active teaching is teaching characterised by high levels of teacher explanation, together with demonstrations and student interaction.

In the area of cognitive level of learners finding from the respondent shows how the learners were able to process information that they receive when been taught. The overall response of the learners shows that they do get picture and a word of what they were taught a day before. Looking at the percentage responses to the question, it was clear that both respondents who tend to understand the overall structure but fuzzy about detail did respond to the question were equal. With this the researcher believe that by developing lessons that are demonstrative and investigative the cognitive ability of learners are enhanced. Also, the different views and ideas of each learner can be developed through sharing of ideas, allowing for constructivism. The implication of this is that word and picture that makes the learners to remember what they are taught could be a way of enhancing their cognitive learning skill. This is supported by Giannakopoulos and Buckley (2009:327-328), the cognitive skills (critical thinking, creativity and problem solving) of learners are of vital importance for learners to succeed as they are used in the creation and application of knowledge in real life situations. Mokoena (2014) also purported that “critical thinking implies a process where information is sifted. It involves an intellectually disciplined process of active and skilled conceptualization, application analysis, synthesis and evaluation of information that is collected by means of investigating, observation, experience, reflection, reasoning or communication and the use of the results to make progress in the field in which one works”. The above indicate that physical sciences learning will require critical thinking skills as is indicated in the CAPS document that purpose of Physical sciences is to make learners aware of their environment and equip learners with investigating skills relating to physical and chemical phenomena, for example lightning and solubility.

More so, Practical work which is known to supports development of scientific skills, thinking skills and how scientists work, revealed the learners stated how they wanted physical science to be handled in order to improve their performance with the educators making the lessons more and more of experiments, more labs and the lab stuffs.). Practical work for learners caters for learning in different ways such as experiential, independent,

team and peer dialogue (Zimbardi, Bugarcic, Colthorpe, Good & Lluca, 2013). Practical work also provides learners with evidence to support their understanding and to concretise scientific principles (Jormanainen, 2008)

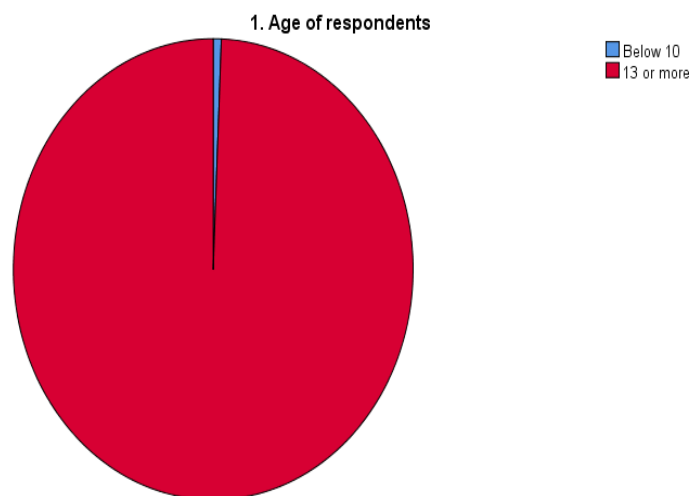
4.4.2 Quantitative Findings

The questionnaire was arranged to cover two main sections of the research topic. Section A of the questionnaire looked at the background information of the learners, while section B examined their views on physical science and section C is an open ended question that allowed respondents to provide their own response to the question.

Table 4.8.1

1. Age of respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 10	1	.6	.6	.6
	13 or more	153	99.4	99.4	100.0
	Total	154	100.0	100.0	

As depicted in table 4.8.1, Most respondents (99.4%, N=153) are 13 years old or more. Only one respondent was below the age of 10.



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	82	53.2	53.2	53.2
	Female	72	46.8	46.8	100.0
	Total	154	100.0	100.0	

As depicted in table 4.8,2 53.2% of respondents were male (N=82) compared to 46.8% of female respondents (N=72)

Table 4.8.3

3. Where does the respondent live?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Imbali 3	3	1.9	2.0	2.0
	Cato Ridge	1	.6	.7	2.7
	Pietermaritzburg	37	24.0	25.0	27.7
	Henly Dam (PMB)	1	.6	.7	28.4
	Westgate (Ostuizen) road	1	.6	.7	29.1
	Pietermaritzburg (Panorama)	1	.6	.7	29.7
	Scottsville extension (Pietermaritzburg)	1	.6	.7	30.4
	Imbali	2	1.3	1.4	31.8
	Edendale Sinothingi	1	.6	.7	32.4
	Thornville (Pietermaritzburg)	1	.6	.7	33.1
	Richpark (Pietermaritzburg)	1	.6	.7	33.8
	Imbali Unit 1	1	.6	.7	34.5
	Richmond	40	26.0	27.0	61.5
	Zondi store location	1	.6	.7	62.2
	ElovuFielden Street	1	.6	.7	62.8
	Mgxobeleni location	1	.6	.7	63.5
	Richmond-Siyathuthuka-Near Hall	4	2.6	2.7	66.2
	Richmond-Magoda Location	2	1.3	1.4	67.6
	Congo	1	.6	.7	68.2
	Simzomeni (Ezakhweni)	1	.6	.7	68.9

	Richmond-Mxasweni	1	.6	.7	69.6
	Richmond-Sigcekini	1	.6	.7	70.3
	Richmond-Shayamoya	1	.6	.7	70.9
	Richmond (13)	1	.6	.7	71.6
	Richmond-Sahla	1	.6	.7	72.3
	Richmond-Maswazini Mission	1	.6	.7	73.0
	Sweetwaters (Siyanda Secondary School)	28	18.2	18.9	91.9
	Sweetwaters	5	3.2	3.4	95.3
	Richmond-Endaleni	1	.6	.7	95.9
	Richmond-Mgxobeleni	1	.6	.7	96.6
	Camperdown, Manderston	1	.6	.7	97.3
	Westgate (Pietermaritzburg)	1	.6	.7	98.0
	Pietermaritzburg-Scottsville	1	.6	.7	98.6
	Durban/Pietermaritzburg	1	.6	.7	99.3
	Lion Park	1	.6	.7	100.0
	Total	148	96.1	100.0	
Missing	999	6	3.9		
Total		154	100.0		

3. Where does the respondent live?

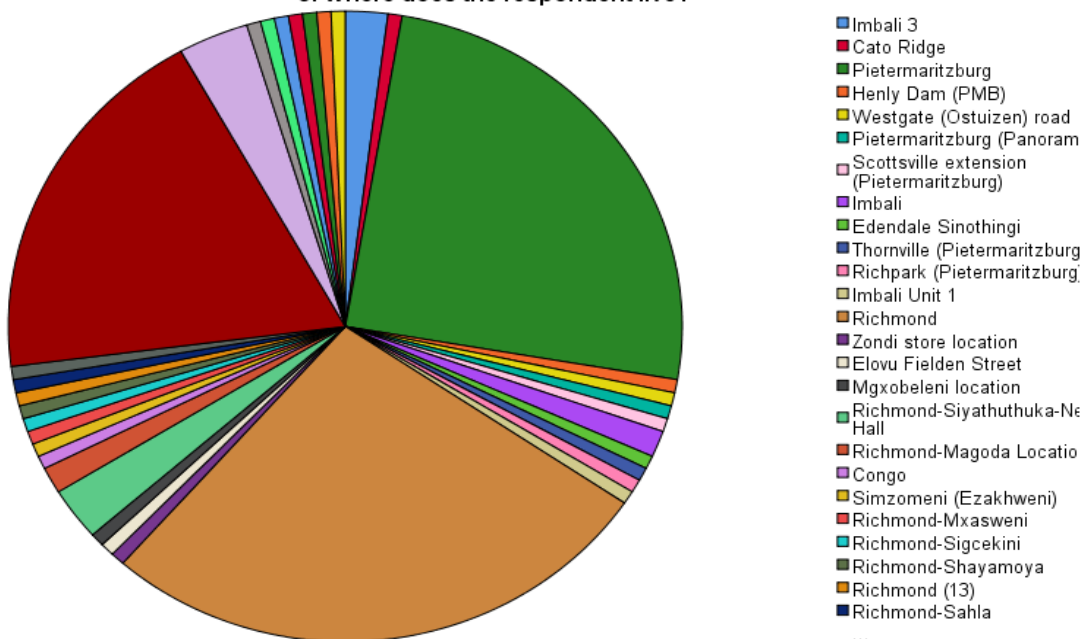
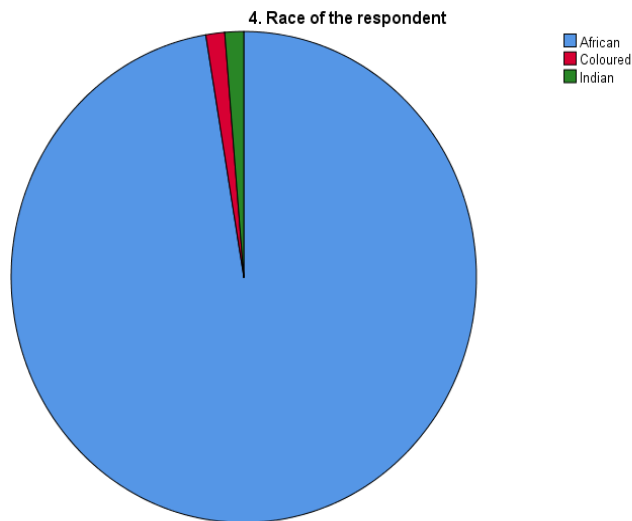


Table 4.8.4

4. Race of the respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	African	149	96.8	97.4	97.4
	Coloured	2	1.3	1.3	98.7
	Indian	2	1.3	1.3	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

Most respondents were Africans (97.4%, N= 149).

**Table 4.8.5**

5. Whom do you live with?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Both parents	63	40.9	40.9	40.9
	Father only	6	3.9	3.9	44.8
	Mother only	49	31.8	31.8	76.6
	Guardian	36	23.4	23.4	100.0
	Total	154	100.0	100.0	

As depicted in table 5, most respondents are living with both parents (40.9%, N=63) followed by those who are living with their mothers only (31.8%, N=49) and those living with their guardians (23.4%, 36%). Only few respondents (N=6, 3.9%) are living with their fathers only.

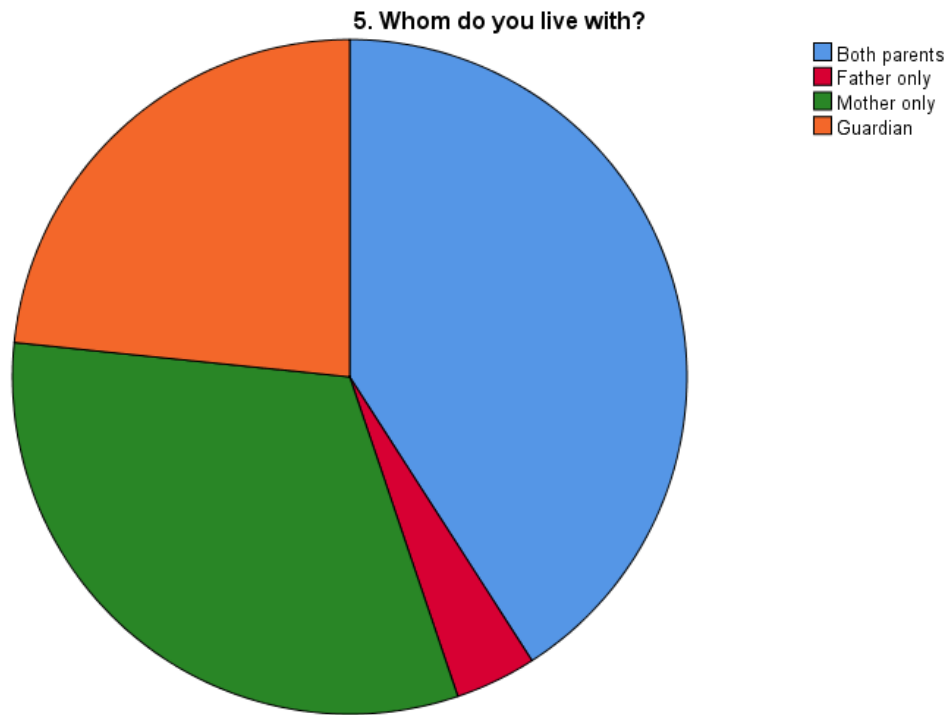


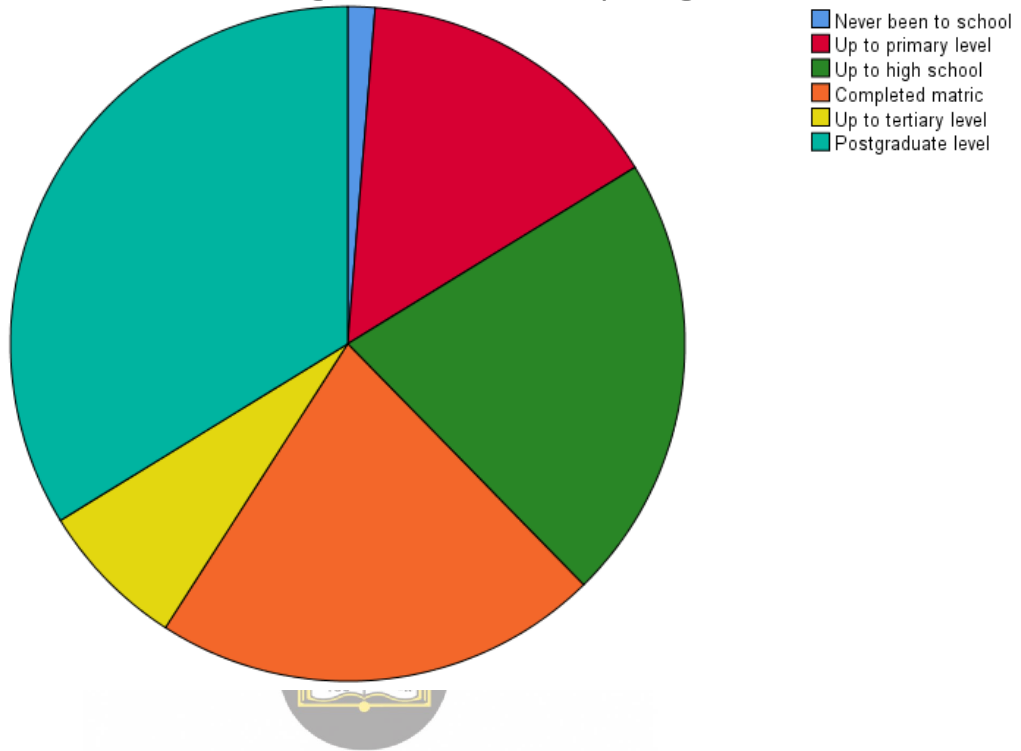
Table 4.8.6

6. The highest educational level of parent/guardian					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never been to school	2	1.3	1.3	1.3
	Up to primary level	23	14.9	14.9	16.2
	Up to high school	33	21.4	21.4	37.7
	Completed matric	33	21.4	21.4	59.1
	Up to tertiary level	11	7.1	7.1	66.2
	Postgraduate level	52	33.8	33.8	100.0
	Total	154	100.0	100.0	

Most the respondents parents have studied up to a postgraduate level (33.8%, N=52). 21.4% (N=33) of the respondents parents had completed matric or had studied to the high

school level. Respondents with parents who never been to school were the least represented in this study (1.3%, N=2)

6. The highest educational level of parent/guardian



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Table 4.8.7

7. Employment status of parents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unemployed	34	22.1	22.4	22.4
	Employed	109	70.8	71.7	94.1
	Unknown	7	4.5	4.6	98.7
	Father is unemployed but mother is employed	1	.6	.7	99.3
	Father is employed but mother is unemployed	1	.6	.7	100.0
	Total	152	98.7	100.0	
Missing	999	2	1.3		
Total		154	100.0		

Most of the learners' parent were employed (71.7%, N=109).

Table 4.8.8

8. What is your mode of transportation to school?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Walking	90	58.4	58.8	58.8
	Public transport	51	33.1	33.3	92.2
	Private transport	10	6.5	6.5	98.7
	Walking and public transportation	1	.6	.7	99.3
	Public and Private transportation	1	.6	.7	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

Most of the respondents attend school by walking (58.8%, N= 90) followed by those who use public transport (33.3%, N=51). Only a few uses private transport (6.5%, N=10)

Table 4.8.9

9. What is your attitude towards the subject physical science?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	11	7.1	7.1	7.1
	Very good	23	14.9	14.9	22.1
	Good	54	35.1	35.1	57.1
	Fair	43	27.9	27.9	85.1
	Poor	23	14.9	14.9	100.0
	Total	154	100.0	100.0	

The first question that was asked of respondents was about their attitude towards the subject physical science. Few respondents 54 (35.1%) indicated “good” attitude towards the subject. 43 (27.9 %) indicated “fair” while 23 (14 %) indicated that their attitude is “Very good” and 11 (7%) indicated “excellence”. However, 23 (14%) indicate “poor” attitude for the subject according to the table above.

10. What is your level of understanding when English is used as a medium of instruction in teaching Physical science

Table 4.8.10		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	21	13.6	13.6	13.6
	Very good	42	27.3	27.3	40.9
	Good	55	35.7	35.7	76.6
	Fair	28	18.2	18.2	94.8
	Poor	8	5.2	5.2	100.0
	Total	154	100.0	100.0	

In question 10, respondents were asked to indicate the level of understanding when English is used as a medium of instruction in teaching Physical science.

Figure 4.8.10 shows that respondents that indicated “good” were 55 (35.7%) which is the highest. The respondents that indicated “very good” were about 42 (27.3%), followed by the respondents with 28 (18.2%); then the respondents with 21 (13.6%) indicated “excellence” and the least respondents that indicated “poor” had 8 (5.2%).



11. What is your level of confidence in answering physical science questions?

Table 4.8.11		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very high	3	1.9	2.0	2.0
	High	61	39.6	39.9	41.8
	Low	77	50.0	50.3	92.2
	Very low	12	7.8	7.8	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

In question 11, respondents were asked to indicate their level of confidence in answering physical science questions. .

Table 4.8.11 shows that 3 (2%) of the respondents indicated “very high”, while 77 (50.3 %) of the learners indicated “Low”, followed by 61 (39.9%) respondents which indicated “high”. 12 (7.8%) of the respondents did indicated “very low”.

12. How do you evaluate the methods your physical science educator uses in teaching?

Table 4.8.12		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	23	14.9	15.0	15.0
	Very good	25	16.2	16.3	31.4
	Good	52	33.8	34.0	65.4
	Fair	33	21.4	21.6	86.9
	Poor	20	13.0	13.1	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

Question 12 asked respondents to indicate How they evaluate the methods their physical science educator uses in teaching?

Table 4 above shows that 52 (33.8 %) of the learners indicated “good”. 33 (21.6%) indicated “Fair” 25(16.3%) of the respondents indicated “very good” while 23(15%) responded “excellence” and 20 (13.1%) did respond, “Poor”.



13. What is the level of motivation given you by your physical science educator in studying physical science?

Table 4.8.13		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very high	41	26.6	27.2	27.2
	High	66	42.9	43.7	70.9
	Low	30	19.5	19.9	90.7
	Very low	14	9.1	9.3	100.0
	Total	151	98.1	100.0	
Missing	999	3	1.9		
Total		154	100.0		

In question 13, respondents were asked what for the level of motivation given by their physical science educator in studying physical science.

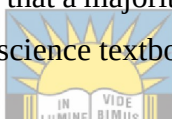
Table 4.8.13 illustrates that 66 (42.7 %) indicated “high” and 41 (27.2%) indicated “very high”. 30(19.9%) respondents indicated “Low” while respondents that indicated “very low is about 14 (9.3%) This therefore shows the majority of the respondents were motivated.

14. How do you evaluate the examples and activities in the Grade 10 physical science textbooks

Table 4.8.14		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	9	5.8	5.9	5.9
	Very good	34	22.1	22.4	28.3
	Good	61	39.6	40.1	68.4
	Fair	33	21.4	21.7	90.1
	Poor	15	9.7	9.9	100.0
	Total	152	98.7	100.0	
Missing	999	2	1.3		
Total		154	100.0		

In Question 14, respondents were asked how they evaluated the examples and activities in the Grade 10 physical science textbooks

From a total of 154 respondents, 61(40.1%) indicated “good “and 34(22.4%) respondents indicated “very good”.33(21.7%) indicated “fair” while 9 (5.9%) respondents indicated “excellent”. It is therefore clear that a majority of the respondents favour the examples and activities in Grade 10 physical science textbooks.



15. What is the state of your study of physical science at home after school?

Table 4.8.15		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	4	2.6	2.6	2.6
	Very good	24	15.6	15.6	18.2
	Good	44	28.6	28.6	46.8
	Fair	45	29.2	29.2	76.0
	Poor	37	24.0	24.0	100.0
	Total	154	100.0	100.0	

Question 15 asked what the state of the learners’ study of physical science at home after school is.

Table 4.8.15 depicts how often the respondents’ states of study of the 154 respondents. 45 (29.2%) responded “fair” and 44(28.6%) responded “good”. 37(24%) responded “poor” and 24(15.6 %) responded “very good”. While 4 (2.6%) responded “excellence”.

16. Do you understand physical science better after you try it out?

Table 4.8.16		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	18	11.7	11.7	11.7
	Very good	46	29.9	29.9	41.6
	Good	50	32.5	32.5	74.0
	Fair	26	16.9	16.9	90.9
	Poor	14	9.1	9.1	100.0
	Total	154	100.0	100.0	

Question 16 asked the learners whether they understand physical science better after trying it out.

Table 4.8.16, shows that 50 (32.5%) indicated that they understand the subject better after trying it out, 46 (29.9%) said “very good” and 26 (16.9%) indicated “fair”. Eleven (11.7%) respondents indicated “excellent” while 14(9.1%) indicated “poor”. This shows that a majority of the learners understand physical science better after trying it out



17. Do you understand physical science better by trying it through

Table 4.8.17		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	12	7.8	7.8	7.8
	Very good	27	17.5	17.5	25.3
	Good	56	36.4	36.4	61.7
	Fair	38	24.7	24.7	86.4
	Poor	21	13.6	13.6	100.0
	Total	154	100.0	100.0	

Question 17 asked learner to indicate whether they understand physical science better by trying it through.

Figure 4.817 shows that 56 (36.4%) indicated “good”. 38 (24.7%) were indicating “fair”, 27 were indicating very good(17.5%) ,21 (13.6%) were indicating “poor”, while 12 (7.8%) respondent did “excellent to the question.

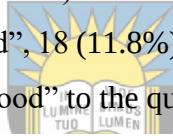
18. How do you rate your parents/guardians' assistance or supervision at home?

Table 4.8.18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	18	11.7	11.8	11.8
	Very good	16	10.4	10.5	22.2
	Good	29	18.8	19.0	41.2
	Fair	40	26.0	26.1	67.3
	Poor	50	32.5	32.7	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

Question 18 asked How the learners rate their parents/guardians' assistance or supervision at home.

Figure 4.8.18 shows that 50 (32.7%) were indicating “poor”, 40 (26.1%) indicated “fair”, 29 (19%) were indicating “good”, 18 (11.8%) respondent did indicated “excellence”, while 16 (10.5%) responded “very good” to the question



19. When I think about what I did yesterday I am most likely to get a picture

Table 4.8.19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	25	16.2	16.7	16.7
	Very good	32	20.8	21.3	38.0
	Good	50	32.5	33.3	71.3
	Fair	28	18.2	18.7	90.0
	Poor	15	9.7	10.0	100.0
	Total	150	97.4	100.0	
Missing	999	4	2.6		
Total		154	100.0		

Question 19 asked the respondents to indicate when they think about what they did yesterday are they most likely to get a picture.

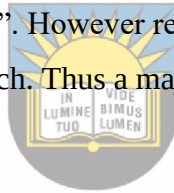
Figure 4.8.19 shows the response of the respondents. 50 (33.3%) indicated “good”, 32 (21.3%) indicated “very good”, and 28 (18.7%) said “fair”. However, 25 (16.7%) responded “excellence” while respondents of about 15 (10%) did respond “poor” to the question.

20. When I think about what I did yesterday I am most likely to get a word

Table 4.8.20

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	16	10.4	10.4	10.4
	Very good	30	19.5	19.5	29.9
	Good	49	31.8	31.8	61.7
	Fair	43	27.9	27.9	89.6
	Poor	16	10.4	10.4	100.0
	Total	154	100.0	100.0	

Question 20 asked respondents when they think about what they did yesterday are they most likely to get a word. 49 (31.8%) indicated “good”, 43 (27.9%) responded “fair”, 30 (19.5%) responded “very good”. However respondents responding to “excellent” and “poor” did have 16 (10.4%) each. Thus a majority of the respondents will most likely get a word.



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21. I tend to understand details of a subject but may be fuzzy about its overall structure

Table 4.8.21

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	3	1.9	2.0	2.0
	Very good	18	11.7	12.1	14.1
	Good	64	41.6	43.0	57.0
	Fair	54	35.1	36.2	93.3
	Poor	10	6.5	6.7	100.0
	Total	149	96.8	100.0	
Missing	999	5	3.2		
Total		154	100.0		

Of the 154 respondents, 64(43%) respondents did indicated “good”.54 (36.2%) indicated “fair”, 18 (12.1%) indicated “very good”. 10(6.7%) did indicated “poor” and 3(2%) indicated “excellent”.

22. I tend to understand the overall structure but may be fuzzy about details

Table 4.8.22

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	8	5.2	5.3	5.3
	Very good	17	11.0	11.3	16.7
	Good	56	36.4	37.3	54.0
	Fair	56	36.4	37.3	91.3
	Poor	13	8.4	8.7	100.0
	Total	150	97.4	100.0	
Missing	999	4	2.6		
Total		154	100.0		

Question 22, of the 154 respondents, 56 (37.3%) indicated “good”, 56 (37.3%) indicated “fair”, 17 (11.3%) did respond “very good”, 13 (8.7%) responded “poor” and 8 (5.3%) respond “excellent” to the question. Looking at the percentage responses to the question, it was clear that both respondents who tend to understand the overall structure but fuzzy about detail did respond to the question were equal.

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23. When I am learning something new, it helps me to talk about it

Table 4.8.23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	45	29.2	29.2	29.2
	Very good	42	27.3	27.3	56.5
	Good	44	28.6	28.6	85.1
	Fair	18	11.7	11.7	96.8
	Poor	5	3.2	3.2	100.0
	Total	154	100.0	100.0	

Question 23 asked the learners when they are learning something new, does it help them to talk about it.

Of the 154 respondents, 45 (29.2%) indicated “excellent”, 44 (28.6 %) had indicated “good”. 42 (27.3%) did responded “very good”, 18(11.7%) indicated “fair” while 5 (3.2%) responded “poor” to the question

24. When I am learning something new, it helps me to think about it

Table 4.8.24

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	46	29.9	29.9	29.9
	Very good	37	24.0	24.0	53.9
	Good	41	26.6	26.6	80.5
	Fair	19	12.3	12.3	92.9
	Poor	11	7.1	7.1	100.0
	Total	154	100.0	100.0	

Question 24 asked the learners when they are learning something new, does it help them to think about it.

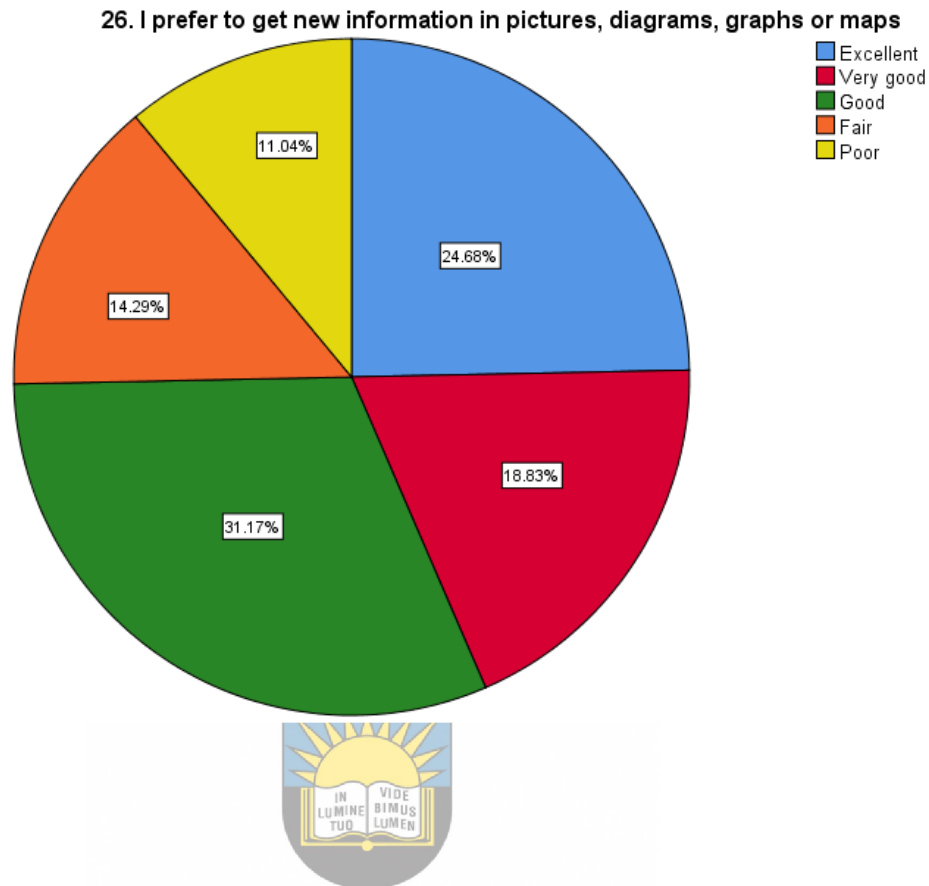
Of the 154 respondents, 46 (29.9%) indicated “excellent”, 41 (26.6 %) had indicated “good”. 37 (24 %) did responded “very good”, 19(12.3%) indicated “fair” while 11(7.1%) responded “poor” to the question



25. I prefer to get new information in pictures, diagrams, graphs or maps

Table 4.8.25

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	38	24.7	24.7	24.7
	Very good	29	18.8	18.8	43.5
	Good	48	31.2	31.2	74.7
	Fair	22	14.3	14.3	89.0
	Poor	17	11.0	11.0	100.0
	Total	154	100.0	100.0	

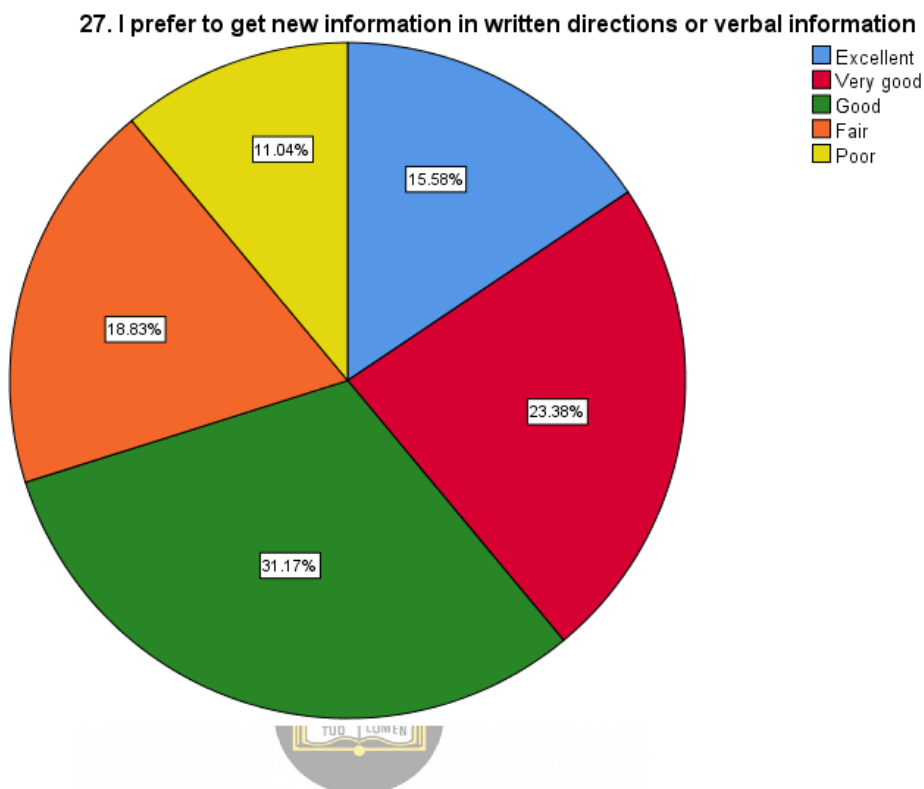


48 respondents(31%) of 154 who prefer to get new information in pictures, diagrams, graphs or maps indicated “good”, 38(24.7%) of the respondents indicated “very good”, 29 (18.8%) of the respondents indicated “very good”, 22(14.3%) of the respondents indicated “fair”, while 17(11%) responded “poor”. This indicates that many of the learners prefer to get new information in pictures, diagrams, graphs or maps.

Table 4.8.26

26. I prefer to get new information in written directions or verbal information					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	24	15.6	15.6	15.6
	Very good	36	23.4	23.4	39.0
	Good	48	31.2	31.2	70.1
	Fair	29	18.8	18.8	89.0
	Poor	17	11.0	11.0	100.0

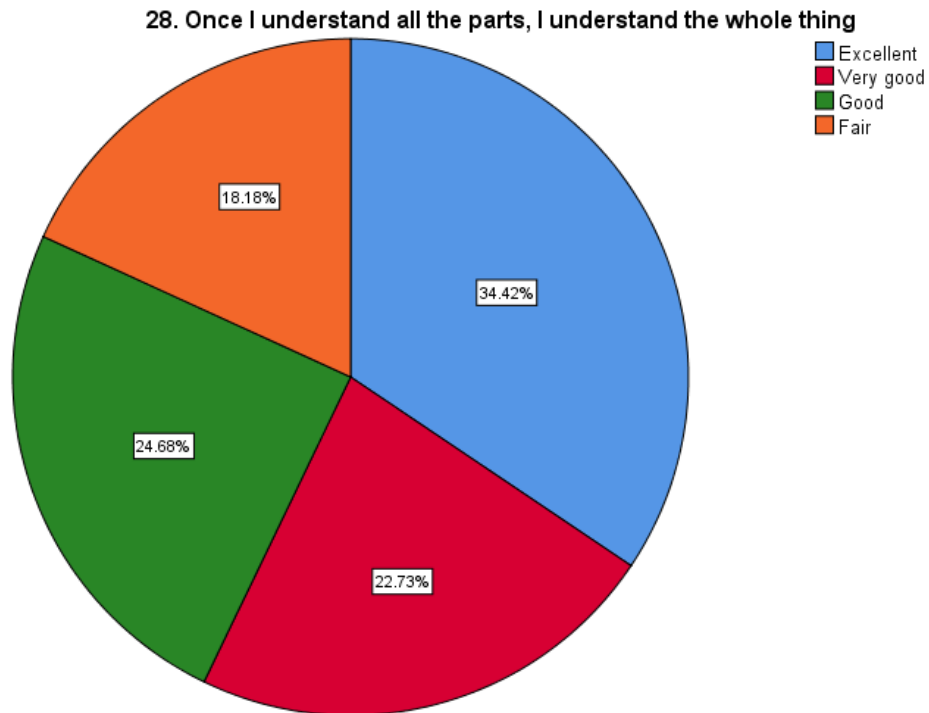
	Total	154	100.0	100.0	
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Question 26 says I prefer to get new information in written directions or verbal information. Out of 154 respondents, 48 (31.2%) responded “good”. 36 (23.4%) said “very good”, 29 (18.8%) responded with “fair” to the question. 24 (15.6%) said “excellent” while 17(11%) responded to “poor”.

Table 4.8.27

28. Once I understand all the parts, I understand the whole thing					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	53	34.4	34.4	34.4
	Very good	35	22.7	22.7	57.1
	Good	38	24.7	24.7	81.8
	Fair	28	18.2	18.2	100.0
	Total	154	100.0	100.0	



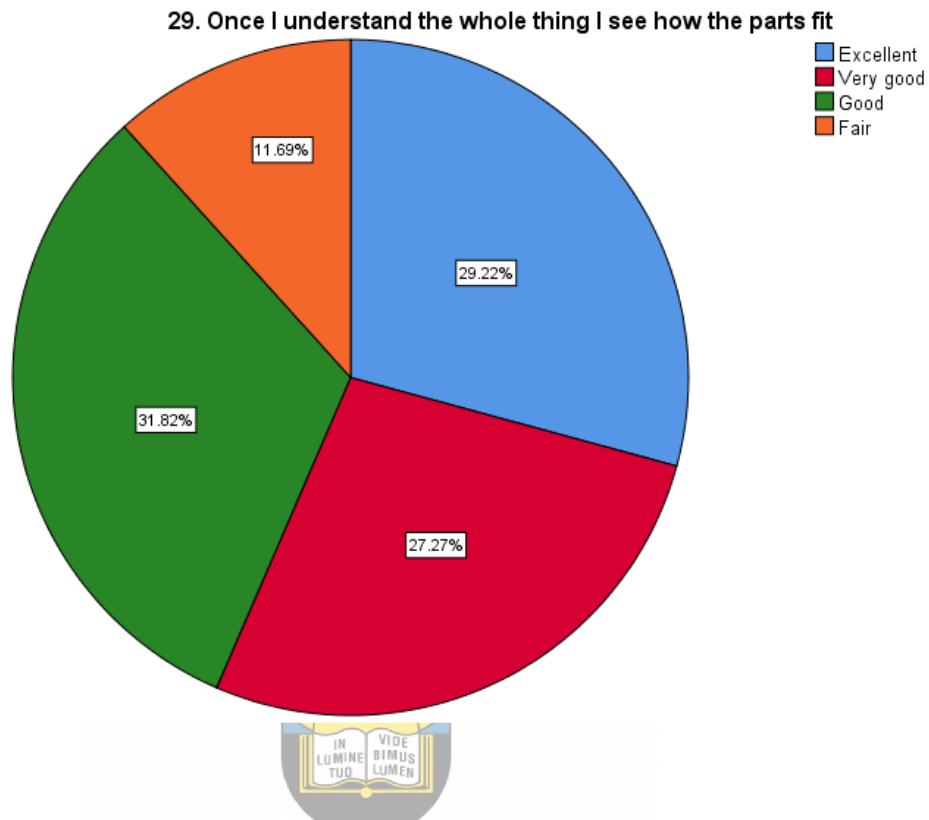
Question 27 said once I understand all the parts, I understand the whole thing.

Out of 154 respondents, 53(34.4%) responded “excellent”. 38 (24.7%) said “good”, 35(22.7%) responded with “very good” to the question. 28 (18.2%) said “fair”.

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Table 4.8.28

28. Once I understand the whole thing I see how the parts fit					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	45	29.2	29.2	29.2
	Very good	42	27.3	27.3	56.5
	Good	49	31.8	31.8	88.3
	Fair	18	11.7	11.7	100.0
	Total	154	100.0	100.0	

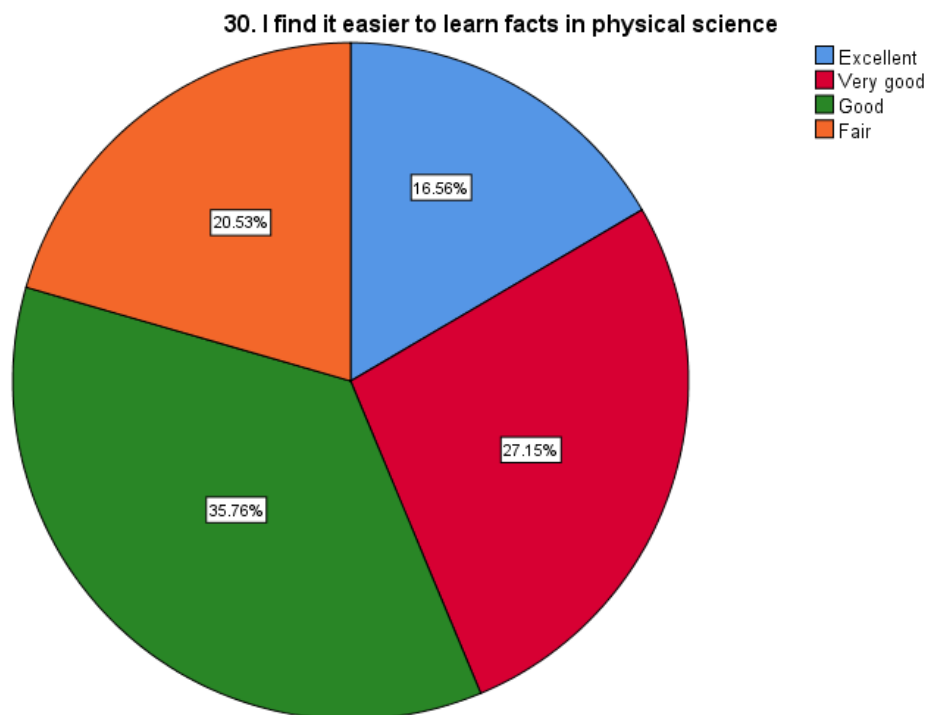


Question 28 said that once I understand the whole thing I see how the parts fit.

Out of 154 respondents, 49(31.8%) responded “good”, 45(29.2%) said “excellent”, 42(27.3%) responded with “very good”, while 18 (11.7%) said “fair” to the question.

Table 4.8.29

29. I find it easier to learn facts in physical science					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	25	16.2	16.6	16.6
	Very good	41	26.6	27.2	43.7
	Good	54	35.1	35.8	79.5
	Fair	31	20.1	20.5	100.0
	Total	151	98.1	100.0	
Missing	999	3	1.9		
Total		154	100.0		

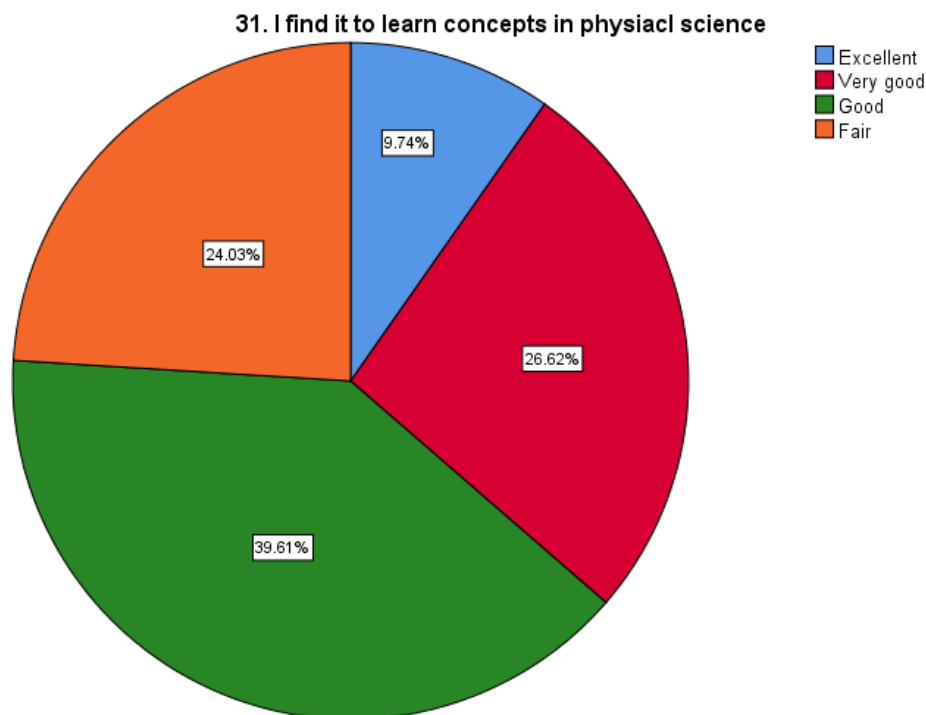


Question 29 said I find it easier to learn facts in physical science.

Out of 154 respondents, 54(31.8%) responded “good”, 41(29.2%) said “excellent”, 31(27.3%) responded with “very good”, while 25(16.6%) said “fair” to the question.

Table 4.8.30

30. I find it to easier to learn concepts in physical science					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	15	9.7	9.7	9.7
	Very good	41	26.6	26.6	36.4
	Good	61	39.6	39.6	76.0
	Fair	37	24.0	24.0	100.0
	Total	154	100.0	100.0	



Question 30 a question, asked the respondents said I find it to easier to learn concepts in physical science.

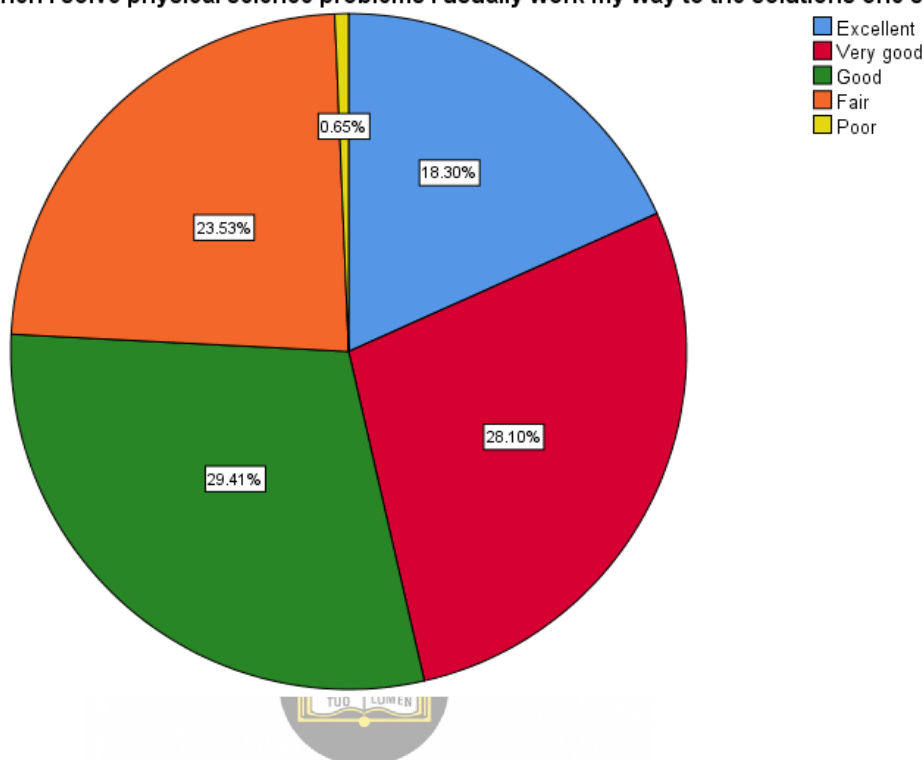
Table 4.8.31 shows that, out of 154 respondents, 61 (39.6%) responded “good”, 41 (28.6%) said “very good”, 37 (24 %) said “fair”, while 15 (9.7%) responded “excellent” to the question. (1.1%) student did not respond to the question. More than half the learners find it to easier to learn concepts in physical science.

.Table 4.8.31

31. When I solve physical science problems I usually work my way to the solutions one step at a time					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	28	18.2	18.3	18.3
	Very good	43	27.9	28.1	46.4
	Good	45	29.2	29.4	75.8
	Fair	36	23.4	23.5	99.3
	Poor	1	.6	.7	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		

Total	154	100.0		
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32. When I solve physical science problems I usually work my way to the solutions one step at a time



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Question 31 a response question, asked the respondents said when I solve physical science problems I usually work my way to the solutions one step at a time.

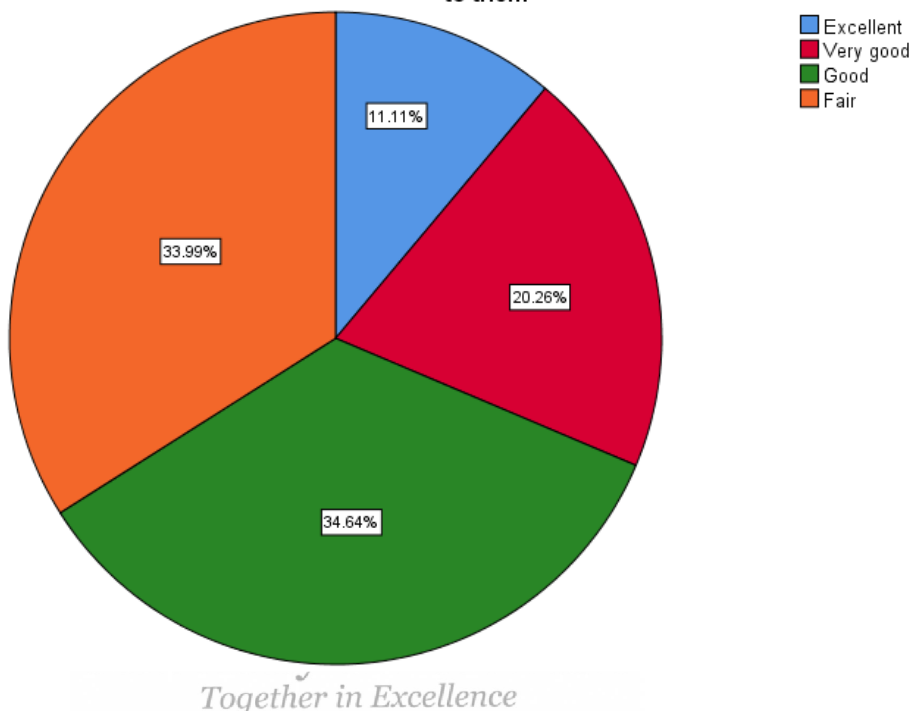
Table 4.8.32 shows that, out of 154 respondents, 45 (29.2%) responded “good”, 43 (28.1%) said “very good”, 36 (23 %) said “fair”, 28 (18.3%) responded “excellent” while One (0.7%) responded “fair” to the question. More than half the learners work their way to the solution one step at a time when solving physical science problem.

Table 4.8.32

32. When I solve physical science problems I often see the solutions but then have to struggle to figure out the step to get to them					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	17	11.0	11.1	11.1
	Very good	31	20.1	20.3	31.4

	Good	53	34.4	34.6	66.0
	Fair	52	33.8	34.0	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

33. When I solve math problems I often see the solutions but then have to struggle to figure out the step to get to them



Question 32 a response question, asked the respondents said when I solve physical science problems I often see the solutions but then have to struggle to figure out the step to get to them.

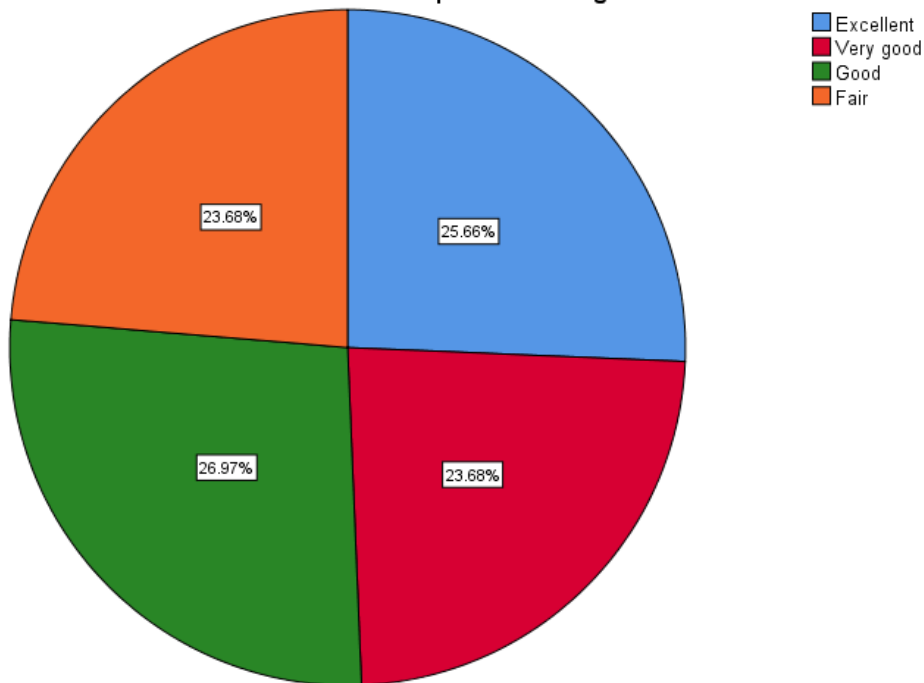
Table 4.8.32 shows that, out of 154 respondents, 53 (34.6%) responded “good”, 52 (34.0%) said “fair”, 31 (20.3 %) said “very good”, while 17 (11.1%) responded “excellent” to the question. More than half the learners often see the solutions but then have to struggle to figure out the step to get to them when solving maths problems.

Table 4.8.33

33.I like teachers who put a lot of diagrams on the board					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	39	25.3	25.7	25.7
	Very good	36	23.4	23.7	49.3

	Good	41	26.6	27.0	76.3
	Fair	36	23.4	23.7	100.0
	Total	152	98.7	100.0	
Missing	999	2	1.3		
Total		154	100.0		

35. I like teachers who put a lot of diagrams on the board



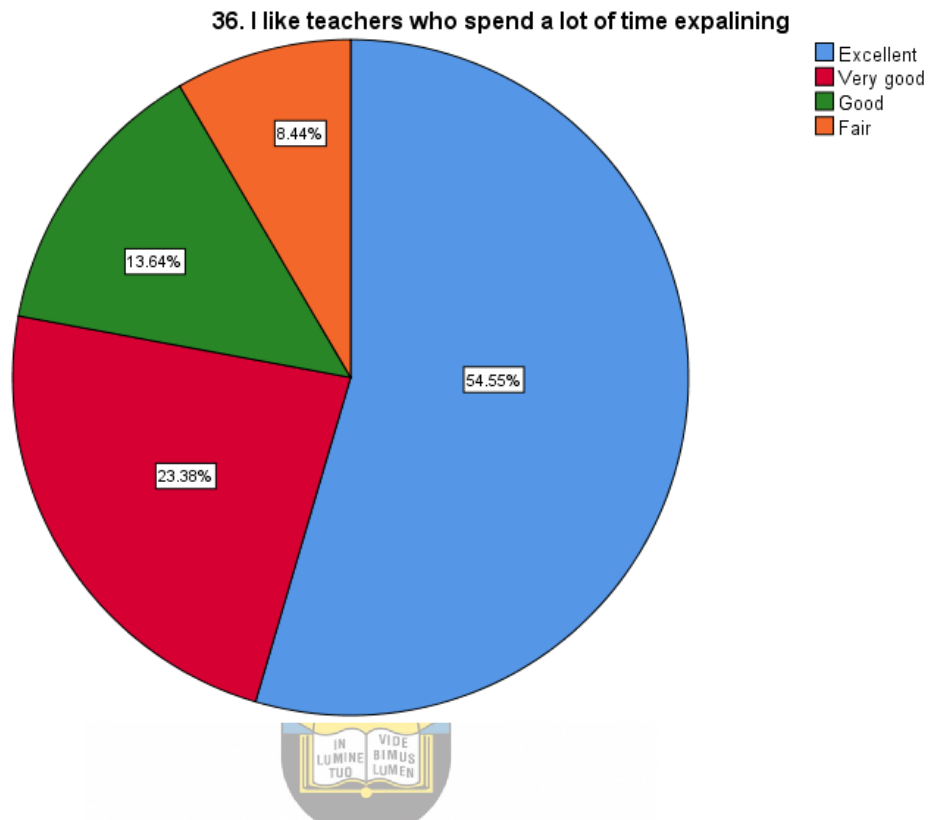
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In question 33, a response question asked of the respondents, which is, “I like teachers who put a lot of diagrams on the board”.

Table 4.8.33 shows that, out of 154 respondents, 41 (27.0%) responded “good”, 36(23.7%) said “fair”, 36 (23.7 %) said “very good”, while 39 (25.7%) responded “excellent” to the question. Almost all the learners like teachers who put a lot of diagrams on the board.

Table 4.8.34

34. I like teachers who spend a lot of time explaining					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	84	54.5	54.5	54.5
	Very good	36	23.4	23.4	77.9
	Good	21	13.6	13.6	91.6
	Fair	13	8.4	8.4	100.0
	Total	154	100.0	100.0	



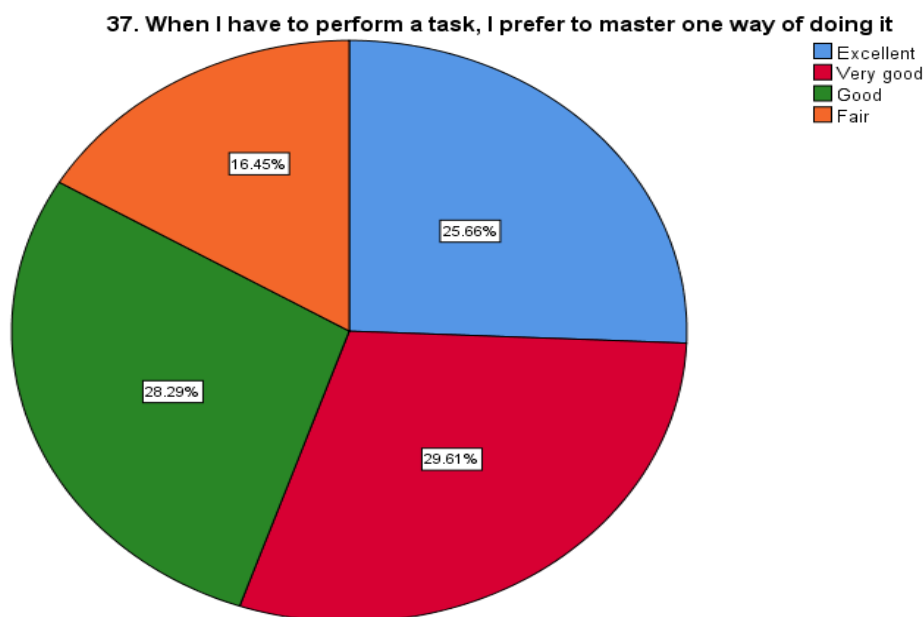
In question 34 a response question asked of the respondents, which is, “I like teachers who put a lot of diagrams on the board”.

Table 4.8.34 shows that, out of 154 respondents, 84 (54.5%) responded “excellent”, 36(23.4%) said “very good”, 21 (13.6 %) said “good”, while 39 (25.7%) responded “fair” to the question. Almost all the learners like teachers who put a lot of diagrams on the board.

Table 4.8.35

35. When I have to perform a task, I prefer to master one way of doing it					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	39	25.3	25.7	25.7
	Very good	45	29.2	29.6	55.3
	Good	43	27.9	28.3	83.6
	Fair	25	16.2	16.4	100.0
	Total	152	98.7	100.0	
Missing	999	2	1.3		

Total	154	100.0		
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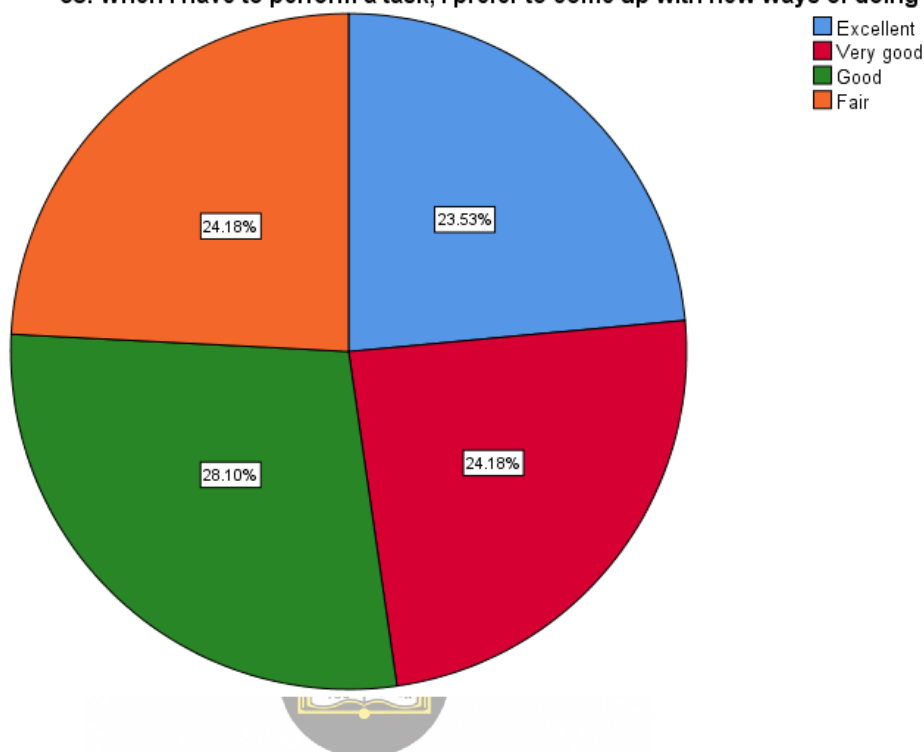
In question 35 a response question, asked the respondents which is when I have to perform a task, I prefer to master one way of doing it

Table 4.8.35 shows that, out of 154 respondents, 45 (29.6%) responded “very good”, 43(28.3%) said “good”, 39 (25.7%) said “excellent”, while 25 (16.4%) responded “fair” to the question. Almost all the learners that perform a task, preferred to master one way of doing it.

Table 4.8.36

36. When I have to perform a task, I prefer to come up with new ways of doing it					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	36	23.4	23.5	23.5
	Very good	37	24.0	24.2	47.7
	Good	43	27.9	28.1	75.8
	Fair	37	24.0	24.2	100.0
	Total	153	99.4	100.0	
Missing	999	1	.6		
Total		154	100.0		

38. When I have to perform a task, I prefer to come up with new ways of doing it



In question 36 a response question, asked the respondents which is when I have to perform a task, I prefer to come up with new ways of doing it

Table 4.8.36 shows that, out of 154 respondents, 43(28.1%) responded “good”, 37(24.2%) said “verygood”, 37 (24.2%) said “fair”, while 36(23.5%) responded “excellent” to the question. Almost all the learners that perform a task, preferred to come up with new ways of doing it.

Table 4.8.37

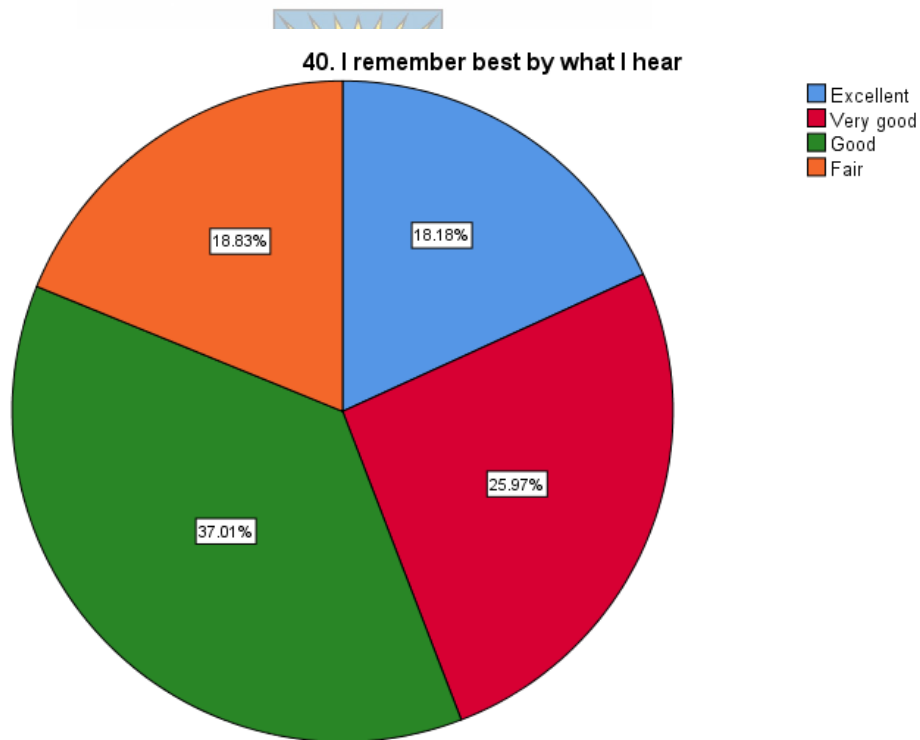
37. I remember best by what I see					
		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Excellent	74	48.1	48.1	48.1
	Very good	38	24.7	24.7	72.7
	Good	28	18.2	18.2	90.9
	Fair	14	9.1	9.1	100.0
	Total	154	100.0	100.0	

In question 37a response question, asked the respondents which is I remember best by what I see.

Table 4.8.37 shows that, out of 154 respondents, 74(48.1%) responded “excellent”, 38(24.7%) said “very good”, 28 (18.2%) said “good”, while 14(9.1%) responded “fair” to the question. Almost all the learners remember best by what they see.

Table 4.8.38

38. I remember best by what I hear					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	28	18.2	18.2	18.2
	Very good	40	26.0	26.0	44.2
	Good	57	37.0	37.0	81.2
	Fair	29	18.8	18.8	100.0
	Total	154	100.0	100.0	



Footnote

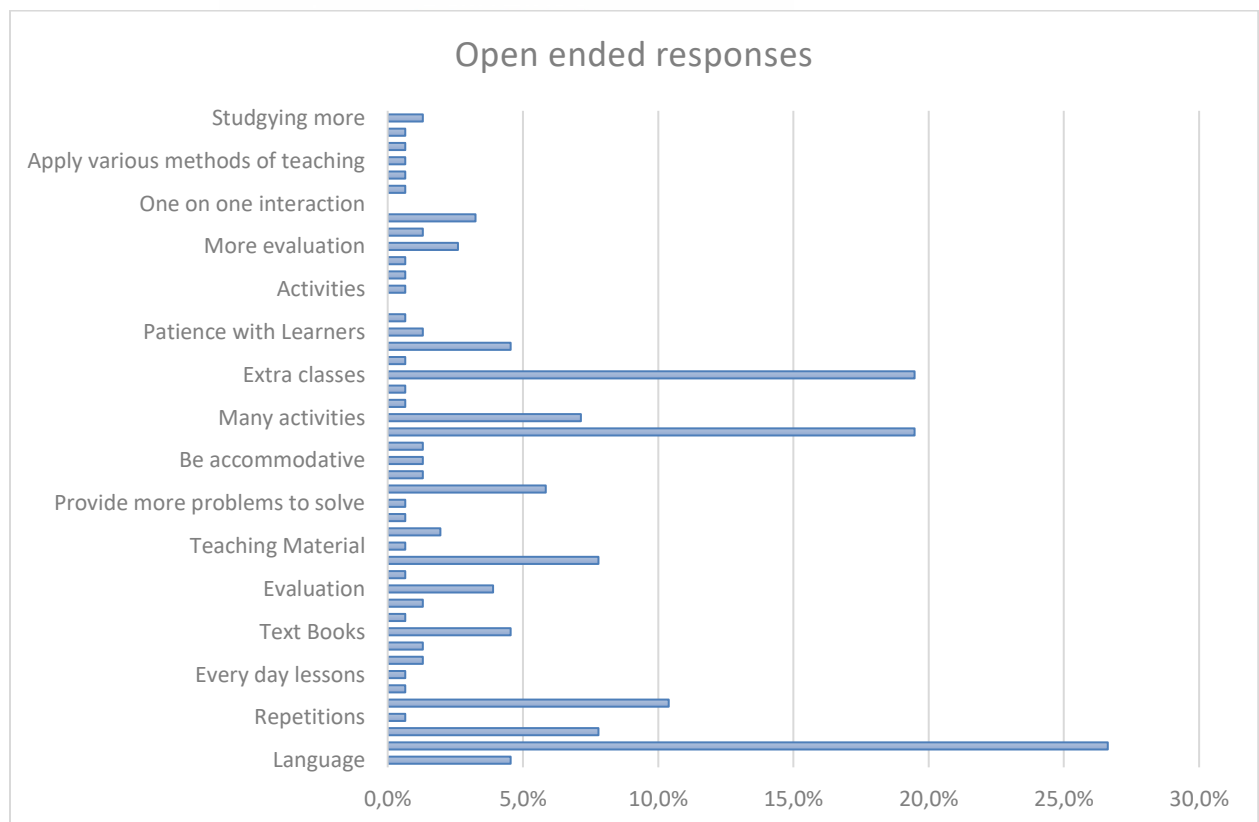
In question 38 a response question, asked the respondents which is I remember best by what I hear.

Table 4.8.38 shows that, out of 154 respondents, 57(37.0%) responded “good”, 40(26.0%) said “very good”, 29 (18.8%) said “fair”, while 28 (18.2%) responded “excellent” to the question. Almost all the learners remember best by what they hear.

Responses from open ended questions

As depicted in the figure below the more recurring responses related to “having extra classes”, “having many activities” and language-related factors that could contribute to better learners’ performance

OPR

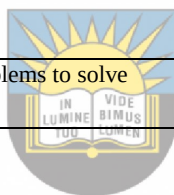


The table below shows the emerged in proportion to the total number of students that were surveyed. The table indicates that the theme that emerged the most relate to the students need of more explanations (26.6% of the respondents), hands on experience (19.5%), need for extra classes (19.5%), etc....

Table 4.8.39 Total number of student surveyed

More explanations	26.6%
Hands on experience	19.5%
Extra classes	19.5%
Demonstrations	10.4%
Teachers competency	7.8%
Extra help	7.8%
Many activities	7.1%
Visuals	5.8%
Language	4.5%
Text Books	4.5%
Study groups	4.5%
Evaluation	3.9%
More examples	3.2%
More evaluation	2.6%
Write notes on the board	1.9%
Satisfied	1.3%
Teach slowly	1.3%
More time to study	1.3%
Ethics/Professionalism	1.3%
Be accommodative	1.3%

Class work	1.3%
Patience with Learners	1.3%
More Ways of Learning	1.3%
Studying more	1.3%
Repetitions	0.6%
Morning sessions	0.6%
Every day lessons	0.6%
Teachers observation	0.6%
Concepts	0.6%
Teaching Material	0.6%
Terminology	0.6%
Provide more problems to solve	0.6%
Illustrations	0.6%
Teachers commitment	0.6%
Asking Questions	0.6%
Personal Effort	0.6%
Activities	0.6%
More home works	0.6%
Teacher's attitude	0.6%
Detailed explanations	0.6%
Rewards	0.6%
Apply various methods of teaching	0.6%
More time allocated to teaching the subject	0.6%



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use the simplest methods of working a certain problem	0.6%
One on one interaction	0.0%

The following table shows the responses associated with each theme. Some respondents provided answers that fit within two or more themes

Table 4.9.1 Responses associated with each themes

Responses	
Theme: More explanations	
Take more time to explain the concepts	Spend more time on physics
Spend more time on doing chemistry	Spend more time in doing chemistry and physical science
Concepts should be explained in details	More explanations
Expand more on topics with relevant examples	Explain more
Teachers should explain everything in details	I would like physical science educator to explain various times in order for us to understand
I want the physical science teacher to sit down with me and explain from the beginning of the year work until the end	I would like a teacher that like to explain
I would like physical sciences to be explained again and again since it is kind of tough. Also, to have a textbook which I will use at home to study	I want the physical sciences teacher to have more time and explain thoroughly and spend more time and give us diagrams and illustrations
When I learn that subject I need a lot of time so that I can understand and especially when I am lonely, it is very hard. I need someone who will explain	I would like physical science to be handled by giving a lot of terms, explain that particular term we are on to. Teachers must commit themselves to us in order to make us understand in all subjects in facts
Teachers should take more time to explain it to us and to see what we are told about	I want it to be handled by spending more time explaining what we find hard and the best way of handling it is acting/performing it out

Teacher must spend a lot of time explaining everything we learn we have to sing it. Study like we are crazy. Have to put it in our mind and believe in ourselves	I would really appreciate it if physical science would have many examples than activities. Even exams I would do better if they were similar to those in the text book
By explaining clearly experiments and more using the Lab to understand physical science and the physical science seem not to help me to understand physics	Maybe a teacher can take a lot of time to explain and also every topic we finish we can write a test about it. A teacher must give us extra time like morning , afternoon classes
I want the physical science educator to have more time for teaching us and more examples so we could remember more and also I want the educator to explain the homework first before we do it. I mean how can you do something you don't know	I want physical science to be handled in order to improve the performance by explaining everything, teach properly, do the example, write notes on the board, give us homework, give us time to hear everything he explains
I think our teacher must do more explaining because he just skips the topic without us having a clear understanding I think if he can do more explaining we can understand physical science and we can pass it.	By explaining more and doing examples and have extra classes and have notes to write and activities
I want physical science to be handled in a way where they make a lot of examples and the teacher must be friendly and not always upset. A teacher must not always threaten to hit us because we get scared and what he teaches does not stay in our minds.	I think that the teacher should get more time so that she/he can give us more methods of solving physics problems. And they will also get more time to give us more examples
I think the teacher can explain more and use diagrams to explain so that I could understand more and the teacher should show all his working when calculating and explain each step how he did it	I would prefer physical science to be taught like the lecturer who will go and explain to each of the students up until they understand
I would like the teacher to explain clearly or just have a new teacher who would do so. The teacher should engage more with learners when doing activities and accept questions	I think that teachers should spend their time explaining the notes and calculations than giving learners work without them fully understanding the section being dealt with
The teacher should explain in details using different sources until the whole class understands (Using illustrations and words)	I think teachers should take more time explaining it to us for us to understand and they must also do practicals in order for us to understand it better because I personally understand something better when I see it

Table 4.9.2

Response Theme: Hands on Experience	
I remember when I see things and items. Mostly make the lessons more and more experiments	we need lab to do our practicals
Get us more lab and the stuff that is used or important in science	I want physical science to be handled by doing everything in practicals and the teacher may try to explain. We need to be involved by a teacher in order to improve and we need to participate
Bring things that we don't have for e.g. lab so that we can do practicals	I want physical science to be handled by doing everything practically for us to believe in it
 Bring a lab close by so that we can see all experiments	I think we must have a teacher that we will understand and we must have more practicals and assignments than examination and we need extra lessons and us as black people when the teacher does not know how to speak Zulu, they must find a translator
University of Fort Hare Together in Excellence Having a close by lab so that we can do experiments	Have less verbal explanation by the teacher and more practical and hand in hand interaction with the learners because explaining with your mouth is most likely that the learners will forget it by the end of the day. And from myself must have persistent studying
Having a lab in our school so that we can do our experiment closer	I want it to be taught in such a way that if we are learning about experiments we do each and every experiment based on that topic so that it will be easier to remember
...to have a lab so that we can see reactions	There should be more experiments done in class when it comes to activities
By doing more practicals than theories. Theories should come after doing the practical parts because it will explain what we have seen happening	I want us to be more involved in experiments and other actual practices rather than just learning a lot of theory and doing a few experiments

Table 4.9.3

Responses	
Theme: Extra classes	
I would like us to learn extra times even Saturdays or afternoon classes to improve my performance	I would like the teacher to teach us more times even afternoon classes so that we can improve our performance
To improve my performance is to do extra classes and all of us have to get text books and it needs to be explained	I want to get extra classes to learn physical sciences and the teacher should spend a lot of time while explaining
I would like to have extra classes maybe that can improve on our learning	Change the teacher, have morning and afternoon classes
I would like if we could even learn after school. Our teachers ask us more questions so to understand physical science because it is very hard	In my opinion, I will like to have extra classes after school and needing someone to assist me with his or her understanding after that we write that test to prove ourselves
It could be better if we could have extra classes with a physical teacher and our physical teacher should give us more assignments and more practical	By giving us after school classes and to be more patient with us
To improve my performance I need to have more extra classes at school and form a team to help me and I need to have more class activity and assignments	We should have extra lessons as a class and those who understand well should share with us
I need extra classes to improve what I need to increasing my marks or to make a study so that it can be easy or a teacher needs to give a project or assessment every week. We need at least five problems to solve each day.	If only I could have extra lessons, be able to understand better and get assignments
Extra lessons should be considered. Also assistance from any teacher who have knowledge about physical science. The teacher should explain more and use explainable/understandable language	I need more extra classes that can help me understand physical sciences better and assignment to do, practicals and a lot of time to study and work hard to have good marks and good performance
I need extra classes from the educator or another educator to teach more about physical sciences. I need to be given more class and home work. I need the educator to explain more	We could have more extra classes after school. We need to be introduced to the laboratory in order to know what we are doing

I would like to have extra classes. I would like to be assisted by Mr Zuma. I would like to join groups	I think we must have afternoon classes and our teacher must give us a test when we finish a chapter like a math teacher so that we can understand more
I think when we have extra classes and sharing information in terms of group and lot of assessment to improve my performance	I would like to have extra classes or maybe have a tutor someone who will be patient enough to explain clearly. Studying in a group can help me because I find it hard to study alone
To have many classes of physical science and many ways of learning e.g. study group, extra class, extra periods and time	I think physical science should be handled in the way that there is improvement by having more assignments, projects to assist us with better marks. Extra lessons can also help
I want consolidation lessons on Saturdays or after school, to do more exercises, revision and preparations for the exams	There should be extra classes so that I can ask questions as to why we do things in a certain way

Table 4.9.4



Responses

Theme: Demonstrations

Demonstrate the experience	Get more examples
More practicals	I should have demonstrations in activities
More examples	Need more experiments
More practical	Be shown models and examples of physics
Participating in practicals and do laboratory work will enhance understanding	I also like to see evidence of that particular study in physics to get a better understanding
I want our educator to show us what we are learning in that particular and our experiment did our by our own and our teacher give us class work every time we finish to write notes and explain it correctly	Physical science problems must be solved practically. Teachers must spend more time in explaining and involving us
Physical learning to see that thing in order when you see it again you will remember it. It will improve my learning skills	Physical science can be handled by practical learning. This will improve my performance in a way that learning will be more easy and fast

Responses	
Theme: Teachers' competency	
Teachers must firstly understand it	To have a student teacher and an experienced one so that the former can learn from the latter
Try to teach the way we will understand	Since they changed our teacher from Miss X to Mr Y I haven't been able to understand properly. His teaching methods are difficult for me.
I want a teacher who will teach me and I can understand because I love physical science and I want to improve my performance with good results	We want a teacher who will teach us in a good way and explain notes and make us understand how to solve this and how to do this and make sure that we all get what he said. And we don't understand our physical teacher we want another teacher please
I want physical science to be handled in a fair manner that we can be able to understand it very easily and maybe we will be able to improve and our teacher must stop comparing us with his sisters we are not the same in knowledge.	A teacher who knows how to explain and will help us individually when it comes to activities. A teacher won't rely on a textbook because sometimes it doesn't explain clearly, it is hard to understand it.
By the teacher being able to explain something /situation in more than one way, having different methods to a solution. Being able to relate to everyday life. Mostly assurance of understanding.	I would like my teacher to work more on his explanations and put things through into simpler ways not repeat what is written in the textbook.

Table 4.9.5

Responses	
Theme: Extra help	
Provide extra help	Provide free extra lessons
A teacher that does things right e.g. assisting us with problems	I want to seat down with a teacher take things one at a time and most be understandable so that now I may learn things as well

I would like an assistance to help me study at home	I want to have a person who will be my assistance and guard in all workings of physical science and tell me where did I go wrong and also teach me new or easy ways of solving problems
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Table 4.9.6

Responses	
Theme: Visuals	
More images	Bring things that we can see so that we can remember easily
I want and I will be thankful if the teacher that we have can show us physical science methods	Physical science should be more in visual things that we see. Most of them should be on labs and shown to us as learners
I would like it to be taught using visible things like laptops and computers even projectors	I would like more time to be allocated in teaching the subject and more pictorial representations of what we are learning

Table 4.9.7

Responses	
Theme: Language	
Use understandable terminology, use simpler English word	I prefer it to be taught in my language (IsiZulu)
Use simpler English words	Try to make the English they use to be more understandable and not confusing

Table 4.9.8

Responses	
Theme: Textbooks	
Update the text books and make them explain things in a better way so that we have a better vision	Text books should be updated/new ones should be bought

Do not use textbooks	The teacher should use the simplest methods of working a certain problem. The Oxford Successful Physical Science Grade 10 book must be improved because it has very minimal information hence it is difficult to get an "A" symbol in a national exam
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Table 4.9.9

Responses	
Theme: Study groups	
I think that we should have study groups and our teacher should give more time to our lessons and we should do a lot of experiments so that we can see what we are learning about	Because my performance is poor, I think I should join study groups for physical science, put more effort to my school work and especially maths and physics because these are the subjects I am not doing well in it.
We must have study groups so that we can understand physical science when we work together as a group. It is more easier for us to cope very well	



Table 4:9.10 **University of Fort Hare**
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Responses	
Theme: Evaluation	
Be more specific about certain questions/clarify questions	I want the teacher to mark the work that he or she give us and to always help us to understand

Table 4:9.11

Responses	
Theme: More examples	
More examples	I would enjoy it if the teachers would explain everything properly. If they took care to make examples they know we as teenagers would remember.

They must use many examples, use more pictures or diagrams and have one on one interaction with the learner	Be used in everyday life, also to be used in examples where youth will understand like use examples with food or entertainment that would help
I want the teachers to have more examples and I would prefer more textbooks. The more examples one makes, the more I tend to understand. More practice and homework would also improve my performance	

Table 4.9.12

Responses	
Theme: More evaluation	
I think that our teacher for physical science should give us a test after every module we've learnt because that would measure our understanding of that certain module	I think we must have afternoon classes and our teacher must give us a test when we finish a chapter like a math teacher so that we can understand more
The physical science teacher should give us more activities and homework's. We must get a test after finishing a chapter so that a teacher can see if we understand a chapter or not	I think when we have extra classes and sharing information in terms of group and lot of assessment to improve my performance

Table 4.9.13

Responses	
Theme: Write Notes on the Board	
Teachers should write notes on the board	By explaining more and doing examples and have extra classes and have notes to write and activities

4.6 How does the motivation of educators affects the teaching of physical science

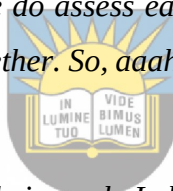
4.6.1 Supervision of teachers.

The respondents indicated by saying that they check the way the teachers teach. One of the respondents said that they do assess each other, and do discuss the way things are done and work things out together. Another respondent speaks about checking everything they do and that it must be in line with the curriculum assessment policy statement. Some of the respondents had this to say:

HoD B: *Yes, we do have class visits, here and now. Eeeeh, where we visit to see what is going on in class and how well possible*

HoD C: *Aaahm yes we do. We do assess each other, but we also discuss the way we do things and work things out together. So, aaahm we are aware, aaahm and we do influence each on other Yes.*

HoD D: *Yes I do, I monitor their work, I check everything they do that it must be in line with the curriculum assessment policy statement.*



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4.6.2 Encouraging Teacher effectiveness

The respondents agreed that they receive their educational in- service training and orientation session at the beginning of the year which is generally one session per year from the department of education especially through workshop and moderations. This moderation and training by the department of education were done in other to encourage the teachers. They added that this help especially teachers that are struggling with the content and to pick up new ways of dealing with the subject of physical science. These were some of the statements of the respondents:

EdrA: *I am just new.*

EdrB: *mhmmm. Almost every term of the year we do attend a content workshop Yes*

EdrC: The training that we receive is just attending some workshop during aaaah moderation. The physical science aaah coordinator normally has got some questions or sometimes that is educative that he will deliver unto us.

EdrD: eeeheeeh, I do attend a series of educational training workshop, conferences. I am also a facilitator, I present during this workshop couple with other workshop for teachers development.

The respondents from the department of education confirms the in –service training, workshops and conferences are being conducted in other to encourage the teachers.

HoD A: Content workshop and moderation, once per term.

HoD B: Quite often eeehm. Through workshop, in – service training and we go for moderations and teachers who are in the Grade 12, they often go for marking. That's where they pick up new ways of dealing with the subject.

HoD C: We have annual, aahm orientation session at the beginning of the year, that's generally one session per year to which one teacher goes and in the whole moderation session in each term and their, there is some input there also.

HoD D: Serious educational training workshop, eeehm like just in time, in just, in order to assist the teachers that are struggling with the content.



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4.6.3 The place of curriculum

The respondents indicated that they use the CAPS curriculum and it was confirmed that it is helping the teachers and the learners. It was confirmed by the respondents that the CAPS document, gives them clarity and direction most of the things which when they follow, help them. One of the respondents indicated that the CAPS curriculum is different to implement with the kind of learners they have. The respondents have this to say;

HoD A: CAPS curriculum is different to implement with the kind of learners we have.

HoD B: Well because, eeehm they, we have the document, the CAPS document, which gives us the direction which when we follow it well, it clarify most of the things and then that's how we get help.

HoD C: Aaahm, I think that the CAPS curriculum in most subject is most specific than the previous curriculum which are, is probably easier for the teacher to follow. And it means

that aaaaah that most teacher are following the curriculum closely and it means that most teachers are following the curriculum more closely which will benefit the learners.

HoD D: *Yeah, the curriculum policy statement the new revised is helping the learners because teachers have been trained for this, so what they have learnt there during the workshop they have to come and apply it to the learners. So the learners can, you know, they can have a better understanding, because there is nothing wrong with the curriculum. The curriculum is as anything like any other country.*

4.6.4 Summary of findings and discussion on how the motivation of educators affects the teaching of physical science

The discussion on how the motivation of educators affects the teaching of physical science as indicated by respondents that they check the way the teachers teach. One of the respondents said that they do assess each other, and do discuss the way things are done and work things out together. Another respondent speaks about checking everything which the educators do in line with the curriculum assessment policy statement. The interview also confirms that the respondents undergo educational in-service training and orientation from the department of education every year through workshop and moderations in order to encourage the teachers. They added that this help especially teachers that are struggling with the content and to pick up new ways of dealing with the subject of physical science.

More so, the respondents indicated that they use the CAPS curriculum and it was confirmed that this curriculum helps the teachers and the learners giving clarity and direction as they follow it. One of the respondents indicated that the CAPS curriculum is different to implement with the kind of learners they have.

4.7 How the right methods should be adopted to foster cognitive learning for performance

4.7.1 Cognitive learning strategies

Cognitive learning strategies are those that work directly on the incoming information while it is being transformed into knowledge. This covers the understanding of the learner on how they process the information that is release to them. Finding from the interview reveals that 88% of the 16 respondents did understand what they have been taught. Another respondent said they do understand some of what had been taught but needed time to get them which the teachers does explain. Many of the respondents (80%) said once they understand all the parts, they understand the whole thing. While other respondents (88%) said when they think about what they did previous day they most likely to get a picture. Lastly about (91%) of the respondents said when they are learning something new, does it help them to think about it. This

Fourteen (88%) of the 16 learners said “Yes they understood what they are taught.

Respondent Lr3B answers yes but some of what had been taught but needed time to get them which the teachersdo explain.

Lr3A response is” No” meaning the respondent never understand what was been taught.

Question 28said once I understand all the parts, I understand the whole thing.

Out of 154 respondents, 34(34.4%) responded “excellent”. 24 (24.7%) said “good”, 22(22.7%) responded with “very good” to the question. Fifteen (18.2%) said “fair”.

When they think about what they did yesterday are they most likely to get a picture.

Figure 4.8.19 shows the response of the respondents. 33 (33.3%) indicated “good”, 21 (21.3%) indicated “very good”, and 18 (18.7%) said “fair”. However, sixteen (16.7%) responded “excellent” while respondents of about 10 % did respond “poor” to the question.

Question 25 asked the learners. When they are learning something new, does it help them to think about it?Of the 154 respondents, 29 (29.9%) indicated “excellent”, 26 (26.6 %) had indicated “good”. 24 (24 %) did responded “very good”, 12 (12.3%) indicated “fair” while 7(7.1%) responded “poor” to the question

4.7.2 Attention

Attention means screening out some external stimuli and becoming focused on the information one has selected for processing. There are respondents whose understanding of what they are taught is based on this. Respondents indicated that they like teachers who put a lot of diagrams on the board. This shows the best way they can easily get things been taught. Table 4.8.35 shows that, out of 154 respondents, 84(54.5%) responded “excellent”, 36(23.4%) said “very good”, 21 (13.6 %) said “good”, while 39 (25.7%) responded “fair” to the question.

Lastly some of the respondents said that they remember best what they see. Almost all the learners remember best by what they see. The information is given below.

Table 4.8.38 shows that, out of 154 respondents, 74(48.1%) responded “excellent”, 38(24.7%) said “very good”, 28 (18.2%) said “good”, while 14(9.1%) responded “fair” to the question.



4.7.3 Rehearsal

Rehearsal is a strategy used for deliberately trying to keep information in the STM by repeating it. Most respondents reveal that when they are learning something new, does it help them to talk about it. This fall on the aspect of rehearsal.

Table 4.8.24 shows of the 154 respondents, 29 (29.2%) indicated “excellent”, 28 (28.6 %) had indicated “good”. 27 (27.3%) did responded “very good”, 11 (11.7%) indicated “fair” while 3(3.2%) responded “poor” to the question

4.7.4 Elaboration strategies

Elaboration strategies teachers can use this to integrate the new information with knowledge already stored in the learners’ LTM so that they can gain a deeper level of understanding of the information. The respondents (90%) indicated that they like teachers who spend a lot of time explaining.

Table 4.8.34 shows that, out of 154 respondents, (54 %) said excellent” (23.4%) responded “very good”, (13.6%) said “good” while (8.4%) responded “fair” to the question.

In the open ended question about 26% of the respondents indicated that they want more explanation by the teacher. The following show the information given:

I would like physical science educator to explain various times in order for us to understand

I want the physical sciences teacher to have more time and explain thoroughly and spend more time and give us diagrams and illustrations

I would like physical science to be handled by giving a lot of terms, explain that particular term we are on to. Teachers must commit themselves to us in order to make us understand in all subjects in facts

I want it to be handled by spending more time explaining what we find hard and the best way of handling it is acting/performing it out

I want physical science to be handled in order to improve the performance by explaining everything, teach properly, do the example, write notes on the board, give us homework, and give us time to hear everything he explains

By explaining more and doing examples and have extra classes and have notes to write and activities

I think that the teacher should get more time so that she/he can give us more methods of solving physics problems. And they will also get more time to give us more examples

I would prefer physical science to be taught like the lecturer who will go and explain to each of the students up until they understand

I think that teachers should spend their time explaining the notes and calculations than giving learners work without them fully understanding the section being dealt with

I think teachers should take more time explaining it to us for us to understand and they must also do practicals in order for us to understand it better because I personally understand something better when I see it.

4.7.5 Summary of findings and discussion on the right methods that should be adopted to foster cognitive learning for performance

The discussion on the right methods that should be adopted to foster cognitive learning for performance of physical science depends on the strategies that are being used. As indicated by respondents, more of the learners reveals that they understand what they have been taught. Another respondent said they do understand some of what had been taught but needed time to get them which the teachers does explain. Many of the respondents said once they understand all the parts, they understand the whole thing. While other respondents said when they think about what they did previous day they most likely to get a picture. Lastly about of the respondents said when they are learning something new, does it help them to think about it.

From the finding it was discovered that other respondents indicated that they prefer to get new information in pictures, diagrams, graphs or maps which helps them to remember what they have been taught. While most respondents reveal that when they are learning something new, does it help them to talk about it? The respondents indicated that they like teachers who spend a lot of time explaining. Woolfolk explains that strategies that help learners to focus their attention on appropriate features of the learning tasks include the creation of expectation, or making prediction, underlining, or highlighting the relevant information in a different colour or boldface (Woolfolk 2010:240). Once attention has been paid to the relevant features of the task, the learner must encode the material to ensure that the information is retained and later retrieved. Matseke (2011:49) cited Lopez saying the simplest strategies for the restructuring of information are the repetition strategies or rehearsal strategies (Lopez 2001:50). The researcher believes that the focus of the attention on the part of the learner on the appropriate feature of learning task is expedient.

4.8.0 Learner non-standardized test

The learner test (Annexure J) were used to determine the broad basic knowledge of the learners. The activity was based on the fundamental aspects chemistry in physical sciences. Concepts, such as moles percentage composition empirical and molecular formula writing of chemical formulae, balancing chemical equations, chemical names and the common

name of chemical substances that are taught to learners in Grade 10. These are requirements that a learner needs to have in order to succeed in Physical Sciences. The questions would be regarded as common sense and require learners to put the basic concepts of physical sciences which they have learnt into practice. This activity not only tests learners' knowledge but also their broad knowledge in the area of chemistry (see Table 4.8.1). The tables only have the rest of the learners with the exclusion of learners that participated in the interview which had been recorded in table 4.8.1.

Table 4.8.1

Score (%)	School A (Frequency)	School B (Frequency)	School C (Frequency)	School D (Frequency)
0-5	0	0	0	0
10	0		1	1
15	5	1	1	3
18	3	1	1	4
20	5	1	2	2
25	4	2	2	5
26	4	0	2	4
30	3	0	2	1
35	6	0	2	4
36	7	0	2	3
40	2	1	3	3
43	3	1	4	6
45	2		0	3
50	0		3	3
55	1		3	3
60	2		2	3
65	1		1	3
70	1			
75				
80				
90-100				
Numbers Of Learners	50	6	31	51

The mean which is basically the arithmetic average of all scores (Mcmillian&Schumacher 2006:159) below.

Mean For School A Mean For School B

$$X_A = \Sigma X / n \quad X_B = \Sigma X / n$$

$$1595/50$$

$$163/6$$

$$32$$

$$27.1$$

Mean For School C

Mean For School D

$$X_A = \Sigma X / n \quad X_B = \Sigma X / n$$

$$1174/31$$

$$1852/51$$

$$38$$

$$36.3$$

The above calculation are descriptive statistics that summarizes the data gathered from the sample population. The performance level of the learners per school are narrowed down to single numbers. Based on the above results almost 50% of the Grade 10 physical science with basic concept of physical science taught. The difference between the average scores for the four schools is fundamentally insignificant. Dhrurumraj (2013) cited McMillian and Schumacher on the median which refers to that point that divide the rank ordered distribution into halve that contain an equal number of scores (McMillian & Schumacher 2006). Table 4.8.2 shows the median for each school based the test result.

Table 4.8.2 The median for each school based the test results
(Annexure D)

Median of school A	Median of school B	Median of school C	Median of school D
Mdn=35	Mdn=25	Mdn=40	Mdn=36

The medians for both School A, School C and School D were a little above average of 50% while School B was below average thus indicating the central tendency was still on a poor performance level at the schools. The mode, which refers to the score that appears most frequently in the distribution (McMillan & Schumacher 2006:160), was calculated.

Table 4.8.4: The mode for each school based on the Activity Results (Annexure D)

Median of school A	Median of school B	Median of school C	Median of school D
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Mode=36	Mode=25	Mode=43	Mode=43
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Based on the descriptive statistics above, it was clear that the learners of the four schools were struggling with physical sciences. Learners were unable to understand with basic Grade content knowledge. The mean for School A was 32, School B was significantly lower than School A at 27.1, School C was a little above the average of the mark 38 and while School D was also a little above average 36.3.

Based on the results from the non-standardised test, it was noted that in the four schools more than 70% of learners were unable to know the basics concept and calculation in the activity (Annexure D), which tests the learners' formal operational thinking ability. Most learners did not answer this question or got it wrong. Fejfar (2007) argues that Piaget, in his work, was of the firm belief that a more abstract and difficult type of thinking known as the formal operations or hypo-deductive thought existed and would be developed fully between the ages of eleven to fifteen years. Formal operations are the last of the major stages of cognitive growth (Simatwa 2010:367). Thus, many learners in the above four schools have not reached this stage as yet (although some have passed the age of fifteen); they are most likely still at the concrete operations stage of development. Individuals in concrete operations cannot plan for the future, cannot compare and contrast possible alternative future courses of action nor choose a future which is logically superior (Fejfar 2007). In the activity many learners were unable to compare and contrast the two paths given and see that path B would have been the better of the two.

4.9 Summary of the observation at the schools

4.9.1 How does the teacher introduce the lesson to the learners?

ObsA-D: The teachers started the lesson by asking the learners about the previous topic so as to refresh their memories prior to the new topic. They also did review the homework given.

4.9.2 How do the learners participate in physical science lessons?

ObsA-D: Very few learners really participated when the educators asked question and when they were asked to calculators to confirm some worked examples a lot do not have calculator. Some gave excuses that they forgot at home.

4.9.3 What teaching method the educator employed?

ObsA-D: Almost all the teachers were using lecture method and two of the teachers used group method during class lessons. The educators interacted with the learners by asking them questions. And during class exercises, they moved from one learner to the other to see if the learners were doing the right thing.

4.9.4 Learner responsiveness to teaching

ObsA&ObsD: Majority of the learners were quiet when the teacher was talking. Only few learners were able to ask question(s) on the topic being taught. The teacher on his part does asked if they understand or following what they were teaching.

ObsB&ObsD: There were few distractions by the learners especially movements and side talk during teaching but it is easily curbed by the teachers.

4.9.5 How did the educators motivate learners?

ObsA-D: The educators checked the learners writing books and paste stickers on any completed work. As the lesson progressed, they kept on asking if they understood every step of the lesson. They went to some learners to see their work.

4.9.6 Was there any homework given at the end of the lesson?

ObsA-D: At the end of the lessons, the educators gave homework/exercises to the learners to be submitted on a due date.

4.9.7 Chapter Summary

This chapter focused on the presentation and analysis of data on the views of learners,

educators, heads of department on examining the cognitive learning effect on Grade 10 students' performance in physical science in selected schools in uMgungundlovu education district KwaZulu-Natal.

This study assessed the view of the participants on the factors that impede cognitive learning, factors that can enhance the learner's cognitive learning for performance, how the motivation of educators affects the teaching of physical science and the right methods that should be adopted to foster cognitive learning for performance. Employing the qualitative interviews, quantitative, non-standardized test and observations as primary research instruments, with questions developed and discussed appropriately. The results indicated that cognitive learning shows an effect on the performance of the learners in physical science. The next chapter will discuss the summary of findings, conclusions and recommendations of the study. Furthermore, areas for further research will be highlighted.



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Chapter Five

FINDINGS, FINAL CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the summaries of the findings with reference to the problem statement, research question and aims. Recommendations for improvement of Physical Sciences teaching and learning based on the analysis of data are also presented. Lastly, I suggest areas for future research.

5.2 Restating the research questions



The main research question that guided this study was “examining the cognitive learning effect on Grade 10 students’ performance in physical science in selected schools in uMgungundlovu education district in KwaZulu-Natal Province?” This question was answered through the following sub-research questions:

The sub-research questions are:

1. What are the factors that impede cognitive learning?
2. What are the factors that can enhance the learner’s cognitive learning for performance?
3. How the right methods of teaching should be adopted to foster cognitive learning for improved performance?
4. How does the motivation of educators affect the teaching of Physical Science?

5.3 Summary of findings

This section summarizes the major findings with respect to the views of learners, educators and heads of department in line with the research questions and objectives of the study. The outcomes of the study are summarized as follows.

5.3.2 What are the factors that impede cognitive learning?

5.3.2.1 Learners Attitude towards physical science

Majority of the respondents reported that they have interest and positive attitude for Physical science, while majority of the learners indicated that their interest and positive attitude towards physical science. However, the few remaining shows lack of interest and low form of attitude toward the subject. From the interview two respondents indicated that they have a fair attitude towards the subject. One respondent reveals that physical science is too tough and the reason was not specified by the learner.

5.3.2.2 Non parental involvement

The data gathered from the respondents showed the evidence of weak parent involvement seen in the learners. Learners, who were living with their parents, said that they were never available to assist them in the physical sciences as they were always working. A Learner also mentioned that the only time the parent gets involved was when their report card arrived and it shows bad results. Obviously most parents lacked knowledge about Physical Sciences and could not assist their children.

Those learners who were able to get assistance at home with physical sciences had a brother or sister who had done the subject at school. Few learners thus had received assistance in physical sciences from their parents or legal guardians

5.3.2.3 Language Problem

The findings of the present study show that most of respondents indicated the level of understanding when English is used as a medium of instruction in teaching physical science is good. From the interview half of the learners responded to this question saying that they prefer both languages to be used by the teacher to teach them. The reason for both languages is for their understanding.

5.3.2.4 Teachers-learners relationship

All the learners agreed that their teachers are approachable especially for personal explanation on a particular topic. This is a major determinant of teacher-learner relationship. It also implies that they were free to relate their problem to the teachers especially when it comes to the subject. They affirmed that their educators always give them attention whenever they ask for assistance and large number of the teachers create an atmosphere that makes it easy for the learner to learn.

5.3.3 Factors that can enhance the learner's cognitive learning for performance

5.3.3.1 The motivation of the learners

On the aspect of motivation, the respondents identified that the teachers get them motivated them enough to like physical science. Many of the learners indicated that their teachers do motivate them in physical science. Almost all the learners had a high rate of their teachers motivating them. The remaining low view of their teachers in the area of motivation.

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5.3.3.2 The teaching approach

The teaching approach comes in a form of the method's the teacher uses to teach the learners. From the findings it was discovered that most of respondents says that their teachers use different method for them to understand the subject. Majority of the overall respondents actually responded that the approach of their teachers that are used in teaching is good most follow their teacher's method but only few learners use their own method. Other learners indicated that their teacher does not use different method of approach to teach them. This was also confirmed by the educators that they do give the learners different method such as lecture, group method and practical demonstration for their understanding. Supported The heads of departments confirming that many of the learners enjoy their method of teaching.

5.3.3.3 Cognitive level of Learners

The way in which learners typically receive and process information was revealed to have relation to academic performance and cognitive ability of the learner. A finding from the respondent shows how the learners were able to process information that they receive when been taught indicating most likely to get a picture and a word of what they were taught a day before. Looking at the percentage responses, it was clear that majority of the learners tend to understand the overall structure though few are fuzzy about detail of things been taught.

5.3.3.4 The inclusive of practical work in physical science

Practical work is known to supports development of scientific skills, thinking skills and how scientists work. It helps learners to be exposed to basic processes of science. From the open-ended question most of the learners stated how they wanted physical science to be handled in order to improve their performance stating that the educator should make the lessons more and more experiments. Other respondents asked for more laboratories and the stuff that is used or important in science. They indicated that they want to be more involved in practicals in the laboratory. Finding shows that the teacher and the HoD supports the use of practical demonstration to help the learners to have more understanding of physical science

5.3.4 How does the motivation of educators affects the teaching of physical science

5.3.4.1 Supervision of teachers.

In this finding the head of departments indicated that they do check the way the teachers teach for effectiveness on the part of the teachers. One of the respondentsaid that they do assess each other, and do discuss the way things are done and work things out together. Another head of department actually speaks about checking everything they do which must be in line with the curriculum assessment policy statement from the department of education.

5.3.4.2 Encouraging teacher effectiveness

According to the view the educators they agreed that they receive their educational in-service training and orientation session at the beginning of the year which is generally one session per year from the department of education especially through workshop and moderations. This moderation and training by the department of education were done in order to encourage the teacher's effective performance. They added that this help especially teachers that are struggling with the content and topick up new ways of dealing with the subject of physical science

5.3.4.3 The place of curriculum

With the vital role of the curriculum the heads of departments indicated that they use the CAPS curriculum and it was confirm that it is helping the teachers and the learners. It was confirmed that the CAPS document, gives them clarify and direction most of the things which when they follow, help them. One of the respondents indicated that the CAPS curriculum is different to implement with the kind of learners they have

5.3.5 How the right methods of teaching that should be adopted to foster cognitive learning for performance

5.3.5.1 Cognitive learning strategies

Cognitive learning strategies are those that work directly on the incoming information while it is being transformed into knowledge. This covers the understanding of the learner on how they process the information that is release to them. Most learners do shows that they did understand what they have been taught. Other learners said they do understand some of what had been taught but needed time to get them which the teachers does explain. Majority of the learners said once they understand all the parts, they understand the whole thing. While some learners said when they think about what they did previous day in the class they most likely to get a picture of what they were been taught. Lastly most learners affirm that when they learn something new.

5.3.5.2 Attention

Attention means screening out some external stimuli and becoming focused on the information one has selected for processing. Learners whose understanding of what they are taught is based on this indicated that they prefer to get new information in pictures, diagrams, graphs or maps which helps them to remember what they have been taught.

5.3.5.3 Rehearsal

Rehearsal is a strategy used for deliberately trying to keep information in the STM by repeating it. Most of the learners revealed that when they are learning something new, does it help them to talk about it. This helps them to retain the things they have been taught in their memory as they begin to say it to themselves often.

5.3.5.4 Elaboration strategies

The learners emphasized that the physical sciences teacher should have more time and explain thoroughly particular term and spend more time and using diagrams and illustrations in order to make them understand in all subject. This includes time explaining the notes and calculations than giving learners work without them fully understanding the section that they are being taught thoroughly.

5.4 Conclusions

The study sought to assess the views of learners, educators and the heads of department on the factors that impede cognitive learning, the factors that can enhance the learner's cognitive learning for performance, the right methods of teaching should be adopted to foster cognitive learning for improved performance, how does the motivation of educators affect the teaching of physical science. The conclusions will be presented in line with the main themes which emerged during the data analysis.

5.4.1 What are the factors that impede cognitive learning?

The study shows that a number of factors were responsible for impeding cognitive learning?

What are the factors that can enhance the learner's cognitive learning for performance?

The findings from the study indicated that:

- Majority of the learners reported that they have interest and positive attitude toward physical science.
- It was obvious that most parents lacked knowledge about physical sciences and could not assist their children.
- Most of learners indicated the level of understanding when English is used as a medium of instruction in teaching physical science with some of the learners who prefer both languages to be used for their understanding.

All the learners agreed that their teachers are approachable especially for personal explanation on a particular topic and also giving them attention whenever they ask for assistance, creating an atmosphere that makes it easy for the learner to learn.

5.4.2 Factors that can enhance the learner's cognitive learning for performance

. *On the aspect of motivation, the learners had a high rate of their teachers motivating them enough to like physical science, but few view of their teachers in the area of not motivating.

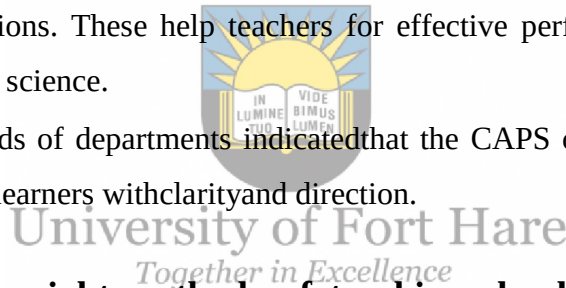
- Most of learners indicated that their teachers use different method for them to understand the subject and majority follow their teachers method but only few learners use their own method. The educators and the heads of departments confirmed that they do give the learners different method such as lecture, group method and practical demonstration for their understanding
- Learner shows how they were able to process and understand information that they receive when been taught indicating most likely to get a picture and a word of what they were taught a day before.
- Most of the learners stated that in physical science in order to improve their performance stating that the educator should be involve in more experiments. The

teacher and the HoD support the use of practical demonstration to help the learners to have more understanding of physical science

5.4.3 How does the motivation of educators affects the teaching of physical science

According to the analysis in this study the study showed that:

- The head of departments indicated that they do check the way the teachers teach for effectiveness on the part of the teachers in line with the curriculum assessment policy statement from the department of education.
- According the educators they receive their educational in- service training and orientation session at the beginning of the year which is generally one session per year from the department of education especially through workshop and moderations. These help teachers for effective performance with the subject of physical science.
- The heads of departments indicated that the CAPS curriculum helps the teachers and the learners with clarity and direction.



5.4.4 How the right methods of teaching should be adopted to foster cognitive learning for improved performance?

The participants agreed that:

- With Cognitive learning strategies that they did understand what they have been taught. Other learners said they do understand some of what had been taught but needed time to get them which the teachers do explain. While some learners said when they think about what they did previous day in the class they most likely to get a picture of what they were been taught. Lastly most learners affirm that when they are learning something new, does it help them to think about it.
- Since attention means screening out some external stimuli and becoming focused on the information one has selected for processing, learners whose understanding of what they are taught is based on this indicated that they prefer to get new

information in pictures, diagrams, graphs or maps which helps them to remember what they have been taught.

- In rehearsal which involve repeating things learnt, most of the learners revealed that when they are learning something new, does it help them to talk about it. This help them to retain the thing they have been taught in their memory as they begin to say it to themselves often.
- While in elaboration strategies learners emphasized that the physical sciences teacher should have more time and explain thoroughly particular term, using diagrams and illustrations in order to make them understand in all subject.

5.5 The study's contribution to new knowledge

Looking at the factors contributing to cognitive learning in the area of performance in physical science has received a high attention in research. Thus, learners in the four selected schools need to be motivated enough to begin to develop interest in physical science. The result confirms that attitude is one contributing factor to their performance, and educator have a major role as an agent of change, helping learners gain the knowledge, skills, motivating to influence the learners' performance.

From observation the teaching method and approach that were employed were more learner-centered and the methods were linked to constructivist way of learning which assert that learning is an active process. The study reveals that incorporated English language teaching in science content teaching showed that it had many positive effects on the learners.

In general, study shows that parents should also be actively involved in their children's academic process, by regular monitoring of their children's performance.

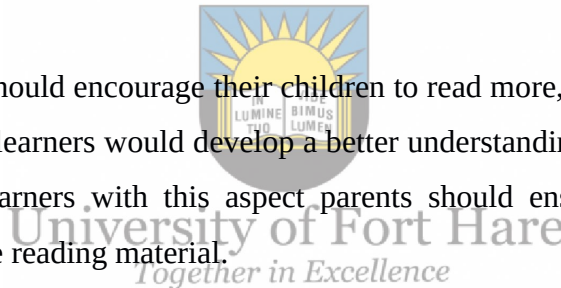
Finally, the research reveal the right methods that should be adopted to foster cognitive learning for performance in physical science depends on the strategies that are being used. Many participants reveal that they understand what they have been taught especially when repeated or rehearsed. More so, learners indicated that elaborates strategies which involve

explanation by the educators with the use of laboratory help to stimulate the cognitive development.

5.6 Recommendations

Based on the findings of this research into examining the cognitive learning effect on Grade 10 students' performance in physical science in selected schools in uMgungundlovu education district KwaZulu Natal the researcher recommends that schools ensure that:

- Learners are appropriately assisted with regards to the selection of subjects at the FET phase.
- Parents should spend more time encouraging learners in physical science subject motivate, speaking positive word (like completing tasks or achievements) by words like “you can make it”, “you can do better”, and never use words to discourage them.
- Parent should encourage their children to read more, thus improving language. By reading learners would develop a better understanding of words and meaning. To assist learners with this aspect parents should ensure that their children have adequate reading material.
- In addition, parents should supervise their children to complete their school works and homework and have a good relationship with the educators so as to monitor how the learner is making progress.
- More activities should be provided which stimulate the cognitive development of every learner.
- Testing could include more comprehension and critique-based questions and material, depending on the level required.
- Educators could, otherwise, take steps to ensure that students have retained and comprehended the material learned, such as testing the students again at a later stage.
- Physical sciences laboratories are in working order with the necessary equipment. The laboratory reflects the subject being taught and creates a positive teaching and learning environment.



- Visits to schools to assess the laboratory status of schools.
- Adequate funding for new updated text books in line with the current syllabus.
- Department of Education should revisit the physical science curriculum which expected to be done with the short term and possibly separating it into physics and chemistry in the FET phase.
- It is also recommended, that future studies investigating academic performance should describe the tests and exams used in order to obtain an average score as a measure of academic performance. For example, what kinds of tests were used as well as what the tests intended to assess.

5.7 Recommendations for future research

Although this study involve the cognitive learning effect on Grade 10 students' performance in physical science in selected schools in uMgungundlovu education district the researcher recommends that schools ensure that:

Future research could focus on the importance of rehearsal especially in the area of retention. For example, to ascertain cognitive ability thus produces changes in the use of rehearsal, which in turn produces changes in a learner's academic performance. Research could affirm if understanding and long-term retention is effectively obtained through rehearsal. Furthermore, this research focused on the learner; however, some teachers who choose physical sciences as a subject teaching are very well trained in theory, but have very little to no experience with conducting practical activities. Due to the inexperience and for the safety of all learners, they may not know how to conduct practical lessons especially those involving dangerous chemicals. Further research in the following areas will be encouraged:

- Further research that focuses on the physical sciences pre-service teacher education in order to find methods to improve teaching and learning strategies in the classroom, thereby ultimately helping to improve learner performance.
- Research project to determine whether the natural sciences syllabus for Grades 8 and 9 provides learners with the basic foundations required for physical sciences

5.8 Chapter summary

This study presented the factors responsible for the cognitive learning effect on Grade 10 students' performance in physical science performance of learners in Physical Sciences in uMgungundlovu District in Kwa-Zulu Natal. The results of the present study provide an important aspect of cognitive ability, learning and performance by examining their interactions and relations. It can be emphasised that individual differences in academic performance are strongly related to cognitive ability. There are few factors that can be outlined as to affect performance in learners. More so, it must be known that the dynamics of every child differs, from parents' involvements to the socio-economic status. Although there have been recommendations made for the schools, the Department of Education and parents, correcting the situation is no easy task. All stakeholders in the education sector should play their role so that the education that is provided to learners is of good quality. The chapter has offered some practical recommendations and suggestions for further research.



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APPENDICES

APPENDIX A: INTERVIEW SCHEDULE

Learners' Interview Questions

1. What is your interest in doing physical science?
2. What is your attitude towards physical science?
3. Which physical science topics do you like most and which ones do you dislike? Why?
4. Does your teaching use different method for you to understand the subject?
5. Do you use your teacher's method in solving physical science problems? If no, why not?
6. Which of the method do you like your teacher to use to teach you. Is there specific one?
7. Do you find your teacher way of teaching interesting or boring?
8. Do you most often understand what you are been taught.
9. Do you tell your teacher immediate during teaching if you do not understand the subject?
10. How does the teacher respond to you when you ask question?
11. How approachable is your teacher for personal explanation on a particular topic?
12. How often are you given class work in the class?
13. How often do you get feedback in marking from your teacher?
14. Which medium of communication do you prefer physical science to be taught in at school? Why?
15. Are you motivated in any way in physical science lessons? If no, why?
16. Do you get assistance from your parents/ guardian to do your homework? If no then why?

Teachers' Interview Questions

1. What field of qualification do you have?
2. How do you plan your teaching of physical science
3. How long have you been teaching physical science
4. Are majority of parents showing interest in the learners' work? If no, why?
5. Do you get motivated in any way to teach physical science? If no, why?
6. Do you have challenges areas in teaching physical science? If yes, what are some of the challenging areas?
7. Do many of the learners enjoy your method of teaching?
8. Do you give them different method of teaching for their understanding?
9. In all the methods you use which of methods suit's you as a teacher?
10. In the different method you use which of it do they use often?
11. How often do you permit them to ask question if they do not understand?
12. Are the learners free with you during teaching?
13. How often do you give class exercises?
14. How often do you mark class exercises?
15. Does the activities given to the learners stimulate the way they think in physical science?
16. What is the class average performance in the School Based Assessment?
17. What is the class average performance in the common paper?
18. How much educational training in a year do you receive from the department of Education?

Teachers' Interview Questions



1. What field of qualification do you have?
2. How do you plan your teaching of physical science
3. How long have you been teaching physical science
4. Do you get motivated in any way when you were teaching physical science? If no, why?
5. Are majority of parents showing interest in the learners' work? If no, why?
6. Are your teachers having any challenges while teaching physical science? If yes, what are some of the challenging areas?
7. Did many of the learners enjoy their method of teaching?
8. Do the teachers give the learners different method of teaching for their understanding?
9. In all the methods they use which of methods suit's when they teaching?
10. Do you often check the way they teach?
11. During their teaching do you see the response of the learners ,if they do not understand?
12. How often do you permit them to ask question if they do not understand?
13. Are the learners free with the teachers during teaching?
14. How often does your teachers give class exercises?
15. How do you help them to help learners that are struggling, if there is any?
16. What is the class average performance in the School Based Assessment?
17. What is the class average performance in the common paper?
18. How much educational training in a year do you receive from the department of Education?
19. How the current curriculum is CAPS helping the learner in learning well.

APPENDIX B: LEARNERS' QUESTIONNAIRE

Section A

1. Indicate your age in years

Below 10	11 – 12	13+
----------	---------	-----

2. Gender or Sex

Male	Female
------	--------

3. Indicate your Town/Location

4. Race or Racial Group

African	Coloured	Indian	Asian	White
---------	----------	--------	-------	-------



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5. Whom do you live with?

Both parents	Father only	Mother only	Guardian	On my own
--------------	-------------	-------------	----------	-----------

6. The highest educational level of parent/guardian

Never been to school	Up to primary level	Up to high school	Completed Matric	Up to tertiary level	Post graduate level
----------------------	---------------------	-------------------	------------------	----------------------	---------------------

7. Employment status of parents

Unemployed	Employed	Unknown
------------	----------	---------

8. What is your mode of transportation to school?

By walking	Bicycle	Public transport
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Section B

9. What is your attitude towards the subject physical science?

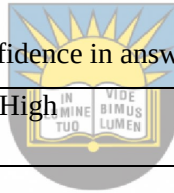
Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

10. What is your level of understanding when English is used as a medium of instruction in teaching physical science?

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

11. What is your level of confidence in answering physical science questions?

Very High	High	Low	Very low
-----------	------	-----	----------



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12. How do you evaluate the methods your physical science educator uses in teaching

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

13. What is the level of motivation given you by your physical science educator in studying physical science?

Very High	High	Low	Very Low
-----------	------	-----	----------

15. How do you evaluate the examples and activities in the Grade 10 physical science textbooks?

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

16. What is the state of your study of physical science at home after school?

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

17. Do you understand physical science better after you try it out?

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

18 Do you understand physical science better by thinking it through?

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

19. How do you rate your parents'/guardians' assistance or supervision of physical science at home?

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------



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20 When I think about what I did yesterday, I am most likely to get a picture

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

21 When I think about what I did yesterday, I am most likely to get a word

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

22. I tend to understand details of a subject but may be fuzzy about its overall structure

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

23 I tend to understand the overall structure but may be fuzzy about details.

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

24 When I am learning something new, it helps me to **talk** about it.

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

25 **When** I am learning something new, it helps me to think about it.

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

26 I prefer to get new information in pictures, diagrams, graphs, or maps.

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

27 I prefer to get new information in written directions or verbal information

Excellent	Very good	Good	Fair	Poor
-----------	-----------	------	------	------

28 Once I understand **all** the parts, I understand the whole thing.

Excellent	Very good	Good	Fair
-----------	-----------	------	------

29 Once I understand the whole thing, I see how the parts fit.

Excellent	Very good	Good	Fair
-----------	-----------	------	------

30 I find it easier to learn facts in physical science

Excellent	Very good	Good	Fair
-----------	-----------	------	------

31. I find it easier **to** learn concepts in physical science

Excellent	Very good	Good	Fair
-----------	-----------	------	------

32 When I solve physical science problems I usually work my way to the solutions one step at a time.

Excellent	Very good	Good	Fair
-----------	-----------	------	------



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Excellent	Very good	Good	Fair
-----------	-----------	------	------

Excellent	Very good	Good	Fair
-----------	-----------	------	------

Excellent	Very good	Good	Fair
-----------	-----------	------	------

Excellent	Very good	Good	Fair
-----------	-----------	------	------

Excellent	Very good 	Good	Fair
-----------	--	------	------

Excellent	Very good	Good	Fair
-----------	-----------	------	------

Excellent	Very good	Good	Fair
-----------	-----------	------	------

41 How do you want physical science to be handled in order to improve your performance?

.....

 **Thank you very much.**

APPENDIX C: ACCESS LETTER REQUESTING PERMISSION TO CONDUCT RESEARCH

The Research Unit; Resource Planning
KwaZulu Natal Department of Education
Office G25; 188 Pietermaritz Street
Pietermaritzburg 3201

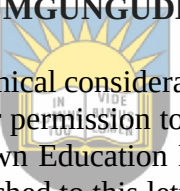
Dear Sir/Madam,

REQUEST FOR PERMISSION TO UNDERTAKE RESEARCH

I am currently registered for the degree of Masters in Education at the University of Fort Hare.

My research topic is **‘EXAMINING THE COGNITIVE LEARNING EFFECT ON GRADE 10 STUDENTS’ PERFORMANCE IN PHYSICAL SCIENCE IN SELECTED SCHOOLS IN UMGUNGUDLOVU EDUCATION DISTRICT’**.

I undertake to ensure that the ethical consideration in carrying out research shall be strictly adhered to. I hereby request for permission to carryout research in the selected schools at the Mafukuzela circuit, Pinetown Education District in KwaZulu-Natal. To assist you in reaching a decision, I have attached to this letter:

- 
- University of Fort Hare
Together in Excellence
1. Ethical clearance certificate from University of Fort Hare’s Research Ethics Committee (UREC)
 2. Ethics Confidentiality Consent Form
 3. Consent form for use by parents
 4. List of schools where the research will be carried out
 4. Interview Questions

Researcher : D.O.Olorunda, Cellularphone:0735629522, Email: dfa2010rccg@gmail.com

Supervisor : Prof . E.O Adu. Cellular 0849251948, **Email:** EAdu@ufh.ac.za

Yours sincerely
D.O Olorunda

APPENDIX D: DEPARTMENT OF EDUCATION'S APPROVAL LETTER TO CONDUCT RESEARCH



education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma

Tel: 033 392 1063

Ref.:2/4/8/1610

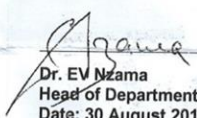
Mr DO Olorunda
187 Alexandra Road
Scottsville
Pietermaritzburg
3201

Dear Mr Olorunda

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"EXAMINING THE COGNITIVE LEARNING EFFECT ON GRADE 10 STUDENTS PERFORMANCE IN PHYSICAL SCIENCE IN SELECTED SCHOOLS IN UMGUNGUNDLOVU EDUCATION DISTRICT"**, 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 30 August 2018 to 01 March 2021.
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 Phindile Duma 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.

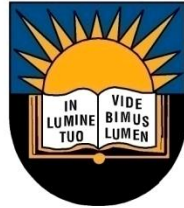

Dr. EV Nzama
Head of Department: Education
Date: 30 August 2018

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 1063 • Fax: +27 033 392 1203 • Email: Phindile.Duma@kzndoe.gov.za • Web: www.kzndoe.gov.za
Facebook: KZNDOE... Twitter: @DBE_KZN... Instagram: kzndoe... Youtube: kzndoe

...Championing Quality Education - Creating and Securing a Brighter Future

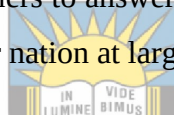
APPENDIX E: ETHICS RESEARCH CONFIDENTIALITY AND INFORMED CONSENT FORM



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Ethics Research Confidentiality and Informed Consent Form

I, David Oluyemi Olorunda, Faculty of Education, University of Fort Hare, is asking learners and mathematics teachers to answer some interview questions, which I hope will benefit our community and our nation at large now and time to come.



David Oluyemi Olorunda of Faculty of Education, University of Fort Hare, is conducting research regarding “Examining the cognitive learning effect on Grade 10 students’ performance in physical science in selected schools in UMgungudlovu Education District”. I am interested in finding out more about Grade 9 learners’ attitude towards mathematics which thereby affects their performance.

Please understand that you are not being forced to take part in this study and the choice whether to participate or not is yours alone. However, we would really appreciate it if you do share your thoughts with us. If you choose not take part in answering these questions, you will not be affected in any way. If you agree to participate, you may stop me at any time and tell me that you don’t want to go on with the interview. If you do this there will also be no penalties and you will NOT be prejudiced in ANY way. Confidentiality will be observed professionally.

I will not be recording your name anywhere on the interview schedule and no one will be able to link you to the answers you give. Only the researchers will have access to the

unlinked information. The information will remain confidential and there will be no “come-backs” from the answers you give.

The administration of the interview questions will last for one day I beseech you to be open and honest as possible in answering these questions. Some questions may be of a personal and/or sensitive nature. I plead with you to think deeply before answering the questions.

INFORMED CONSENT

I hereby agree to participate in research **Examining the cognitive learning effect on Grade 10 students’ performance in physical science in selected schools in UMgungundlovu Education District.** I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively. I understand that this is a research project whose purpose is not necessarily to benefit me personally. I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview. I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential. I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of participant Date:.....

I hereby agree to the tape recording of my participation in the study
.....

Signature of participant

Date:.....

APPENDIX F: CONSENT FORM FOR USE BY PARENTS/LEGAL GUARDIANS



University of Fort Hare
Together in Excellence

TITLE OF THE RESEARCH PROJECT: Examining the cognitive learning effect on Grade 10 students' performance in physical science in selected schools in UMgungudlovu Education District

REFERENCE NUMBER: 201707513

PRINCIPAL INVESTIGATOR: Mr. D.O. Olorunda

ADDRESS: SCHOOL OF GENERAL AND CONTINUING EDUCATION, EAST LONDON

CONTACT NUMBER: 0786918984

Your child (or ward) is being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how your child could be involved. Also, your child's participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you or your child negatively in any way whatsoever. You are also free to withdraw him/her from the study at any point, even if you do initially agree to let him/her take part.

This study has been approved by the University Research Ethics Committee at the University of Fort Hare and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

This study intends:

To examine some of the factors associated with why some of the Grade 9 learners in South Africa do not like mathematics as a subject

To examine the role of educators in learners' attitude and performance in mathematics

To identify policy directions to develop the interest of learners in mathematics education. Your child has been invited to participate in this study because he/she is currently a physical science learner in Grade 10.

You are not going to participating in the study. Your responsibility will only be to give consent for your child's participation.

This study is for academic purposes and that the findings are important in the improvement of learners' physical science performance and curriculum development There will be no any risk involved in your child taking part in this research because of the nature of the study.

If you do not agree to allow your child to take part, your child will not be affected in anyway. The information that will be collected about your child will not be available to anyone else and will be treated as confidential and protected.. if it is used in a publication or thesis, your child's identity will remain anonymous.

Your child's participation in this research will be only in the interview, therefore there will be no injury in any way, as a result of taking part in this research study.

You or your child will not be paid to take part in the study, but out-of-pocket expenses will be covered for each study visit. There will be no costs involved for you if your child does take part.

You may also:

inform your family practitioner or usual doctor that your child is taking part in a research study.

Contact Pro E.O. Adu at 0437047176 if you have any further queries or encounter any problems. Contact the Chairperson of the University Research Ethics Committee if you have any concerns or complaints that have not been adequately addressed by your child's study doctor.

You will receive a copy of this information and consent form for your own records.
Declaration by parent/legal guardian

By signing below, I (name of parent/legal guardian) agree to allow my child (name of child) who is years old, to take part in a research study entitled (insert title of study)

I declare that:

- I have read or had read to me this information and consent form and that it is written in a language with which I am fluent and comfortable.
- If my child is older than 7 years, he/she must agree to take part in the study and his/her ASSENT must be recorded on this form.

- I have had a chance to ask questions and all my questions have been adequately answered
- I understand that taking part in this study is voluntary and I have not been pressurised to let my child take part. ☐ I may choose to withdraw my child from the study at any time and my child will not be penalised or prejudiced in any way.
- My child may be asked to leave the study before it has finished if the study doctor or researcher feels it is in my child's best interests, or if my child do not follow the study plan as agreed to.

Signed at (place) on(date)

Signature of parent/legal guardian Signature of witness

Declaration by investigator

I Mr D.O. Olorunda declare that:

- I explained the information in this document to Participants.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understand all aspects of the research, as discussed above
- I did/did not use a interpreter (if a interpreter is used, then the interpreter must sign the declaration below).

Signed at (place) on (date)

Signature of investigator

Declaration by interpreter (Only complete if applicable)

I (name).....declare that:

- I assisted the investigator (name) to explain the information in this document to (name of parent/legal guardian) using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the parent/legal guardian fully understands the content of this informed consent document and has had all his/her questions satisfactorily answered.

Signed at (place).....on(date).....

.....
Signature of interpreter Signature of witness

APPENDIX G: ETHICAL CLEARANCE CERTIFICATE.



University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE **REC-270710-028-RA Level 01**

Certificate Reference Number: ADU011SOLO01

Project title: **EXAMINING THE COGNITIVE LEARNING EFFECT ON GRADE 10 STUDENTS' PERFORMANCE IN PHYSICAL SCIENCE IN SELECTED SCHOOLS IN UMGUNGUDLOVU EDUCATION DISTRICT.**

Nature of Project Masters in Education

Principal Researcher: David Olorunda

Supervisor: Prof E.O Adu

Co-supervisor: N/A

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document;
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The Principal Researcher must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

Special conditions: Research that includes children as per the official regulations of the act must take the following into account:

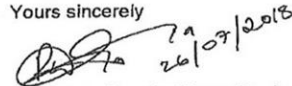
Note: The UREC is aware of the provisions of s71 of the National Health Act 61 of 2003 and that matters pertaining to obtaining the Minister's consent are under discussion and remain unresolved. Nonetheless, as was decided at a meeting between the National Health Research Ethics Committee and stakeholders on 6 June 2013, university ethics committees may continue to grant ethical clearance for research involving children without the Minister's consent, provided that the prescripts of the previous rules have been met. This certificate is granted in terms of this agreement.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
 - Any unethical principal or practices are revealed or suspected;
 - Relevant information has been withheld or misrepresented;
 - Regulatory changes of whatsoever nature so require;
 - The conditions contained in the Certificate have not been adhered to.
- Request access to any information or data at any time during the course or after completion of the project.
- In addition to the need to comply with the highest level of ethical conduct principle investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to the Dean of Research's office.

The Ethics Committee wished you well in your research.

Yours sincerely



Professor Pumla Dineo Gqola
Dean of Research

25 July 2018

APPENDIX H: HUBA HIGH SCHOOL

HUBA HIGH SCHOOL

PO BOX 864

RICHMOND

3780

CELL NO: 084 7610307



EMIS NO. 158915

EMAIL ADDRESS: hubahigh@gmail.com

CIRCUIT: RICHMOND

DISTRICT: UMGUNGUNDLOVU

REGION: PIETERMARITZBURG
TEL NO. 033 212 1001

4 September 2018

To Whom It May Concern

This letter serves to confirm that Mr Olorunda has been granted permission from the above school to conduct his research.

The research involves grade 10 physical sciences participants, four of whom will be interviewed by Mr Olorunda and the other will fill in a questionnaire. One HOD and one educator will be present throughout the whole process which will be convened in the school hall.

Your co-operation will be appreciated.

Yours faithfully

Mr SF Ndlovu (Acting Principal)

DATE: 04/09/18
P.O. BOX 864 RICHMOND 3780
DEPUTY PRINCIPAL

APPENDIX I: INDALA HIGH SCHOOL



To Whom It May Concern

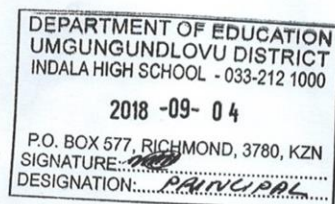
This letter serves to confirm that Mr Olorunda is granted a permission from the school mentioned above to undergo his research .

The research involves Grade 10 participants, four of the participant will be interviewed by Mr Olorunda . 55 of them will do questionnaire . There will be One HOD and one educator present. The venue will be the School Hall.

Your co-operation will appreciated.

Yours Faithfully

N.M Khanyile(Principal)



APPENDIX J: PHYSICAL SCIENCE QUESTION

GRADE 10C
70
60 MARKS

PHYSICAL SCIENCES

1. Calculate the number of moles of oxygen molecules in 64g of oxygen (O_2) gas. (2)
2. Find the mass of 0.5 mol of iron oxide (Fe_2O_3) (2)
3. What amount of oxygen (in mol) does 1.2×10^{24} oxygen molecules represent? (2)
4. The only products of combustion of methane in a plentiful supply of oxygen are CO_2 and H_2O . A chemist who carried out this reaction was able to measure the mass of CO_2 and H_2O produced and found it to be 1.32g and 1.08g respectively. Calculate :
 - a) Number of moles of CO_2 produced (2)
 - b) Number of moles of H_2O produced (2)
 - c) Number of moles of carbon atoms in CO_2 (2)
 - d) Number of moles of H atoms in H_2O (2)
 - e) Ratio of moles of C to H in the methane gas (2)
 - f) Deduce the formula of methane (1)
5. Find the percentage composition of potassium carbonate (K_2CO_3) (6)
6. A 0.523g sample of the unknown compound C_xH_y was burned to give 1.612g of CO_2 and 0.7425g of H_2O . A separate experiment gave a molar mass for C_xH_y of 112g.mol⁻¹. Determine the empirical and molecular formula for the hydrocarbon. (12)
7. Calculate the concentration of sodium carbonate solution (Na_2CO_3) made by dissolving 7.42g sodium carbonate in water and making volume up to 250cm³. (4)
8. Calculate the mass of oxalic acid dihydrate required to make up 250cm³ of a 0.100mol.dm⁻³ solution. $(COOH)_2 \cdot 2H_2O$ (4)
9. Use the ff balanced equation for the chemical reaction that occurs when ethanol burns in a plentiful supply of oxygen to answer the question that follow:

$$2C_2H_5OH(l) + 7O_2 = 4CO_2(g) + 6H_2O(g)$$
 - a) How many moles of oxygen react with 8 moles of ethanol? (3)
 - b) What mass of CO_2 is produced if 9.2g of ethanol burns in a plentiful supply of oxygen? (7)
 - c) What mass of ethanol will burn in excess oxygen to produce 784cm³ carbon dioxide measured at STP? (7)

APPENDIX K: CERTIFICATE OF EDITING

To whom it may concern

This document certifies that the thesis whose title appears below was edited for proper English language usage, grammar, punctuation, spelling and overall style by Dr Anthony Masha who is a member of the Professional Editors" Group and whose academic qualifications appear in the footer of this document.

DISERTATION TITLE

EXAMINING THE COGNITIVE LEARNING EFFECT ON GRADE 10
STUDENTS" PERFORMANCE IN PHYSICAL SCIENCE IN SELECTED
SCHOOLS IN UMGUNGUDLOVU EDUCATION DISTRICT

RESEARCHER OLORUNDA, D.O

DATE EDITED

March 2019

Editor"s comment All mistakes relating to grammar, punctuation, spelling and overall style have been corrected. The editor was not responsible for conducting a cross- referencing check.

B.A (Ed), Honours B.A. (Social Sciences), Honours B.A (Group Dynamics),
Postgraduate Diploma in Education, M.ADMIN (Public Administration), Doctor of
Administration in Public Administration