A reflective study of the factors that influence learner performance in physical sciences in an education district of the Eastern Cape Province

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DECLARATION

I, Ntsikelelo Ndzala, declare that the thesis, **'A reflective study of the factors that influence learner performance in physical sciences in an education district of the Eastern Cape Province'** is my own original work and has not been submitted to any other university for a degree. All sources have been fully acknowledged in the text and a list of references has been provided.

_____ _____

Ntsikelelo Ndzala **Date**

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Thank you, in addition, to the principals of the three schools that were part of the study and their teachers, as well as the parents of the previous grade 12 learners for allowing the learners to participate. I must also mention the SGB and principals who agreed for the study to be conducted by their respective physical sciences teachers.

DEDICATION

The study is dedicated to my lovely wife who is always there to receive me in good and trying times, even when I spend most of the time away from home. I also acknowledge my family traits both from my father and mother's side that gave me the will to persevere for success, and my in-laws for their understanding and moral support.

ABSTRACT

This study was conducted in three rural high schools in the province of the Eastern Cape, South Africa whose physical sciences results were not consistent. The main issue in the research was that when schools' results improve it becomes a challenge to keep it consistent. It is therefore important to reflect and assess what were the good practices that resulted in the results improving. Practices by both teachers and learners need reflection in order to keep what works and get rid of all the bad influences that affect the achievement of physical sciences results. The physical sciences performance for the past three years (2011-2013) for the whole country (excluding 2014) had shown steady improvement, but this could not readily mean that all was well in our schools. There is more to be done because the physical sciences results are not highly rated against those of other countries. The research itself was an attempt to highlight the importance of always looking back at what has been influencing the teaching and learning in the classroom, whether good or bad results were achieved, to see what practices could still be improved, while also looking at or reflecting on the strategies used by educators in delivering the subject matter. The study used reflective practice theory which was related by several authors. The physical sciences learners and physical sciences teachers were the participants where interviews were conducted to obtain reflections by the participants. The data was collected at three different schools whose learners had passed grade 12 in physical sciences to reflect on their own experiences in the teaching and learning of physical sciences. The study identified a number of factors affecting the performance in physical sciences, particularly in the three schools sampled in the district of the Eastern Cape. The factors include the lack of resources, lack of time to complete the syllabus, exclusion of practical work, learner participation, inability of learners to explain or present what was taught in the physical science classes and teacher confidence. The study contributes to identifying the factors that contributed to the poor performance in physical sciences and demonstrates that reflection is a key strategy that teachers could employ to ensure that the teaching and learning environment receive the value-addition it deserves.

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ABBREVIATIONS AND DEFINITIONS OF CONCEPTS

ACE- Advanced Certificate in Education

ANA- Annual National Assessment.

Assessment- as per the National Curriculum Statement (NCS), FET phase, it is a process of collecting and interpreting evidence in order to determine the learner's progress in learning and to make a judgment about a learner's performance (DoE2003:55).

C2005 - Curriculum 2005

CAPS-Curriculum and Assessment Policy Statement

DBE-Department of Basic Education

DoE- Department of Education.

FET- Further Education and Training

ILIMA-an intervention program where learners are expected to be spending time day and night in one common place for studying purposes before they sit for end of the year examinations with all stakeholders actively involved.

Learner performance-learner's ability to demonstrate and show that learning has taken place through an activity or task (Woolfolk 2007:562-563)

MSTE-Mathematics, Science and Technology Education.

NCS-National Curriculum Statement

PIRLS- Progress in International Reading and Literacy Studies.

Poor performance-it refers to when learners obtain marks which are below 30% in the National Senior Certificate and therefore fail that particular subject (DoE 2003).

RNCS - Revised National Curriculum Statement

SACMEQ- Southern and Eastern African Consortium for Monitoring Educational Quality.

SKA-Square Kilometer Array

TIMMS- Trends in International Mathematics and Science Study.

TVBC - Transkei, Venda, Bophuthatswana, Ciskei

CHAPTER ONE

RATIONALE OF THE STUDY

1.1 Introduction

This chapter presents the background to the study and the rationale used in order to address the main research question, the factors that influence the performance in physical sciences. The chapter also gives an overview of the underlying reasons why the study was conducted.

1.2 Background to the study

The performance of learners in physical sciences has been a major headache for the Department of Education for a number of years up to this point in our democratic era. The physical sciences performance for the past three years for the whole country excluding 2014 has shown steady improvement, but that cannot readily mean that all is well in our schools. There is more to be done because physical sciences results are rated against other countries. For the past three years (2011-2013), the country's national physical sciences results were at 53,4%; 61,3%; and 67,4% respectively. The results dropped in 2014. The Eastern Cape Province always came last in performance levels compared to other provinces. For the same three years national (for all subjects countrywide) results were standing at 46%, 53%, and 64,9% respectively and it became the same drop in 2014 where the Province of the Eastern Cape came last out of nine provinces. Table 1, below, illustrates how the results of the province were fluctuating as well as the results of the three schools that are involved in the study in the district of the Eastern Cape. The NCS national results first written in 2008 were 62,5% with a decline the following year to 60,6 %(DBE, 2010). From this the physical sciences results were standing at 55% in 2008 and in 2009 they were at 36,8% which really was a cause for concern for physical sciences teachers. This indicates the trend that physical sciences performance results for the past years were not at all impressing, as is also the case currently.

Table 1. Grade 12 physical sciences results national, provincial and school from 2011-2015

Years	2011	2012	2013	2014	2015
National physical sciences results in percentages	53,4%	61,3%	67,4%	61,5%	56,5%
Provincial physical sciences results in percentages	46%	53%	55,8%	51,5%	49,5%
School A physical sciences results percentages	8%	23,8%	66,7%	50%	46,4%
School B physical sciences results in percentages	0	0	71,4%	61,7%	51,9%
School C physical sciences results in percentages	0	0	83,3%	61,1%	62,2%

The physical sciences performance has been inconsistent resulting in very low morale amongst teachers as they sometimes seem to be improving and then suddenly become one of the worst compared to other countries both in mathematics and physical sciences and at the end find themselves wondering what went wrong. An analysis of the alignment of the grade 12 physical sciences examinations and the core curriculum in South Africa by Edwards (2010) highlights some important facts regarding the trends in how the physical sciences results continued to drop in South Africa significantly. This study makes mention of how the NCS was introduced, how it affected the performance of learners, and the moral of physical sciences teachers.

1.2 State of science education in South Africa

The physical sciences as a subject in the curriculum of this country does not make it immune from all other subjects. It has undergone all the major challenges in the education system. In my opinion it was meant for a certain group of people only; hence I have some scholarly arguments to include regarding the entire education system.

The historical background of the South African education system indicated huge inequalities for a very long time - approximately more than a hundred years between regime changes. The education system was characterized by class segregation and unequal distribution of resources. Christie (2008) states that for the white middle class children who attended church schools, the government made sure that those schools were subsidized and well resourced.

During that era education was believed to be able to bring about social order and prompted the government of the day to develop a free and compulsory education system for the white people. The education of the black children was neither free nor compulsory but remained the responsibility of various mission societies (Christie, 2008).

The devastating effects suffered by black children under the colonial rule because of education inequalities are immeasurable. During the apartheid era, the black population was portrayed as inferior and few years of free education was regarded as sufficient to prepare black people for labourers' roles (Christie, 2008). Volumes and volumes of evidence regarding that catastrophe has been provided far and wide, locally and internationally, attesting to this.

After the democratic dispensation, the education system was structured and aimed at providing all South African citizens with an equal opportunity. Pieces of legislation were passed by the government regarding education and in 1996 the South African Schools Act was enacted as law. The South African Schools Act (SASA, 1996d, Section 34(1)) states that the state provides and ensures access to quality education for all and redresses the past education especially for those who suffered particular disadvantage.

Before 1994, only a few learners took physical sciences as a subject for the senior certificate. This is still the case even after 1994. The trend continues as the subject is regarded as very complex and not for every learner.

The country's state of science education is improving in terms of programmes aimed at improving the teaching and learning of science. Unfortunately, those endeavours were not moving as speedily as needed. The amount of effort and funding provided to various projects such as outreach programmes, e-learning and telematics aimed at improving the quality of science performance did not always translate into improvement of science achievement. This could be attributed to too many changes in the curriculum of this country which were not adequately researched before being implemented. South Africa has since 1994 been subjected to the following curricular changes: NATED 550, C2005, RNCS, NCS and CAPS. All these changes were introduced to teachers for implementation without proper training to adapt to the changing approaches. The most affected sector of our society were the learners who were at the receiving end.

According to the report by Spaull (2013) on the state of education in South Africa, it is stated that since the transition of South Africa to democracy, the quality of education in the country has been in a crisis and the trend continues thus failing the majority of South Africa's youth. The report indicated through independently conducted assessments of pupil achievement that most South African pupils could not read, write and compute at grade-appropriate levels, with the exception of a wealthy minority who were functionally literate and numerate. This report further claimed that even though there have been recent improvements in pupil outcomes and important policy innovations, the picture that continues to emerge time and again is that of both dire and consistent collapsing systems.

According to the Spaull (2013) report, currently the South African education system is grossly inefficient, severely underperforming and egregiously unfair. Even though South Africa currently participates in a number of local and international tests of educational achievement, like the recently implemented Annual National Assessment, it continues to face challenges which were not anticipated and now the ultimate goal of this assessment is completely obscured, that of providing some standardized indication of learning at the primary grades for the early identification and remediation of the learning deficit.

The report continues to assess South Africa's participation in international tests of educational achievement through the Trend in International Mathematics and Science

Study. (TIMMS), Progress in International Reading and Literacy Studies (PIRLS) and the Southern and Eastern African Consortium for Monitoring Educational Quality. (SACMEQ). These tests also indicated the change in learner performance over time to earlier cohorts and relative to other countries participating in these studies. The outcomes of those assessments again indicated less improvement in numeracy performance compared to 13 other African countries who also participated in the studies and the same scenario prevailed for mathematics and science performance. The country has recently participated in the World Economic Forum and again it also rated South Africa in the last position of all the participating countries of the world in mathematics and science.

1.3 Interventions in science education in South Africa and the Eastern Cape Province

There have been various programmes in the country even before the new government had taken over trying to assist the Education Department to improve physical sciences performance. There was the Science Education Project, steered by the Department to promote the use of mobile practical laboratories throughout the country. In television there were programmes meant for those who don't have access to the project to watch the television as a form of additional support in both mathematics and physical sciences. There were also foundations like the ZENEX Foundation which was involved in assisting schools by supplying practical work material for science teaching and learning. It also trained teachers for the use of those materials and built school science laboratories. The researcher was one of the recipients of this foundation in which he was offered assistance in funding a mathematics project from 2005-2007. In addition, there were also projects run by the Telkom and Eskom Foundations. The researcher was involved with mathematics, science and technology as key subjects.

South African Breweries was also involved in trying to alleviate the conditions under which mathematics and science were taught. The Dinaledi Schools Project evolved in June 2001, initiated by the Department of Education, to pursue the same dream to enable a higher number of learners to pass matric with university entry requirements in both mathematics and science. The teachers received high quality training in subject content. As from 2015,

the Dinaledi schools were replaced by technical high schools in a programme called National Strategy for Mathematics, Science and Technology Education. The programme was funded by a grant from the Department of Education and is currently evaluated by the ZENEX Foundation. The study was conducted in respect of how the programme is running and challenges that may be encountered (National Education Draft, November 2014).

This researcher was part of project initiated by the Eastern Cape Department of Education, where selected physical sciences teachers from various districts were granted an opportunity to be trained in physical sciences through an Advanced Certificate in Education for FET Science (ACE-FET) in 2010. The programme was very intense where the practical work was the order of the day combining with the theory part to assist the teachers in the classroom situation for the content to be understood. The requirement was for the teachers to also assist those who could not be in the programme. The programme developed in leaps and bounds and enabled the participating teachers to be candidates for a Master's study in 2015. There are also other programmes that the Education Department is busy with in other institutions like the Nelson Mandela Metropolitan University in the Eastern Cape.

1.4 Research problem

The study intended to identify factors that influence achievement in the performance of physical sciences in a district of the Eastern Cape Province and to find ways that could assist the learners improve performance and remain consistent in their achievement in physical sciences. It was meant to investigate daily practices of what is working and not working in the teaching and learning of physical sciences by the teachers themselves in the classroom. The importance of giving much attention on how to facilitate physical sciences to all learners is imperative, since science skills are much needed in this ever changing technical world, skills that are also in demand in the world of work (Redish, 2006). In South Africa these skills are very scarce, therefore, the country cannot afford to falter in harnessing the future of the young minds for a stable economy.

1.4.1 Why is the focus on physical sciences?

This is one of the most valued subjects in various education departments all over the world, and in South Africa there is great value attached to this subject as well. The DoE (2003) describes this value of physical sciences as "focusing 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. The subject deals with society's desire to understand how the physical environment works, how to benefit from it and how to care for it responsibly" (DoE, 2003, p13). Physical sciences encourage a responsible and ethical attitude towards learning, constructing and applying science, and it allows for reflection and debates on theories and scientific models (DoE, 2003). Physical sciences play a significant role in in this country as it sets trends in research of high quality and standards with the nations of the world. The recent involvement of South Africa with Australia to host the famous Square Kilometer Array (SKA) is evidence of how this country is committed to work with the global community to answer complex questions about the universe.

1.5 Research questions

The study is directed at the following main research question:

What factors influenced the performance of learners in grade 12 physical sciences at three schools?

The main research question was further broken down into the following sub-questions:

1. What were the learners' achievements in physical sciences over the past three years in each of the three schools?
2. What were the learners' perceptions of the factors that influenced their performance in physical sciences?
3. What were the physical science teachers' perceptions of the factors that influenced the performance of learners in physical sciences?

4. What were the principals' perceptions of the factors that impacted the teaching and learning of physical sciences in their schools?

1.6 Significance of the study

The study could lead to the improvement of physical sciences results and provide baseline research data on the strategies used. The researcher believes the study is significant, firstly, to the teachers who are under dire pressure trying to find what could be done better to improve and maintain the physical sciences performance to acceptable levels as well as to improve their practice in teaching and learning of physical sciences.

When teachers are demotivated and ineffective as claimed by their superiors based on the performance of their learners, they tend to fail to execute their duties efficiently which in turn reflects badly on those learners who see their teachers as their only hope for a better future. The study could assist teachers to try other strategies in teaching and learning of science, because teaching has been identified as one of the highly stressful professions (Klaasen & Chiu, 2010).

Secondly, the researcher further trusts that the study will have significance to the school principals, subject advisors, circuit managers and district managers within the Departments of Education. The superiors of the Department of Education need to be hands on in addressing these issues and hire highly qualified and experienced teachers who are passionate about their work.

1.7 Limitations of the study

The study was done using past grade 12 learners as participants, which made it not so simple to secure most of them because some of them were in various institutions of higher learning which were not necessarily in the Eastern Cape Province. The researcher made all means to secure their invitations to attend and in so doing was dependent on their responses, also making it difficult to know exactly the number of those who were going to attend which would impact on the sample size.

The researcher had to also secure the presence of the physical sciences teachers who were extremely busy at that time of the year and their principals had to be convinced about the importance of this study so as to release their teachers. The researcher understood that even though other stakeholders were not participants in the study, Creswell (2005) argues that the researcher is able to apply the results of a study from a small sample to a larger sample if the sample is representative.

1.8 Overview of the chapters

This thesis has five chapters:

Chapter one presents the introduction to the study, it outlines the research problem, the significance of the study, the state of science education in South Africa, interventions in science education and limitations to the study.

Chapter two deals with the theoretical framework which is a reflective practice with the supporting literature. It reviews previous studies in order to demonstrate how the present study develops from the previous studies.

Chapter three reports on the methodology employed to conduct the study. It describes the research design, data collection plan, research methods and population sample used, instruments used and analysis. Validity and reliability are also included as well as ethical considerations.

Chapter four reports the findings and discussion which includes the data analysis, data interpretation and presents the findings of the study. The data collected was analysed into themes which were tabulated and converted into graphs.

Chapter five provides the implications of the study and draws conclusions with regards to the effectiveness of the applied strategies and approaches in the reflective study.

1.9 Conclusion

Rationale of the study was discussed in chapter one. The background of the study was outlined in order to get a clear picture of the performance of the physical sciences. The schools' results in the Eastern Cape were compared to the national physical sciences'

results. The following chapter will present the theoretical framework that underpins the study and the literature that is relevant to the study will be reviewed.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The previous chapter provided the rationale for the study. This chapter provides a review of the relevant literature and clarifies the theoretical framework that underpins this study. According to Johnson and Christensen (2011), a literature review can either be used to explain the theoretical underpinnings of the research study, to assist in formulation of the research question and the selection of the study population, or to stimulate new insights and concepts throughout the study. In the literature review the researcher examined the reflective practices in teaching and learning as discussed and defined by other authors. The researcher reviewed the literature on reflection on how it could assist the teaching and learning of physical sciences and how it could improve and maintain the grade 12 results of physical sciences. National and international authors have made significant contributions towards addressing this issue through research they have made over the years and through their findings and recommendations. Locally there are a few authors who have also made their mark to highlight the importance of reflections in their fields of study. The literature in this study talks about the importance of reflection in teaching and learning of physical sciences in schools and teachers' own reflective practices.

Physical sciences subject is regarded as the most vital, critical subject ever around the world, hence its performance is always under the spotlight, not leaving behind its economic impact in terms of research that develops the nations internationally. That was the reason the researcher did this literature review. The aim was to find out exactly what other scholars are saying regarding this matter, especially in South Africa, to help the country and to start in my own district to address the underlying issues.

2.2 Theoretical framework

This study is underpinned by the theory of reflective practice. Moon (2004) refers to reflection as part of learning thinking. He says people reflect in order to learn something, or people learn as a result of reflecting, and the term ‘reflective learning’ emphasises the intention to learn from current or prior experience. It is imperative to acknowledge that reflection is a process of being able to build a structure based on construction of knowledge. Platzer, Blake & Ashford (1997) see models of reflection within learning as essential to the construction of reflective practices within the educational environment. There were also contrasting views between Kolb (1984) whose creation on reflective practices talks about a learning cycle that incorporates elements that lead to learning as a cyclical process while Gibb (1988) uses a model that sees reflection processes within general learning and it assumes repetitive experiential contexts. John (2000) uses a model for structured reflection which highlights the ways in which people seek out and validate experiential knowledge. This model requires structured formats, such as diaries, and supervisor support and feedback.

2.3 Studies on reflection in education

Moon (2004) refers to reflection as part of learning thinking. He says people reflect in order to learn something, or people learn as a result of reflecting, and the term ‘reflective learning’ emphasises the intention to learn from current or prior experience. It is imperative to acknowledge that reflection is a process of being able to build a structure based on construction of knowledge.

Freire (1971) outlines clearly that one of the challenges to progressive educators is not to feel superior in the public school system to the learners from the slums, to the lower class children, to the children with no comforts, who do not eat well, who do not "dress nicely", who do not "speak correctly", who speak with their own syntax, semantics, and accent. The disadvantaged children, especially those in rural contexts, are voiceless and do not enjoy the benefits of well-resourced schools, qualified teachers and basic necessities like comfortable homes and food.

Reflecting on my teaching was one of my key tools. This was to try and assess the effectiveness of my presentation and teaching. The researcher had to keep in mind the objectives of teaching and learning. The researcher had to ensure that learners themselves were able to reach the desired outcomes at the end of each lesson. Reflection is the essence of Freire's principles of conscientisation and praxis. Teachers in oppressed contexts need to reflect on their practice and to take into consideration the social conditions of their learners and strive towards true education that opens the minds of the learners so that they can change society and their social context (Freire, 1971). In reflective teaching I am able to ask questions on what teaching model am I using, how does it apply in specific teaching situations and how well is it working and what action should be taken to improve the learning.

Tice (2004) attests to the above by making the following points: Reflective teaching means looking at what you do in the classroom, thinking about why you do it and thinking about if it works - a process of self-observation. By collecting information about what goes on in our classroom and by analysing and evaluating this information, we identify and explore our own practice. Reflective teaching is therefore a means of professional development which begins in our classroom. It is a cyclical process, because you start to implement changes, and then the reflective and evaluative cycle begins again. Schon (1983) affirms that reflection in action concerns thinking about something whilst engaged in doing it, having a feeling about something and practicing according to that feeling. This model celebrates the intuitive and artistic approaches that can be brought to uncertain situations. On the other hand, Boud (1985) formulated some points regarding reflection and one of them is that you have to re-evaluate the event in the light of experimentation. Seek to understand the meaning of experience and then you have to plan for what you might change.

Research on effective teaching over the past two decades has shown that effective practice is linked to inquiry, reflection and continuous professional growth (Harris, 1998). Reflective practice can be a beneficial form of professional development at both the pre-service and in-service levels of teaching. By gaining a better understanding of their own individual teaching styles through reflective practice, teachers can improve their effectiveness in the classroom.

There is a contrasting view about how research should be conducted according to McIntyre (1997) who used Elliot's (1989) work on teacher practices and research done by professional researchers. The argument is how can educational research be done without the involvement of teachers so that teachers can articulate, analyse and hypothesise solutions to the educational challenges. Elliot (1989) is adamant that these professional researchers must be subordinate to the process. Van Manen (1995) quoting Schon (1987) suggests that the literature of teaching and teacher education has shown that professional practices of education cannot be properly understood unless we are willing to conceive of practical knowledge and reflective practice quite differently.

The concept of 'pedagogy' has long carried the meaning of discretion, prudence, judgment, caution, forethought (Van Manen, 1994). So, there is nothing provocative about the idea that reflection is central to the life of the educator. It is the very nature of the pedagogical relations that the teacher reflectively deals with children, rather than doing so unthinkingly, dogmatically, or prejudicially. Therefore, the idea of an unreflective type of pedagogy or teaching would really be a contradiction in terms (which is not to say that there are no unreflective 'teachers').

Reflective thinking is important not only as a tool for teaching, but also as an aim of education and Dewey (1964) concurs that it enables people to know what they are about when they act. Reflective thinking converts action that is merely appetite, blind, and impulsive into intelligent action Dewey (1964). It is therefore of vital importance for the teachers to reflect on their daily practices. The learners should get used to reflecting on their own world of learning, for better understanding between them for improved results today and in the future.

Reflection is a process in which teachers become aware of, or are supported to become aware of the theory and motives behind their own teaching, to reflect on this, and to take some deliberate steps to develop (Gibbs, 1998). In 1933, Dewey was among the first people to identify reflection as a specialized form of thinking. Conceptualizing reflection crucially starts with experience and stresses how learning happens from actions. Dewey (1933)

explains that open-mindedness is the ability to listen to both sides of the issue, paying more attention to alternatives and acknowledging that traditional belief are also subject to scrutiny. Dewey (1933) also views responsibility as one's aspirations to probe for truth and the application of the information gathered to solve problems. He further argues that wholeheartedness refers to the individuals' ability to deal with fears and uncertainty to effect change and evaluate one's practices, that of children, school and society (*ibid)*.

This type of reflection affords the practitioner the opportunity to redesign the task at hand whilst doing it. In addition, Van Manen (1991) defines reflective-in-action as the interactive reflection that affords the practitioners an opportunity to respond immediately to problems or situations that they are confronted with. He views it as a *stop-and-think* process that allows practitioners to make decisions on their feet. This, according to Beck and Kosnik (2001), means forgetting what happened during the lesson and an immediate remedy is provided as opposed to waiting for future remediation.

As concurred by Moon (2004), awareness alone doesn't necessarily result in an improvement of a situation although it is an important first step and may lead to increased confidence or sense of pride. The reflective process is triggered by the acknowledgement that there is an aspect that requires special attention. This realization may be caused by an unexpected experience or outcome or just a sense that something isn't quite right. According to Greenwood (2003), reflection is when the practitioner considers what he is doing whilst busy doing it. He further suggests that the consideration can be stimulated by surprise. On the other hand, Patil (2013) views reflective practices as the means to engage in a process of on-going learning and developmental awareness whilst paying attention to the practical values and theories. He sees it as an instrument that practitioners may utilize to gauge their professional development and improvement, and their practice based professional learning. This is consistent with Osterman and Kottkamp (1993) who define reflective practice as a means by which educators can develop a deeper level of self-awareness about the nature and impact of their performance, an awareness that creates opportunities for professional growth and development. The fact that educators put a lot of effort into a strategy but did not obtain quality results caused a dialogue within the researcher. Dialogic approach in constructivism (Moon, 2004) requires an individual to re-evaluate his/her own personal view

of education, teaching and learning. It is valuable to use critical reflection with the aim of improving society as a goal of the reflective process. Centre managers, school principals and lead teachers should be aware that what happens in the classroom is linked to the social, political and cultural institutions of any particular society in framing practical problems and need to be taken into account when trying to arrive at any solutions (Hatton & Smith, 1995).

Brookfield (1995) and McAdams (2004) added that some teachers claimed that the most important content of reflection should focus on one's own school life experiences as a student, on the grounds that processes of transference from schooling are extremely significant in the construction of one's own identity, beliefs and subsequent practices as a teacher. Black and Plowright (2010) elucidate that the study they conducted is an effective one as it can be interpreted to contain elements regarding both reflective processes which are teacher's own teaching and the consideration of the ethical consequences of classroom procedures on learners. Hence everybody should take part in sharing these values of being a teacher that is a reflective practitioner and a moral practitioner with one another as supported by Senge (1990), who suggested that the ability to develop a shared vision will become one of the key disciplines of the learning organisation. Furthermore, Senge (1990) feels that visions that are truly shared take time to emerge and sharing visions with others help individuals' aspirations and visions to be realized and allow others to reach their optimal potential. It is in this manner that all stakeholders become role players who participate constructively in developing the vision of the learning centre.

Furthermore, Larrivee (2008) and Korthagen (2004) have placed an emphasis on the role reflection can play in improving professional development of teachers. In physical sciences teaching there is a need to ensure that not only lip service is given to reflection on teaching, but rather that teachers are actively evaluating their own teaching practice. Teachers need to reflect on the time they have spent on the activity and how this has affected their intended outcomes, what Schon (1983) refers to as reflection-on-action. Schon (1983) defines reflection-on-action as a process whereby the practitioner intentionally recalls a specific event/action after it has occurred. Moreover, Day (1999a), contends that reflection-on-action is a systematic process that knowingly allows for analysis, reconstruction and re-framing of

past actions/event to plan for future events. Day (1999) continues to suggest that reflection-on-action may lead to productive collaborations with regard to planning for the future, as it allows for interaction with other practitioners. These views are also corroborated by Butler (1996) and Pinksy, Monson & Irby (1998), who also contend that reflection-on-action is a process where teachers look back on past events and analyse their strengths and weaknesses, interrogate their teaching techniques and places where challenges were found, and, in addition, suggest solutions and future directions that their teaching might follow. The researcher applied this theory to review the strategies that have been used in the three schools to obtain their results in grade 12 physical sciences in the district under study.

Patil (2013) states that, within the educational context, reflection refers to the process in which the teacher studies his own teaching methods, and identifies the best practices. He says this includes the consideration of ethical consequences of the classroom procedure on learners. Within the context of this study, this view has implications, as centres of learning achieve vastly different physical sciences results despite the fact that they are in the same district but with different centre managers. Boud (1985) states that reflection is an important people endeavour, in which individuals relive their personal experience, rethink about it, consider it again and evaluate it. They view experience as crucial to learning and teaching. On the other hand, Dewey (1933) provides three qualities of reflective people, namely that they are open-minded, they exercise restraint, and they show devotion. There are some shared notions of a cyclic process of planning, acting, assessing and planning again, thereby creating a spiral of change with regard to what should constitute the content of reflection.

Ross & Gray (2006) cited the fact that other research studies have demonstrated that transformational leadership contributes to valued teacher outcomes. In support of the previous statement, Leithwood, Jantzi, & Steinbach (1999) cited an example that, teachers in schools characterized by transformational principal behaviour are more likely to express satisfaction with their principal, report that they exert extra effort, and be more committed to the organization and to improving it. This as a result can affect the discipline of learners from

the two centres in a positive or negative way which will in turn translates to the end results of the centres to be inconsistent with the desired outcomes.

When there was a lesson presentation, teacher discovered that learners were not responding as expected or were not engaging well. This was an indication that there were some problems that needed to be addressed by the teacher. The teacher could have, maybe, started to look if direct link this non-participation could be the class management during the lesson. The teacher was supposed to lookout for any learners who would potentially disturb the planned lesson. The teacher should later on have reflected on the teaching strategies he utilised. The teacher was also to find out and identify what strategies could have been used to enhance and stimulate learner participation. He had to find ways to engage learners in physical sciences teaching, and to guide learners' responses in a positive manner in the classroom.

Engaging in self-reflection should involve a move from this semi-conscious, informal approach to a more explicit, intentional approach. Critical reflection and experiential reflection or 'assumption analysis' are argued to be two prominent characteristics and essential components of reflective practice (Brookfield, 1995). Research has explained that prior attitudes and beliefs must be recognized, modified and reconstructed for professional growth to occur (Doolittle, Dodds and Placek, 1993; Kagan, 1992; McCormack, 2001; Gubacs-Collins, 2007; Tsangaridou, 2006). As a form of discourse, the *reflective conversation* (Loughran, 1996; Schon, 1983, 1987; Yinger, 1990) is recognized as the responsive interchange between acting and thinking and an insight into the data of reflective practice. As such, the reflective conversation can be positioned at the very core of the improvement process and has potential to challenge and disturb those educational values and goals practitioners perceive to be important, and reaffirm the values and goals they perceive as important in defining the kind of learners they aspire to be.

If practitioners are to recognize factors which serve either to improve or constrain their practice, Smyth (1992) claims that they will need to engage with some fundamental questions:

Describe – What do I do?

Inform – What does this mean?

Confront - How did I come to be like this?

Reconstruct – How might I do things differently?

It was suggested by Smyth (1992) that these fundamental questions could be used by the managers of the learning centres to implement the strategies in question in order to sustain their long term objectives on how they were applied in the study and beyond. The typology devised by Ghaye and Ghaye (1998) recognises useful qualitative distinctions, which can be drawn between reflective conversations:

- *Descriptive* reflection on practice - is personal and retrospective
- *Perceptive* reflection on practice - links teaching to feelings
- *Receptive* reflection on practice - relates personal views to others' views
- *Interactive* reflection on practice - links learning with future action
- *Critical* reflection on practice - places individual teaching within a broader system.

As a researcher I suggested that teachers should be encouraged to use distinctions in their teaching and learning. If there were thorough monitoring by managers, that could help assist in the improvement of results. However, research studies highlighting qualitative distinctions in student teachers' reflective practice have shown that critical reflective conversations are far less frequent than descriptive reflective conversations, as their principle concerns focus on the development of subject matter knowledge and pedagogical content knowledge (Hatton and Smith, 1995; Macdonald and Brooker, 1999; Tsangaridou, 2005). The latter statement clearly indicates that some teachers are not on par with each other in their professional development. This suggests that some of them might need more guidance compared to others. This guidance should be in respect of how they had positioned their own teaching within the wider professional landscape of ideological and political contexts. When teaching and learning of physical sciences engages with reflective practice, that automatically links it with the improvement of the quality of care, stimulating personal and professional growth and bridging the gap between theory and practice. Larrivee (2000) argues that unless teachers develop the practice of critical reflection, they stay trapped in unexamined judgements, interpretations, assumptions and expectations. Approaching teaching as a reflective practitioner involves incorporating personal beliefs and

values into a professional identity (Larrivee, 2000). Gibbs' reflective cycle (1988) is fairly straightforward and encourages a clear description of the situation, analysis of feelings, evaluation of the experience, analysis to make sense of the experience, conclusion where other options are considered and reflection upon experience to examine what you do if the situation arises again. (Gibbs, 1988). Just like learners do, teachers learn by doing, reading and reflecting, by coming together with other teachers, by looking closely at students' work and their work and by sharing what they see. This kind of learning enables teachers to make the biggest leap from theory to accomplished practice. In addition to a powerful base of theoretical knowledge, such learning requires settings that support teacher inquiry and collaboration strategies grounded in teachers' questions and concerns (Darling-Hammond & McLaughlin, 1995).

The collaborative teaching technique is another good example of a reflective practice that the researcher has practiced with his colleague who was teaching physical sciences in a neighbouring school. We usually met in order to prepare a lesson together. After school we would meet again to reflect on lessons we taught during school hours to check if the lessons had gone according to plan. If there were challenges, we would address them and appreciate the highlights. On weekends we exchanged classes, I taught his class and he taught mine. Input from peers in an informal setting can be considered a mentoring experience. Quinlan and Akerlind's (2000) study demonstrates the importance of considering the context within which peer review of teaching and collaborative teaching activities are attempted. The results were witnessed by a drastic improvement in matric physical sciences results in both schools.

Thoughtful teachers engage in reflective practice as a way to think about their teaching and about ways to continually develop and implement curriculum that is personally meaningful and culturally relevant to students (Arlington, 2002). Various reasons were there for teachers to develop as reflective practitioners and the chief amongst them was that they needed to be reflective practitioners in order to deal with the unavoidable uncertainties and complexities involved in everyday decisions that affect lives of students. Reflective practitioners encourage learning when they reflect, because the subject matter they are reflecting on is being reviewed in their minds and revived in order to be taught effectively

again. Effective teachers continually engage in both critical inquiry and thoughtful reflection. Many researchers viewed the development of reflective practice as the foundation for the highest professional competence (Cole & Knowles, 2000; Jay, 2003; Larrivee, 2008; Osterman & Kottkamp, 2004; Steffy, Wolfe, Pasch & Enz, 2000; Valli, 1997, York-Barr, Somers, Ghere & Montie, 2001; Zeichner & Liston, 1996).

Teachers today need to be dynamic and flexible due to the fact that our classrooms represent more complex student diversity. All over the world, including South Africa with its not so new political dimension, education systems are subjected to this diversity. In this complex environment, teachers have to be accommodative and adjust to this greater range of differences.

Factors like ethnical groups, socio-economic status, developmental levels, motivation to learn and achievement need to be considered. Teachers need be vigilant and be equal to the task of dealing with these types of learners. When a teacher is not a reflective teacher, the chances of success are limited.

Reflective practices help teachers to break away from routine and impulsive acts and provide the platform for them to apply more deliberate and intentional objectives to address the outcomes of their lessons, keeping in mind the learners' socio-economic backgrounds acknowledged in the learners' reflective journals.

Schön (1987) describes the learning process as a complex social activity that cannot be reduced to simplistic thinking. Reflection plays an integral role both in the action and learning from the action. The reflection proposed here involves an openness that requires teachers to challenge their own assumptions and continue to develop their skills. It is a reflection that requires the explicit documenting of the shifting understanding of the learning experience, not just as an individual experience but also as dialogue. In an accounting teacher narrative, Sims (1999) indicates that it is expected that the learner will become an integral part of the narrative or story being promoted by the developer. Effective teaching and learning processes require both a teacher and a learner to forge sound relations that will promote learning and drive away all negative attitudes. The researcher from his study interacted with

learners for longer periods of time. His teaching and learning sessions developed a good attitude towards the learning of physical sciences. When the learners gained a positive attitude towards their own learning, time was allocated for them to reflect on what they had learnt and how they had learnt what they had learnt. Weasner and Woods (2003) agree that teachers identified reflection as a primary outcome of the mentoring experience.

King and Kitchener (1994) distinguish between optimal and functional reflection, i.e. our participants demonstrated a capacity for higher level reflection, but also utilized lower-stage reflective activities regularly. This reflective thought, i.e. utilisation of optimal and functional reflection, is open to questioning or self-interpretation and to greater openness and reliance on social reflection via peer and confidant communications. This is considered evidence of growth in reflective complexity. In Portugal, studies conducted in schools that had confronted and reduced failure rates highlight the importance of variables such as (a) school organisation, including a collaborative environment with parental involvement; (b) relevant curriculum and classroom activities; and (c) the quality of science teaching, including teacher support and expectancies. This illustrates the importance for teachers to reflect effectively on their teaching and ultimately find strategies that can be utilized to achieve quality results in physical sciences.

The learners' daily life terminology is different from the scientific terminology. Some learners therefore find it hard to study chemistry. It can be argued that from this statement there is a dire need for teachers to look for other alternatives to address learners' ways of learning physical sciences concepts.

Schon (1987, xii) has been fundamental in understanding the nature of reflective practice. He also identified technical rationality as the schools' prevailing epistemology. He deemed technical rationality inadequate for solving the complex problems of education practice and proposed that "professional education should be redesigned to combine the teaching of applied sciences with coaching in the artistry of reflection-in-action"It was in this regard that the researcher felt that it would be proper to engage in a study that would try to assist in addressing some of the challenges in the performance of physical sciences, specifically in the province of the Eastern Cape.

According to Tucker, Strong, & Gareis (2002), reflection provides teachers with an opportunity to self-evaluate their teaching and practices. It is my belief as a researcher that when teachers think and reflect on their teaching techniques and find ways needed to improve lessons that are taught, this in turn motivates professional growth. The physical sciences performance results in the schools sampled by the researcher were not getting any better as displayed in table 1 as it appears in the appendix F and this is what needs to be interrogated through reflecting on what has worked and not worked in the teaching and learning of physical sciences over the last five-year period. Due to the frequent poor performance as reflected in the physical sciences results, the researcher wished to find better means and strategies to improve the results. He discovered that reflective practice and a reflection framework were amongst the better means for the researcher to do self-evaluation. Over a period of time, a teacher is able to see his/her growth through the use of a reflective portfolio. (York-Barr, Sommers, Ghere, & Montie, 2001). A reflective portfolio plays an important role for the researcher to think deeply and write about learning experiences. Reflective practice is a vehicle for change and there are several ways to achieve this (Fullan, 2005). It is only through this practice that teachers experience growth (York-Barr et al., 2001). The group participants plan the lesson together, observe each other, and provide feedback about teaching and learning. In this study of group models teachers put theory into practice. This is identified as reflection-for-action (Killion and Todnem, 1991) and reflection on action (Schon, 1983).

Reflection-for-action occurs when the teacher researches, discusses and creates action steps for the new strategies for the purpose of professional growth and positive learner outcomes or quality of results. Schon (1998, 2011) defines reflection as a way of bridging the gap between theory and practice. Schon argues that reflection-in-action occurs during the experiences when the individuals engaging in the process draw on their existing knowledge to solve the problem in that situation. He also acknowledges that reflection-on-action occurs after the event, as a way to engage in the process of continual learning. Reflection-in-action is thought to be a more sophisticated skill while reflection-on-action is common amongst learners and beginning practitioners.

Daily life activities are the source of reflection that contribute to the development of the intellect and permit human beings to live and act together. In this way people learn from their experiences, mistakes and successes (Nakieski, 2005; Taylor, 2010). This study is foregrounded on this framework to assist the researcher to continue developing and being able to assist learners of physical sciences in the school to achieve greater quality of results. In the 1930s Dewey defined reflection as a way of thinking and in 1998 Schon (1998) advocated reflective practice as an essential component of professional action.

2.4 Studies on under-achievement in physical sciences in South Africa

In South Africa it is a well-known fact that the education system was influenced by the apartheid system. The system ensured that the best education was reserved only for white race. Poor quality of education was given to the black race; this therefore meant that the education in South Africa was political. The physical sciences subject was not an exception; hence we see how it is still struggling to be performed better.

South African black learners were and are still expected to learn in a second language. This task is very difficult as these learners feel incompetent and do not want to be embarrassed among friends (Zehler, 1994).

The language in which the learner learns plays an important role in how the learner understands and perform in a particular subject. This goes further to how the learner will interpret a question in the examination and apply his/her mind to attempt the question.

Taylor (2007) emphasises that the legacy of apartheid created a deleterious environment for literacy progression and improvement in South African schools. South African has a worrying crisis in schooling system that is correlated to the low literacy levels achieved at all levels of our education system. A report done on literacy development, based on the results from Annual National Assessment (ANA) and Progress in International Reading Literacy Study (PIRLS, 2006), shows that many learners in South Africa who come from disadvantaged and under-resourced schools have low literacy proficiency influenced by children's social reality (Comber & Hill, 2000).

One of the factors that affects poor performance in the physical sciences is when learners fail to make connections with other subjects. This is called integration, where learning and knowledge should not be done in isolation from other subjects. Knowledge of the subjects should all be linked to a bigger system and every system consists of several parts that work together in order for it to function as a whole (Higgs & Smith, 2006).

Some schools in South Africa are using subject combinations that disadvantage learners. These combinations make the learners' life very challenging because there is no direct integration or link within the subjects. If we take physical sciences and mathematical literacy, for example, what performance are we expecting to receive from this combination? Mathematical literacy and physical sciences do not complement each other, as can be seen from the report in the National Diagnostic Report on Learner Performance in 2012 for NSC Examination for Physical Sciences.

2.5 Conclusion

The chapter provided a literature overview that linked the theoretical background for the study and some factors that might assist in addressing the challenge of performance in physical sciences. The following chapter will be looking at the research design, research methodology, data collection methods and procedures, sampling, location and demographics, ethical considerations, and reliability and validity factors.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter outlines the research design and methodology employed in the study. It presents approaches that were used to investigate the factors that influence the achievement in physical sciences performance in the schools in a district in the Eastern Cape and to reflect on the good practices that were done in the classroom by the teachers as well as students in the process. It also looks at the sample used to collect the data and what instruments were used to collect it. It also explains how the participants were chosen and what was expected of them in the study. This study was directed at answering the following main research question:

What factors influenced the performance of learners in grade 12 physical sciences at the three schools?

The main research question was further broken down into the following sub-questions:

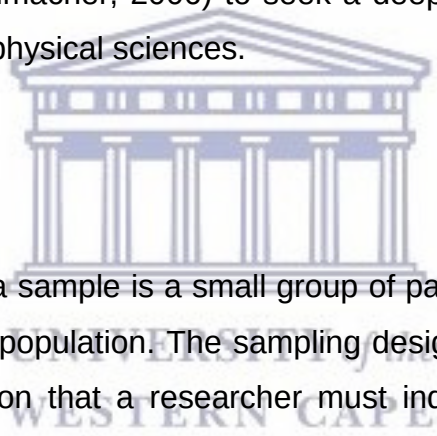
1. What were the learners' achievements in physical sciences over the past three years in each of the three schools?
2. What were the learners' perceptions of the factors that influenced their performance in physical sciences?
3. What were the physical sciences teachers' perceptions of the factors that influenced the performance of learners in physical sciences?
4. What were the principals' perceptions of the factors that impact teaching and learning of physical sciences in their schools?

3.2 Research design

This study has a case study design using a mixed method approach. Harrison (2002) describes a case study as a strategy rather than a method as it sets out to address the understanding of a phenomenon within its operating context. A case study could also be

regarded as a suitable strategy when the ‘how’ or ‘why’ questions are being posed (Yin, 1984). However, Atkins and Wallace (2012) state that the case study has the ability to go beyond the ‘how’ and ‘why’ questions as it offers a way of investigating connections, patterns and context, and of reflecting on the details and the bigger picture under investigation.

This study is a case study where three neighbouring schools were used, whose performance in physical sciences were compared in a district of the Eastern Cape. In the study a mixed method approach was utilized where both quantitative and qualitative approaches were used, involving interviews and questionnaires. The mixed method rationale is more flexible and enables the researcher to delve into a deeper understanding of the learner’s views, fears and thoughts about physical sciences. The incidence, distribution and frequency for the larger population were described by using only a sample of the participants from the population (McMillan & Schumacher, 2006) to seek a deep understanding of factors that lead to poor performance in physical sciences.



3.3 Sample

According to Babbie (2007) a sample is a small group of participants or respondents who have been derived from the population. The sampling design from the population is very important. It is for this reason that a researcher must indicate or mention the type of sample/s he is going to use (Paulo, 2001).

The study’s participants were past grade 12 learners who have achieved scores of level 4 and above from three different schools in the East London district. The physical sciences teacher and the principal from each of the three schools were also included. The researcher interviewed the teachers regarding strategies and methods they used to support the teaching and learning of physical sciences in their schools. Table 2 represents the sample of participants that was used in the study.

Table 2: Sample for the study

Participants	Total number of Sample (Sampling)	Sampling Technique	Criteria
Learners	3 in School A 4 in School B 3 in School C	Purposive	Past grade 12 Ph. Sc. Learners' scored level 4 and above. All learners who responded to the researchers' request
Science educator	One each from 3 schools	Purposive	The physical sciences teacher from each school
Principals	One from each school	Purposive	The principal of schools A, B and C

3.4 Data collection plan

The first step was the collection of NSC physical sciences achievement information about the grade 12 physical sciences results for the past three years from the departmental schedules in the schools through the assistance of the school principals (Table 1). The results were analysed per school that participated in the study. The second step was allowing the selected former grade 12 learners to complete a questionnaire (Appendix F, Annexure 1). The third step was the interviews with the former grade 12 learners using an interview schedule for their responses on the items listed on the schedule in (Appendix F, Annexure 1).

The fourth step was interviews held with the science teacher and the principal from each of the 3 schools (Appendix F, Annexure 2). The data collection plan is outlined in Table 3.

Table 3: Data collection table

Research question	Methodology	Research instrument	Data source	Data analysis
Step 1 What were the learners' achievements in physical sciences over the past 3 years in each of the three schools?	Data analysis of physical sciences performance of learners in the past 3 years	Performance schedules	Three schools	Using Excel data analysis
Step 2 What were learners' perceptions of the factors that influenced their performance in physical sciences?	Survey	Questionnaires	Grade 12	Excel-data analysis
Step 3 What were the physical sciences teachers' perceptions of the factors that influenced the performance of learners in physical sciences?	Interviews	Interview schedule	Physical sciences teacher from each school	Transcription, translation and thematic coding
Step 4 What were the principals' perceptions of the factors that impact teaching and learning of physical sciences in their schools?	Interviews	Interview schedule	Principals of each of the 3 schools	Transcription, translation and thematic coding

3.5 Research instruments

3.5.1 Performance schedules

The performance schedule was used to obtain the physical sciences results of the learners from the three schools involved in the study. The learners' NSC physical sciences results were collected and entered into an Excel spreadsheet for analysis.

3.5.2 Questionnaires

According to Bryman (2008) the term 'questionnaire' can be reserved for contexts in which a series of usually closed questions are completed by the respondents themselves. Questionnaires were developed to accommodate a set of items that formed questions for the learners. The questions addressed the challenges learners were faced with. There were five questions and learners had to complete the items on the questionnaire (see Appendix F).

3.5.2.1 Advantages of questionnaires

Advantages of questionnaires are that they are useful to obtain detailed information about personal and group perceptions and opinions. They can save time compared to interviews and they are also cost efficient. When using questionnaires, it is easy to collect and analyse data. Questionnaires allow researcher to gather information from a large audience.

3.5.2.2 Disadvantages of questionnaires

On the other hand, the questionnaires' disadvantages include the fact that respondents may not be fully truthful with their answers. Some questions may be difficult to analyse because they are open-ended questions.

3.5.3 Interviews

Interviews were used as they are the most important tool for data collection on how participants feel, think, believe and to find out their responses and attitudes towards the teaching and learning process. Kvale (1996) articulates that an interview is literally an inter-view, an inter-change of views between two people conversing about a theme of mutual interest. I prepared an interview schedule for physical sciences teachers which are available in Appendix F, annexure 2. An interview schedule was designed such that additional information that was not covered in the questionnaire could be obtained. Learners were interviewed to cover up some of the items that may not have been covered in the questionnaire. The principal of each of the three schools was also interviewed for their perceptions.

3.5.3.1 Advantages of semi-structured interviews

Silverman (1993) explains that interviews offer an apparently 'deeper' picture than the variable-based correlations of quantitative studies. Interviews enable interviewees to describe their experiences and attitudes towards questions that appear in the interviews.

There are various types of interviews that are used as instruments to gather information and in this study semi-structured interviews were used. Semi-structured interviews enable the researcher to deviate from the questions in order to collect enough data. These type of interviews allow for follow up questions so as to clarify the answer and also get more valid and reliable data. Semi-structured interviews also allow for the attainment of a large amount of collected data. The semi-structured interviews offer a flexible, sensitive, and reliable way to access data that is easy to analyse.

3.5.3.2 Disadvantages of semi-structured interviews

This type of interview does not guarantee honesty when participants answer the questions as their answers might not be realistic. This might be caused by the fact that some want to be seen doing well for the benefit of the researcher. In this type of interview there are open-ended questions that pose a level of complexity when analysed. This is due to the fact that the responses to the questions depend on how the participant understood them. The other disadvantage of the semi-structured interview is that its reliability is reduced by its flexible nature.

3.6 Data analysis

The analysing of the data has to do with the meaning of the data collected. Barbie and Mouton (2001) explain that the worth of all scientific findings depends heavily on the manner in which the data was collected and analysed. Gardner (2009) explains that the 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. When analysing the collected data by this instrument (interviews), the experience of the participants is very important. As such the researcher should consider the thoughts of the participants and their feelings as all these will help the researcher to understand the meaning of their experience (Walter, 2005).

The interviews were coded for themes emerging from the data collected from the respondents.

3.7 Validity and reliability

3.7.1 Validity

Dependability is an imperative facet of qualitative research. It is comparable to the concepts of reliability and validity. Validity refers to how well a test measures what it is supposed to

measure (Cozby, 2001). Validity was ensured by triangulation of results through data obtained from interviews and questionnaires.

3.7.2 Reliability

Reliability is generally understood to concern the replicability of research and the obtaining of similar findings if another study using the same methods was undertaken (Lewis & Ritchie, 2003). I had ensured that the items used were clear, understandable and concise and unclear items were rephrased. The bias in the instruments was minimized to avoid making the respondents trying to put the researcher in a good light.

3.8 Ethics

A letter of request was sent to the Department of Education in the Eastern Cape to allow the researcher to carry on with the study (see Appendix A). Letters of permission were sent to the principals of the three schools, the school governing body, and science teachers for their consent (see Appendices B, C and D). The participants were clearly told of their respect, confidentiality, identity and professionalism that were exercised in handling the research.

Respondents were informed of the purpose of the research and they confirmed their consent to participate in the research. They were informed of their rights and that they were not forced to participate in the research, and their dignity was protected while they had a right to remain anonymous. They were also informed that the research contents would not be divulged without their consent.

3.9 Conclusion

This chapter has given an overview of the methodological aspects of the study, how the data was collected, what instruments were used. The study was underpinned by both the quantitative and qualitative paradigm.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Introduction

This is the results chapter, following the methodology used as described in chapter three. The participants in the research were briefed about all the processes to be followed when the study was conducted. The results respond to answering the main research question:

What were the contributing factors that influenced learner performance in the teaching and learning of physical sciences in three schools in an education district of the Eastern Cape Province?

The main research question was further broken down into the following sub-questions:

1. What were the learners' achievements in physical sciences over the past three years in each of the three schools?
2. What were the learners' perceptions of the factors that influenced their performance in physical sciences?
3. What were the physical science teachers' perceptions of the factors that influenced the performance of learners in physical sciences?
4. What were the principals' perceptions of the factors that impact teaching and learning of physical sciences in their schools?

The findings in this chapter will be presented in response to the research sub-questions.

4.2 What were the learners' achievements in physical sciences over the past three years in each of the three schools?

The achievements of learners were collected from the performance schedules of the three schools. Table 4 represents the provincial results of physical sciences for learners in the NSC examinations from 2013 to 2015.

Table 4: Provincial physical sciences results from 2013 to 2015

Years	2013	2014	2015
Provincial results in percentages	55.8	51.5%	49.5%

Table 4 showed provincial physical sciences results, which indicated a very disturbing trend of a downward slide throughout the past three years. It was noted that between 2013, 2014 and 2015 the percentage drop was between 4,39% and 6,3%. That drop in provincial physical sciences results showed poor performance and the average performance percentage for the province was 52,2%.

4.2.1 Learners' results in school A

The NSC results of the physical sciences learners in school A is presented in Table 5. The physical sciences performance results of school A over the period of three years indicated a significant drop of between 17,7% for the first two years and 3.6% for the last two years respectively. The average performance for the three years of school A was found to be 54,4%.

Table 5: Physical sciences results for school A from 2013 to 2015

Years	2013	2014	2015
Percentage	66,7%%	50%	46,4%

4.2.2 Learners' results in school B

Physical sciences performance results of school B over the period of three years indicated a drop of between 9,7% for the first two years and 1,1% for the last two years. The average performance for the three years of school B was found to be 61,6%.

Table 6: Physical sciences results for school B from 2013 to 2015

Years	2013	2014	2015

Percentage	71,4%	61,7%	51,9%

4.2.2 Learners' results in school C

Table 7: Physical sciences results for school C from 2013 to 2015

Years	2013	2014	2015
Percentage	83,3%	61,1%	62,2%

Physical sciences performance results for school C indicated a significant drop if the results are analysed from the first year when the results were way above that of the other schools, but a drop of 22,2% was huge for the first two years while in the last two years there was an increase of 1,1 % which indicated that the school tried to do things differently to resolve the situation. The average performance for the three years at school C was found to be: 68,86%

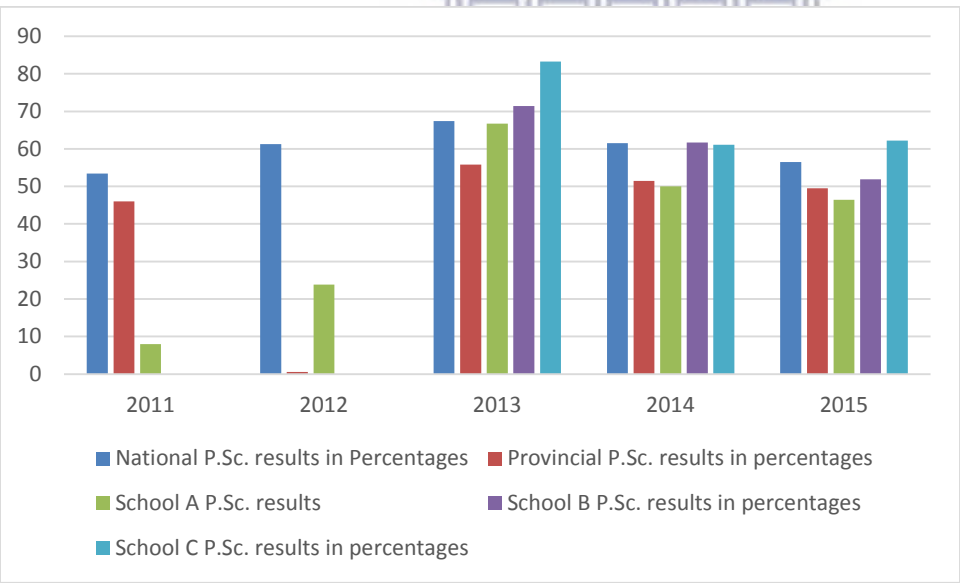


Figure 1: Graph showing the three schools' physical sciences results over three year period (2013-2015) combined with the graph of the provincial results over the same period

Summary of what the graphs indicate

Compared to the results of schools A, B and C in district of the Eastern Cape, the other schools performed better on average. If the performance of the province was to be

considered and compared to the schools' average performance, the provincial average performance was 52,2% compared with 68,86% for the three schools, thus indicating a difference.

4.3 What were the learners' perceptions of the factors that influenced their performance in physical sciences?

4.3.1 Learners' perceptions from the questionnaires

Learners from school A

"The questionnaire assisted me, I really enjoyed expressing myself".

"The Department of Education should make a follow-up especially on handling and monitoring practical work in physical sciences teaching".

"I always thought the physical sciences teacher should do the teaching of practical work by him/herself alone".

Learners from school B

"I wish the questionnaires used, should also to be given to the current grade 12 learners".

"The attitude I had with practical work was really bad, maybe there was not any done in my class".

"I was always told chemicals are dangerous so I must not touch, not allowed in the laboratory".

Learners from school C

"It is very thoughtful thing to reflect on topics that you feel need more attention".

"I didn't know that theory part of physical sciences can be taught using practical work".

"I am happy that more learners will be exposed to many opportunities".

"I think this questionnaire raises most of the issues I had during my time in class".

4.3.2 Learners' perceptions in the interviews

The themes that emerged from the interviews of the learners on their perceptions were classified into the following categories: Learner discipline, learner commitment, and poor learner morale. These categories were rated using a Likert scale with levels from 1-4, i.e. indicating 0-1: Worse, 1-2: Bad, 3- 4 Upwards, 5: Good.

Table 8: Learner perceptions in the interviews for the three schools

	Learner discipline	Learner commitment	Learner morale
School A scale	1	1	1
School B scale	3	2	1
School C scale	4	3	3

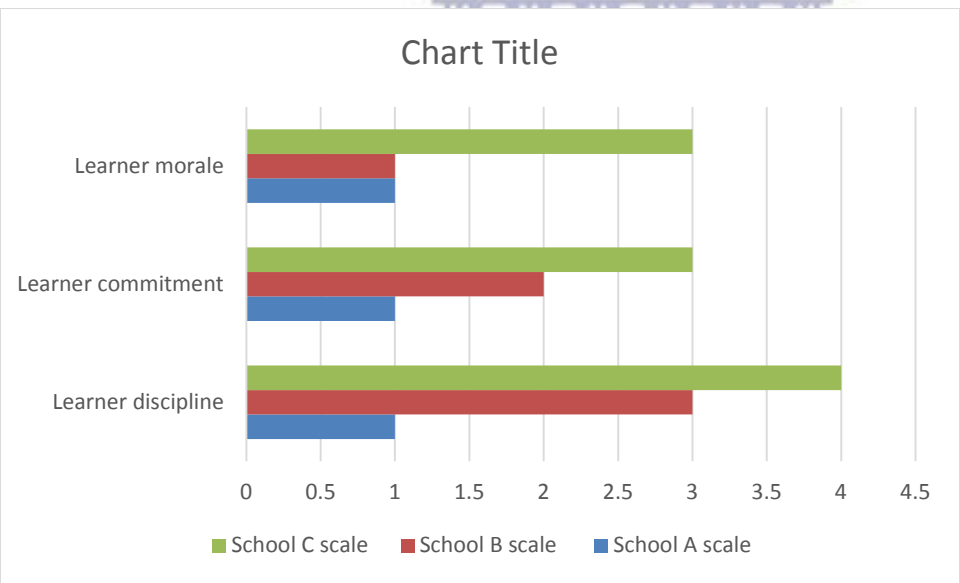


Figure 2: Graph showing the three schools scale indicating learners' discipline, commitment and morale

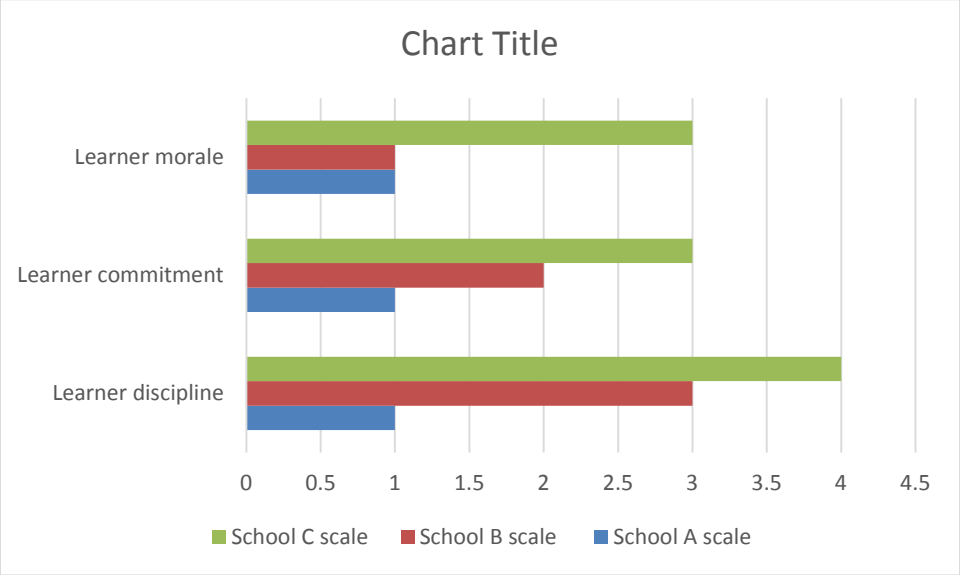


Figure 3: Shows the learners' perceptions of the interviews

Learners from school A

#1. "Most of us don't take our teachers seriously, we literally undermine them".

#2. "I don't see any need for us to study that much, no rewards simple, plain and clear".

#3. "Physical sciences results will always be poor if no action is taken".

Learners from school B

#1." We all know that our teachers have nothing else to enforce discipline, so most of leaners take advantage of the situation".

#2. "Most of our brothers, sisters and cousins had already passed their university studies but still unemployed ".

Learners from school C

#1. "We always tell the teachers we know our rights, so they can't punish us".

#2. "What is the use of going to school and work hard and get no space in the college or university?"

#3. "All the comments we're making shows we're demoralized by the situation; I mean all our fellow students need these issues to be addressed".

4.4 What were the physical sciences teachers' perceptions of the factors that influenced the performance of learners in physical sciences?

The themes that emerged from the teacher's perceptions are classified into the following categories: shortage of teaching resources, teacher morale, and learner discipline.

Table 9: Teacher's perception of the factors that influenced the learner performance in physical sciences for the three schools

	Shortage of teacher resources	Teacher morale	Learner discipline
Percentage rating of school A	48	40	20
Percentage rating of school B	20	50	30
Percentage rating of school C	60	70	50

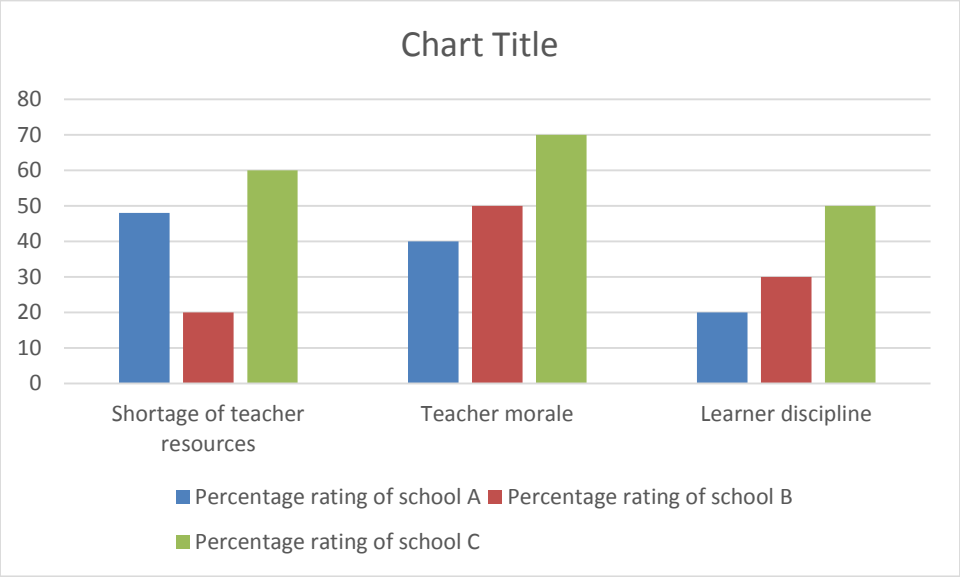


Figure 4: The teacher's perceptions on factors affecting the learner performance in physical sciences.

4.4.1 Teacher from school A

“Our department knows very well that the delivery of science materials and textbooks always arrive late in our schools”.
“These learners at the end contribute to the poor performance themselves most of the time”.
“We as teachers spend most of our time away from school mostly due to low morale”.

4.4.2 Teacher from school B

“Instead of monitoring their supply chain management in schools, the department chooses to blame teachers for poor performance”.
“I no longer chase my learners; I just keep teaching those who care to listen. Most learners refuse to get out of the class claiming to know their right to learn”.
“We are unable to maintain discipline to learners”.

4.4.3 Teacher from school C

“When asking for some funds for science tools and top-up for textbooks, you always get negative response”.
“I have less options when it comes to discipline, even if I chase the learner out, that doesn’t help. The learner will eventually fail because h/she has lost the subject matter”.
“Issues of discipline affect both teachers and learners, so a solution is very complex if we don’t own up”.

If learners are ill-disciplined, that alone has a negative impact on their learning and performance. Learners become too difficult to teach and to take instructions from the teacher. Learners’ poor discipline leads to their carefree attitude, with less interest to own up and work for their success. The comments made by learners in their interviews exposed more information about their thoughts and commitment to their education.

Educators' high rates of absenteeism and truancy caused mainly by demotivation and low morale does not help the situation. The views highlighted by both teachers and learners indicate a dire situation that needs urgent attention. The basic tools used for teaching and learning in physical sciences play a major role in addressing the factors affecting performance of learners, and if this issue is not addressed results will continue to be poor.

When looking at school B from the table it can be observed that there is a dire need for teaching resources there, reading from that teacher's perception. The 20 percent rating in that school is totally not acceptable and it translates in the end result into poor performance. How can a science class be fully functional without teaching resources like primary tools, for example, textbooks? The teacher morale in that school (school B) is nothing to be compared to school A as they are both not at acceptable percentages.

The effectiveness of any institution depends entirely on the people who are doing the ground work and if they are not happy then there are no positive results that can be produced in that environment. What motivates the teachers is what matters in order to achieve good performance, then if working relations within the school are not conducive to teaching and learning, especially with primary stakeholders like learners, disaster prevails.

Table 9 illustrates another aspect that really is of too much concern, the discipline of the learners, specifically again in schools A and B. This can also be noted in the learners' interviews with regard to the learners' attitude towards their own learning which leaves much to be desired. This is reflected in table 8: learner discipline and commitment. In school. The teachers scored their learners' discipline to be very low at 20 percent; likewise, school B lacks discipline and was scored at 30 percent. These situations reflect the kind of learners that teachers have to deal with daily in their schools which does not address the issue of poor performance in physical sciences. It can also be noted that school C is not that good but it shows signs of improvement towards becoming a better school.

It can also be argued that if teachers themselves spend most of their time not at school learners follow suit on those practices. It is for this reason that we do not always have to

look far in diagnosing the conditions that lead to learners being ill-disciplined. How can teachers finish the syllabus if most the teaching time is spent away from the classroom?

4.5 What were the principals' perceptions of the factors that impact teaching and learning of physical sciences in their schools?

The themes that emerged from the principal's perceptions were classified into the following categories: teacher discipline, teacher commitment, teacher morale, and working relations with the education department. The following statements are indicative of the three principals' perceptions in this regard.

4.5.1 Principal from school A

"My teachers have many private jobs after school hours, and I'm unable to stop them".
"I'm not sure if they are making any positive impact on their teaching".
"We as a school don't get any proper interventions from the Department of Education".
"To keep results in good shape is very difficult under the circumstances".
"In my school I have called parents meeting to no avail, you see them in the beginning of the year only".

4.5.2 Principal from school B

"I had two teachers on sick-leave and no one to substitute them, now look at my school's results".
"My physical sciences teacher is also a site-steward of a union and a mathematics teacher".
"When my teacher is absent there is more damage that is disastrous to the school performance".

4.5.3 Principal from school C

“I am used to have learners without a teacher for two to three months. Most of my staff is old, they take early retirement and some get boarded by their doctors”.
“My other issue is on promotion of grades nine to eleven learners”.
“How do I get good results if most learners should be automatically promoted to the next grade?”

In the interviews principals of the three schools highlighted a number of factors that impacted on learners’ performance in physical science. These are represented by Table 10 and Figure 5.

Table 10: Principals’ perceptions on the factors impacting on the performance in physical sciences

	Teacher discipline	Teacher commitment	Teacher morale	Work relations with the DoE
% rating of school A	45	60	50	40
% rating of school B	50	50	40	40
% rating of school C	60	50	40	50

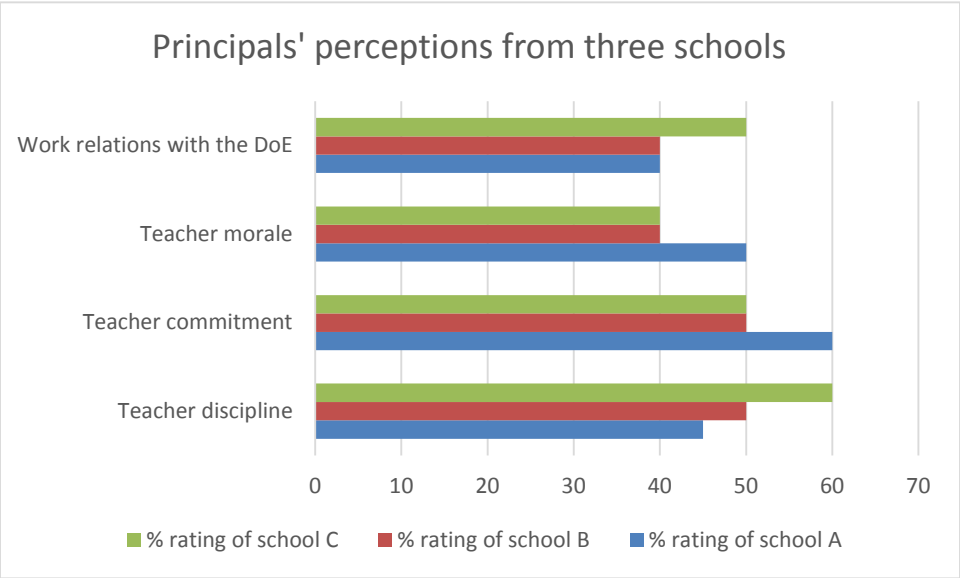


Figure 5: Principal's perceptions on the factors impacting on the performance in physical sciences

4.6 Strategies employed to improve results of the schools

4.6.1 Strategies by managers and learners

From the interviews with the learners, teachers and principals the following strategies were identified.

The school managers played a major role in making sure that their schools were made useful and available for the intervention programmes, which would assist in implementing strategies of improving the performance in physical sciences. The managers motivated the teachers and made sure that teaching and learning took place, and they undertook to enforce discipline especially with learners so that they were committed completely to the programme until it was completed.

Teachers were assigned to lead those activities and trained each other in practical work. Teachers formed clusters that looked at what were other approaches that could be used in teaching of physical sciences. They also looked at how they could prepare learners for examinations.

At the beginning of the year for the past three years, learners were encouraged to attend all science programmes and science related activities starting with the formation of science clubs in their respective schools and twinning with the neighbouring schools. Learners were assisted in attending and participating in the science week, science expos, maths quiz and national festivals. All these activities were made available for learners to have more confidence in physical sciences and to improve their results as well.

4.6.2 Approaches used by the teachers

Teachers made it their primary objective that they had to teach, spend most of their tuition time in class, the syllabus was covered on time where all formal assessments and non-formal assessments were carried out and given to learners on time.

Learners were taught effective ways of learning, conducting experiments, discipline in handling of science lab tools and how to use time effectively, especially in extra classes, thus building up their confidence until their final examinations.

Teachers used *different methods* of teaching. They used the PHET simulations and animations, videos and tele-matics to make the subject matter more clear. This was done after lesson presentations in class to enhance the teaching and understanding of the physical sciences content. They introduced *afternoon classes, extra classes* and *Saturday classes* to consolidate what was not covered during the normal teaching time. Teachers also were engaged with each other by t*raining* one another on complex topics and the use of *practical work* to get more understanding of the concepts

4.6.3 Summary of strategies

The strategies implemented by all the stakeholders were meant to address the performance of physical sciences in the schools mentioned. The school managers played a major role in making schools useful and available for the intervention programme. The learners who were the recipients of the programme made it easier to work with them because of their willingness to participate. It could also be mentioned that there was no single strategy that could be attributed to the success but all of them worked as a unit for one purpose.

The teachers through motivation by the managers made it their duty to teach and prepare learners for final examinations. Teachers also assisted others on multiple representations in various topics and discussed simple ways for syllabus coverage.

4.7 Participation and perception of implementation strategies

4.7.1 Manager's perceptions of strategies used

The Department of Education expected all schools to perform from 60% and above to be considered as high achieving. The managers had no choice but to support all the strategies that assist the schools to perform better. The schools that performed below the said margin were referred to as underperforming schools or MIP schools. The three schools in the study were performing at least better. This was due to the intervention made by the EC DOE with UWC where the researcher had an influence on the surrounding schools in the first two years of the research.

During that intervention, as the time passed the schools were on a downward trend as can be seen from tables 5, 6 and 7: Physical sciences results for school A from 2013 to 2015, Physical sciences results for school B from 2013 to 2015, Physical sciences results for school C from 2013 to 2015 and figure1: Graph showing the three schools' physical sciences results over a three year period (2013-2015) combined with the graph of provincial results over the same period, even though on average these schools over the period of three years, compared to the provincial results they were still better.

The managers were very much concerned and supported ways that could address the challenges of the schools. MST coordinators were roped in full time to spearhead all the intervention programmes. Finances were made available to fund the people who were assisting in various programmes like "ILIMA" Project. The strategies employed were used to address the challenges that could have contributed to the performance of learners in physical sciences. The managers and stakeholders were therefore in full support and positive about the intervention strategies of improving physical sciences results.

4.7.2 Teacher's participation and perceptions

The teachers from the three schools used in this study were in attendance and in full support of the intervention strategies that were implemented in their respective schools. They made themselves available for the morning classes that were initiated by their managers, were involved in the extra classes, afternoon classes and Saturday classes, and incentives were in order to motivate them.

Teachers from other neighbouring schools were invited by these teachers to be involved in the practical work lessons that they introduced. Learners were taught with the focus on how they would like to be assisted in their content knowledge, practical activities and preparation for their examinations.

While all this was done these teachers made sure that the syllabus was covered on time as per their work schedule. They felt that it was their responsibility to change the situation around and it was what they have been planning to do but were limited by the funding and approval from the authorities.

When the academic year was winding down after the last moderations, these teachers were involved in setting up an ILIMA programme which requires learners to sleep over at one common centre as a group in order to have time for studying purposes and to be taught and assisted in any subject until they sat for their final examinations.

4.8 Learner participation and perceptions

4.8.1 Learner participation

The researcher invited five learners from each of the three schools, meaning a total number of 15 learners were expected but they were not all in attendance as expected. In school A only four learners were able to honour the invitation which translates to 80% attendance; in school B, all learners were able to attend which translates to 100% attendance; and in

school C only three learners managed to attend which translates to 60% attendance, therefore the overall attendance was 80%.

Table 10: Attendance of learners in schools A, B and C

Schools	A	B	C
Total number attended	**4**	**5**	**3**

In school A there were only four learners who attended while the expectation was for five learners to participate in the study. In school B, all learners managed to attend which showed commitment to the call made to them, while in school C things were a bit different as the school managed to be represented by only three learners who participated in the study.

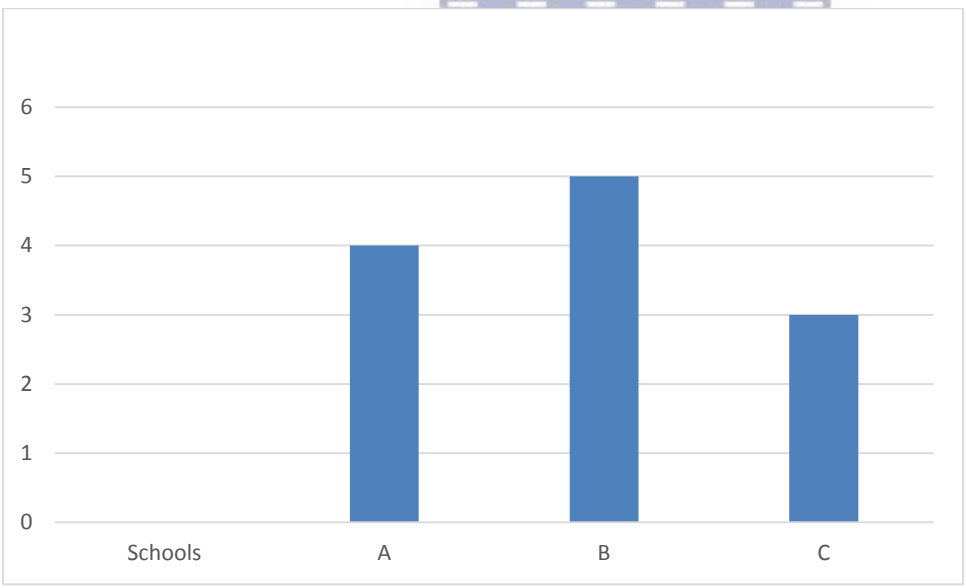


Figure 6: Attendance of learners in schools A, B and C

Table 11: Gender of the learners for schools A, B and C

Schools	A	B	C
Male	1	4	0
Female	3	1	3

In school A, from the four learners who attended, there were three female learners who attended the study while only one learner was a male. In school B from the five learners who attended there were four male learners and one female learner who attended. In school C the learners who attended were all females.

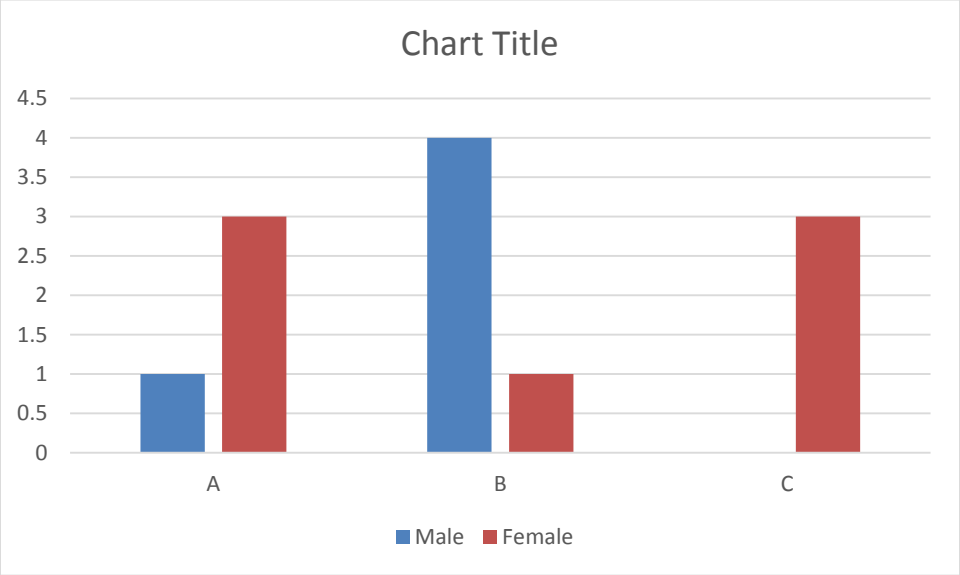


Figure 7: Gender attendance for learners for schools A, B and C

Learners were informed about the purpose of their participation in the study and why it was important not only for their previous schools but for all stakeholders of education, specifically those related to physical sciences teaching and learning. They were also told to give their responses as honestly as possible so as to assist in the improvement of physical sciences results. Their inputs were valued as they would be used later as recommendations that come from the learners in their reflections on how they have studied and what can be improved in the teaching and learning of physical sciences. Questionnaires and interview schedules were issued to the learners to respond to the set of items which were categorised into themes.

4.8.2 Learners' perceptions on the strategies used

Learners participated in the strategies employed by the teachers in their respective schools by getting themselves actively involved throughout the intervention programmes done in their respective schools.

In this study learners felt that their engagement and participation in the teaching and learning of physical sciences was something they have been yearning for in all their schooling years even though it was done only in their last two years of high school.

Learners were of the view that if the strategies employed (in their case) can also be used then performance in physical sciences would definitely improve. The level of engagement and the attention given to their respective needs was very important to them because the learning has to focus on how they learn what they learn, incorporating their own reflections on topics that they feel should be given enough attention.

4.9 Roles played by participants

4.9.1 Manager's role

The managers played their part in making sure that the intervention programme was successful, all the expected participants were present and the necessary tools were available in the three schools. In the study itself the managers assisted the researcher with the necessary organisation and time frames and made the venue available to conduct the study.

The participants were given permission to be part of the study without glitches; the whole activity became orderly because of their involvement. The challenge that managers pointed out was that programmes of intervention need to be planned well in advance and become the culture of their schools because they tend to disturb all other activities in their schools. The other challenge was that of funding which requires team effort and common understanding of the goals that are anticipated by all stakeholders.

4.9.2 Teacher's role

It is of great value for teachers to find ways of improving their teaching strategies undertaking self-reflection. Tucker, Strong, & Gareis (2002) argue that reflection provides teachers with an opportunity to self-evaluate their teaching and practices.

The teachers were keen to be part of the study and to share their own practices that they have applied in their respective schools. The requirement for the teachers was to use the interview schedule to make their responses and to add further information they wished to convey which was not necessarily in the given schedule. This was evident when they discussed how they had felt to be part of the study after finishing their interview schedules. The teachers were recorded in their interviews and then the interviews were transcribed, cleaned and coded and then translated into themes on their experiences in teaching of physical sciences in their classes.

The themes were categorised into topics which were: definitions, basic concepts, substitutions and laws and principles used in different topics. From the teachers' point of view, it was noted from their discussions and interviews that almost in all the three schools the learners were struggling to find an easier way of mastering the definitions and basic concepts for many topics.

One teacher said, "*I have been trying to link my teaching of concepts with definitions and made user friendly definition book for my learners, but I don't get far in succeeding".* The three teachers also talked about time constraints to give enough attention to those learners who have serious gaps from previous grades and at the same time covering the syllabus as per the work-schedule prescribed by the Education Department.

4.9.3 Learners' role

The learners who were available played their part successfully even though their attendance was not as expected from those learners who were invited. These learners were given

questionnaires to fill and respond to the items that were meant for them. The learner items were categorised into: topics, practical work, learner involvement/participation, explanation of what was taught, feed-back on teaching and teacher confidence in lesson presentation.

Learners from schools A, B and C were asked to give topics that they felt were not given enough attention by their teachers which could have made them to do better in their grade 12 results. Most of them indicated the topics in the questionnaire that they felt should be given attention. The topics included, amongst others, projectile motion, and work, power and energy for physical sciences paper 1, saying they lost a considerable number of marks because, as one said, "*Our teachers did not make an emphasis on these topics and it's costing us".*

In the physical sciences paper 2, learners indicated topics like organic molecules; equilibrium constant calculations and acids and bases calculations as those that gave them a tough time when they wrote their examinations.

On the item of practical work, learners of school A, 3/4 learners, i.e. 75% of learners, were of the view that more practical work should be done when teaching physical sciences while one learner felt there should be a focus on doing the basics of physical sciences and only 3/5 of learners from school B, i.e. 60%, were of the view that more focus should be on practical work when teaching physical sciences and the other two learners were adamant that focusing on basics is the way to go and in school C, where 2/3 learners, i.e. about 67%, were also in agreement that the focus should be on practical work when teaching physical sciences.

The next item was the learner participation in the physical sciences class. Almost 3/4 of the learners in school A were always involved in the classroom teaching of physical sciences, i.e. 75% of learners, and the remaining learner indicated as per the questionnaire that she was sometimes involved in the teaching of physical sciences, whereas in school B, 4/5 of learners indicated that they were always participating, i.e. 80%, and the remaining learner indicated that he was sometimes involved in the teaching of physical sciences. In school C,

2/3 of learners indicated that they were participating in the classroom, 67%, and remaining learner indicated that she was sometimes involved in the teaching of physical sciences.

For the item of explaining or presenting what has been learnt in the physical sciences classroom, in school A, 75% of learners responded by saying they could explain physical sciences concepts and what has been learnt in the physical sciences classroom while only one learner was not sure if he could explain or present what was taught in the classroom. In school B, 4 of the 5 learners said they could explain physical sciences concepts while the remaining learner was in doubt if she could be able to explain what was taught in the classroom. In school C, 2 of 3 learners said they would be able to explain physical concepts while the remaining learner indicated that he could not explain what was taught in the classroom.

The last item looked at the confidence of the teacher in the physical sciences classroom. Three-quarters of the learners from school A felt that their teacher was always confident in the physical sciences classroom presentations, and the remaining learner indicated that her teacher was sometimes confident in the classroom. In school B, 3 of 5 learners indicated that their teacher was always confident in lesson presentation in the physical sciences classroom while the remaining two learners felt their teacher was sometimes confident in lesson presentation in the physical sciences classroom. In school C only 2 of 3 learners indicated that their teacher was always confident in lesson presentation in the physical sciences classroom while the remaining learner indicated that his teacher was sometimes confident in the lesson presentation in the physical sciences classroom.

4.10 Conclusion

Chapter 4 provided an exposition of the findings and a discussion of the findings. Chapter 5 will draw conclusions from the findings.

CHAPTER FIVE

CONCLUSION

5.1 Introduction

The previous chapter focused in the discussion of the findings and results. In this chapter the researcher will look at the summary and conclusions and the focus will be on recommendations for further study and the implications of the study

5.2 Overview of the scope of the thesis

In the first chapter it can be noted that the researcher was trying to indicate the current situation in which the Department of Education is finding itself in relation to the performance of physical sciences in the entire South African context. This was backed up by the statistics that were obtained over the period when the study was conducted, specifically looking at the schools in the district in the Province of the Eastern Cape where the study was based.

When teachers are demotivated and ineffective as claimed by their superiors based on the performance of their learners, they tend to fail to execute their duties efficiently which in turn reflects badly on those learners who see their teachers as their only hope for a better future. It is for this reason that it is important for teachers and learners to reflect on how teaching and learning is taking place in their respective schools.

Various interventions were initiated over the years to address the challenges in the performance of physical sciences. The organisations like Zenex Foundation, Eskom Foundation, Telkom Foundation, South African Breweries and the Dinaledi programmes were all involved in trying to change the situation, either by funding teaching programmes or supplying materials for teaching and learning of physical sciences.

Currently we have institutions of higher learning - UWC, NMMU and others - who are also busy bridging the gap by enrolling teachers to be of relevance in the teaching of physical sciences by applying current methods of teaching and learning using the latest technology. The researcher understands that even though other stakeholders are not participants in the

study, Creswell (2005) argues that the researcher is able to apply the results of a study from a small sample to a larger sample if the sample is representative.

The literature used by the researcher was based on the importance of a teacher being a reflective practitioner. It gives an important scope on how reflections can play a role in assisting the teacher to know what it is that works well for him in the classroom when teaching, and also to know how the learners perceive the teacher while teaching and at the same time learners reflecting on their own learning.

The researcher used literature from current studies, both internationally and nationally, that highlight the importance of reflection as a key to effective teaching and learning. Moon (2004) refer to reflection as part of learning thinking. He says people reflect in order to learn something, or people learn as a result of reflecting, and the term 'reflective learning' emphasises the intention to learn from current or prior experience.

Reflection is the essence of Freire's principles of conscientisation and praxis. Teachers in oppressed contexts need to reflect on their practice and to take into consideration the social conditions of their learners and strive towards true education that opens the minds of the learners so that they can change society and their social contexts (Freire, 1971).

The definition given by Greenwood (2003) is that reflection is when the practitioner considers what he is doing whilst busy doing it. He further suggests that the consideration can be stimulated by surprise.

On the other hand, Patil (2013) views reflective practices as the way in which one engages in a process of on-going learning and developmental awareness whilst paying attention to the practical values and theories. He sees it as an instrument that practitioners may utilize to gauge their professional development and improvement, and their practice based professional learning. This is consistent with Osterman and Kottkamp (1993) who define reflective practice as a means by which educators can develop a deeper level of self-awareness about the nature and impact of their performance, an awareness that creates opportunities for professional growth and development.

The above literature indicates the relevance of reflection in the present education scenario as it was in the times of Paulo Freire and it continues to show that, if it is implemented by all stakeholders in the education sector, the current situation can be averted. The teacher has to know the types of learners in the classroom and the learners' background, including the learners' experiences.

In chapter one the study was introduced where the title and its main research question were presented supporting the purpose of why the study was conducted, and clarifying the factors that contribute to the performance of physical sciences. The background information was also given as one of the reasons the study should be done. Physical sciences performance results of the province were not at all satisfactory, which could be seen from the given graphs and tables for the past number of years. This prompted the researcher to find out more about the underlying reasons for this trend.

In chapter two, the study's theoretical framework was introduced and the study was underpinned by reflective practice, where the researcher had to find other supporting literature regarding other similar studies to compare and contrast what other authors believe and have written. The literature used was taken from national and international studies and varied from the past studies to the current studies.

Chapter three dealt with how the study was executed, the methodology and approaches used. The sampling of the participants or respondents was also dealt with in order to focus the study on what it was supposed to address. The respondents were also made aware of ethical issues.

Chapter four is where the results were obtained from the methodology that was applied in the previous chapter. Tables were used to reflect the outcomes that were obtained. The tables were supported by the graphs named as figures to give a clear picture of the results of the study. The chapter also indicated the strategies employed to address the challenges discovered from the study. The strategies addressed the main research question by including all stakeholders involved in improving the performance of physical sciences. The findings were discussed as reflected though the participants, as the research question was

addressing the contributing factors to the performance of physical sciences in a district of the Eastern Cape.

5.3 Major findings of the study

A number of factors have been identified as affecting the performance in physical sciences, particularly in the three schools sampled in the district of the Eastern Cape. Some of the reasons for the inconsistencies in the performance of physical sciences results in these schools can be seen in table 1, 2013 to 2015 (page 14). The factors include the lack of resources, i.e. the under-resourced science laboratories where it becomes impossible for learners to conduct practical work, as learners have indicated in their responses.

The teachers indicated that they had no time to interact with one another to share their experiences, which could also be caused by the lack of time for themselves as they alleged that the physical sciences syllabus was very long. The teachers also indicated that they were overworked and had so many learning areas (subjects) that they were teaching and that made it more difficult to focus on their areas of expertise.

Basic concepts are not properly emphasised earlier in the physical sciences class as indicated by the learners.

On the item of practical work, 75% of learners of school A were of the view that more practical activities should be done when teaching physical sciences while one learner felt there should be a focus on doing the basics of physical sciences. Only 60% of learners from school B were of the view that more focus should be on practical work when teaching physical sciences and the other two learners were adamant that focusing on basics is the way to go. In school C about 67% of learners were also in agreement that the focus should be on practical work when teaching physical sciences.

The next item was the learner participation in the physical sciences class. Almost 75% of learners in school A were always involved in the classroom teaching of physical sciences, and the remaining learner indicated as per the questionnaire that she was sometimes

involved in the teaching of physical sciences, whereas in school B 80% of learners indicated that they were always participating and the remaining learner indicated that he was sometimes involved in the teaching of physical sciences. In school C, 67% of learners indicated that they were participating in the classroom, and the remaining learner indicated that she was sometimes involved in the teaching of physical sciences.

For the item of explaining or presenting what has been learnt in the physical sciences classroom, in school A, 75% of learners responded by saying they could be able to explain physical sciences concepts and what has been learnt in the physical sciences classroom, while only one learner was not sure if he could explain or present what was taught in the classroom. In school B, 80% of the learners said they could be able to explain physical sciences concepts, while the remaining learner was in doubt if she could be able to explain what was taught in the classroom, whereas in school C 67% of the learners said they could be able to explain physical concepts, while the remaining learner indicated that he could not explain what was taught in the classroom.

The last item looked at the confidence of the teacher in the physical sciences classroom. Regarding the learners from school A, 75% felt that their teacher was always confident in the physical sciences classroom presentations, and the remaining learner indicated that her teacher was sometimes confident in the classroom. In school B, 60% of learners indicated that their teacher was always confident in lesson presentations in the physical sciences classroom, while the remaining two learners felt their teacher was sometimes confident in lesson presentation in the physical sciences classroom. In school C only 67% of the learners indicated that their teacher was always confident in lesson presentation in the physical sciences classroom, while the remaining learner indicated that his teacher was sometimes confident in the lesson presentation in the physical sciences classroom.

5.4 Implications of the study

The approach used in the study was unique in the sense that the learners that participated were past grade 12 learners who passed physical sciences and whatever that could have been of assistance after the study would not have had an impact on them. Their reflections

were only to serve the teachers and other stakeholders in implementing and addressing the shortcomings that were identified in the study.

There were also experienced physical sciences teachers who were invited from the three schools to be part of the study to reflect on their good practices during interviews and in open-ended discussions on what should not be done in learning and teaching of physical sciences and these views were shared amongst all other participants.

The researcher designed a questionnaire for learners that helped in trying to better understand how learners view their own learning practices in the classroom situation and the teachers' presentations. The questionnaire was also intended to give space for learners to give advice on what elements are not contributing to their learning of physical sciences, and what topics should be given serious attention in the classroom. The questionnaire assisted the researcher in developing a clear picture of what is happening in our schools, why the performance in physical sciences was deteriorating and how our learners were learning and their shortcomings. The questionnaire in a way represented what was not known and formulated a path for strategies that can be applied to address the known challenges and for further recommendations on the part of the learners.

The researcher also designed a structured interview schedule for the experienced physical sciences teachers. The interview schedule contained open-ended questions and its primary purpose was to use the teachers' experience on how they have made it over these past years teaching physical sciences since they are the people who are always in daily contact with the leaners, know what were the learner's attitudes towards learning and what activities they had observed daily when they were with the learners.

The interview schedule also contained relevant questions that should address the support that these teachers received from the stakeholders of their schools as well as best approaches that could be used to improve physical sciences performance including reflection by the teachers on their teaching.

The interview schedule assisted the researcher in trying to ascertain what could be other elements, either positive or negative, that contributed to the performance in physical sciences on the side of the teachers. Those elements would then also formulate a path for other strategies that could be used to assist teachers to consider a different approach, maybe in their lesson presentation in the physical sciences classroom now that they would have had a better understanding on how learners learn.

The study was in essence trying to highlight the importance of knowing what other good practices can be used in the classroom to assist in improving the performance in the teaching and learning of physical sciences, and in this case some elaborate endeavours were made to indicate that reflections and other interventions in the physical sciences class can make a difference in the teaching and learning. In the three schools participating in the study, learners were taking part in the ILIMA programme afternoon classes. The reflections are some of the strategies that should be done by all education stakeholders who are keen and interested to make a change in how physical sciences can be improved in its teaching and learning.

Managers reflect on what strategies they can employ in order to improve the performance in the teaching and learning of physical sciences. The managers made it possible that learners were taken care of by making available the teachers to assist during the intervention programmes like ILIMA. They also made it possible that provision for catering was made throughout the interventions, while some parents even slept with the learners at the school.

In the classroom level, teachers were teaching and reflecting on their teaching. The teachers examined the approaches that had worked and those that did not work. The following step they applied was to evaluate improvements that could be made for the future and other things that could be done to enhance their teaching.

The learners on the other side were taking part in their own learning, participating and reflecting on their own learning, and on what other things they felt the lessons should include to make them more relevant and interesting. The study was very important for the learners as it laid the foundation for future good practices that should be done by the teachers and

learners in the teaching and learning of physical sciences in the classroom. The learners who participated in the study felt as if they could again sit for their final physical sciences paper now that they had interacted with the teachers.

If the teacher examines his/her teaching strategies, this calls for him/her to compare himself with other teachers to improve the quality of results in his/her respective school through learning from other teachers' practices. Our assumption is that "more reflective teacher actions will lead to greater benefits for the teacher and for all of his or her pupils" (Zeichner & Liston, 1987, p. 25). The study is important foremost to the National Department of Education Ministers, Provincial Department of Education MEC, Curriculum advisors, MSTE coordinators, Department of Education District Managers, school managers, parents, teachers and learners.

The reason it is important is that it will definitely assist in finding more options that could address the challenges that the entire Department of Education is facing, especially this Province of the Eastern Cape. If our districts perform well then obviously the province wins the battle against poor performance.

From the questionnaires it was discovered that learners do have major challenges that are related to the practical work, content knowledge and how they participate in lesson presentations in the classroom. The lack of content knowledge can be attributed maybe to the fact that they received poor background knowledge in their lower grades.

In their responses it can be argued that learners are not all finding physical sciences interesting as it is indicated in their questionnaires. There could be various reasons for this lack of interest which maybe should have been included in the study, i.e. their attitudes. From the practical work point of view in the three schools, it can also be stated that only one school has a nearly functional laboratory, which could be the reason the learners wanted more practical work to be done in the teaching of physical sciences.

5.5 Limitations of the study

The study was limited to the researcher's neighbouring schools and his school was the venue where the study was conducted. The focus of the study was only meant for past grade 12 learners who have passed physical sciences from the three surrounding neighbouring schools.

Since the research was conducted in one district with three schools with a minimum number of five learners from each school together with three physical sciences teachers, this means the findings cannot be generalized to all the schools in this particular district of the Eastern Cape province. The study was only applicable to past grade 12 physical sciences learners and their teachers. In each school the invitation was for at least five learners and three experienced physical sciences teachers.

5.6 Recommendations for future studies

The study could in the future also be with more learners beginning with the lower grades so that the desired goals can be achieved; it should not be focused only on grade 12. The researcher believes that education is a process which should not be short sighted but look at long term goals initiating processes from the foundation phase upwards. The schools that participate should be increased to form maybe geographical clusters or any type of clustering, such that interventions with good practices in our schools should be used in teaching and learning of physical sciences and teachers should be developed on reflective practices.

The results obtained from the clusters can then be used for other bigger schools to show the impact of the interventions on learner performance. If all schools in a district can be engaged in the applied strategies, then the whole province will obtain improved performance in physical sciences.

The best performance in the provinces reflect the overall performance of the country in the achievement of physical sciences. Curriculum advisors should adopt this strategy so that it is used by the teachers under their jurisdiction.

Examples of tools that can be used by the teachers can be recordings of their teaching in order to get to know how the teaching took place and what the good and bad practices were. This will help to improve the teaching and learning of the learners in the classroom. Teachers are expected to give feedback when assessing learners immediately.

More time should be afforded to the learners to spend in science laboratories. Basic concepts should be introduced in lower grades of natural science and physical sciences to create positive teaching and learning. Learners should be encouraged to do pure mathematics.

Learners can use daily reflective books highlighting the activities done on that particular day, clearly indicating what has been understood in the content and what was still not clear. These reflective books should be handed over to the teacher of the relevant subject to reflect on the reflections of the learners and reflect on his/her own reflections on how learners learn physical sciences and where improvements can be made. Physical science classes should be kept to a minimum size as far as possible.

Studies and research can be done to highlight the dire situations that our schools find themselves in. The fact of the matter is that there are other fundamental factors besides those that are discussed by the researcher that contribute to the performance of physical sciences in the province of the Eastern Cape and country as a whole, which must not be taken for granted.

Teachers have challenges that are related to their classroom work and some of these challenges are complex and continuous. These challenges also vary according to the level and type of a school, meaning the school's socio-economic status and the support that teachers receive also play an important role in this regard as well.

The administrators, teachers, parents and learners can provide support for one another to reach a common goal of improving the physical sciences results. A very strong and amicable school climate affords a supportive environment where the managers, teachers and parents work together towards a common objective of improving their own school.

School managers need to be transformed leaders who are innovative and have vision. Mahalinga & Suar (2012) allude to the above statement as they claim also that transformational leaders influence followers to make self-sacrifices, commit to difficult tasks, and attain performance more than expected.

The district officials should regularly visit the physical sciences classrooms to assess the status of the laboratories and funds available to give more support for the school laboratories and equipment.

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6.2 Appendices

Appendix A: Letter to the institution

5391 NU5A
Mdantsane
East London
5219
06 July 2015

THE CHAIRPERSON OF ETHICS COMMITTEE
UNIVERSITY OF THE WESTERN CAPE
BELLVILE, CAPE TOWN
7493

Dear Sir/Madam

Re: Permission to conduct research

I, Mr. Ntsikelelo Ndzala, student number 3082663, currently an M Ed student at the University of the Western Cape, humbly request permission to administer a research through a questionnaire to past grade 12 learners of three schools who have shown an improved performance in physical sciences in the East London district of the Eastern Cape Province.

I pledge and promise not to disrupt any programs of the department and the school. I will work within the framework of the department's disciplinary arrangements and the parents of the learners.

I have also written a letter to the school in this regard. I have a strong belief that the research will benefit the school and other schools that may be affected by the challenge in question.

Yours in Education

……

Mr. N Ndzala
M.Ed. Student University of the Western Cape (UWC) nchicco@webmail.co.za

Appendix B: Letter to the Principal

5391NU5A
Mdantsane
East London
5219
06 July 2015

The Principal
Mizamo High School
PO BOX 240
Mdantsane
East London
5219

Dear Sir/Madam

Re: Permission to conduct research

I, Ntsikelelo Ndzala, currently an M Ed student at the University of the Western Cape, hereby request permission to interview and administer a questionnaire to a sample of past grade 12 learners to be part of my research on what has worked for them to achieve their performance. I also wish to find out what areas of concern they wish to be addressed in some physical sciences topics.

I also invited three experienced physical sciences teachers from neighbouring schools who have been teaching the subject for more than five years to participate in the research.

The identities of the participating learners will remain private while the findings of the study will be disseminated to the management of the schools, the Eastern Cape Education Department in a hard and soft copy format. The schools and the Eastern Cape Department of Education will not be prejudiced or slandered through this research.

Confidentiality is guaranteed and there will be no harm to the learners and school participating in the research. The school will definitely have no disruptions or interference when this research is conducted.

I hope that my request will receive your utmost attention and be treated as a means to support your school when this study has been completed.

Yours in Education

……

Mr. N Ndzala

M.Ed. Student University of the Western Cape (UWC) nchicco@webmail.co.za

Appendix C: Letter to the educators

5391NU5A
Mdantsane
5219
06 June 2015

I, Ntsikelelo Ndzala, currently an M Ed student at the University of the Western Cape, hereby request you to assist me in my research by taking part as a participant to reflect on good practices that assisted you over the years in the teaching of physical sciences, where your input and suggestions will be highly valuable.

Your identity will be treated with extra caution as I will not divulge any findings of the research without your approval and consent. You are also made aware that should you feel uncomfortable with the research you have a right to decline my request. You are in no way under scrutiny or prejudice because of your participation in this research. The findings of this research will then be disseminated to the management of the schools and the Eastern Cape Department of Education in a hard or soft copy format.

Confidentiality is guaranteed and no harm will come to you whatsoever that might put you in a bad light.

I hope that my request will receive your utmost consideration and attention as I need your assistance in this regard as an experienced science educator.

Yours in Education

……

Mr. N Ndzala
M.Ed. Student University of the Western Cape (UWC) nchicco@webmail.co.za

Appendix D: Letter to the Parents

5391NU5A
Mdantsane
East London
5219

Dear Parent/Guardian of……,I would like you to give permission to allow your child to take part in research that will be conducted at Mizamo High School on the 28th of August 2015.

I am currently an M Ed student at the University of the Western Cape; my study requires me to conduct a research using your child as my participant. As a parent you are requested to fill in the form and return it to the school as a token of your agreement that your child will take part in the research.

Thanking you in advance for your understanding and cooperation. I am looking forward to seeing your child.

Yours sincerely
Ndzala N. (Mr.)
0735212834

Appendix E: Parent/Guardian Consent Form

I……. (Name of the parent) give permission that my child…… .(Name of the child) should take part in the research study at his/her school and fully understand that he/she may not be prejudiced while doing this research and later on after it has been completed.

Signature……Date……

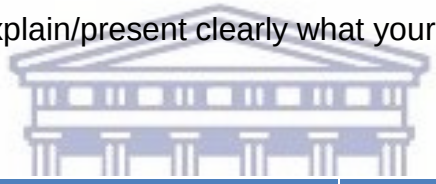
6.3 Instruments

Appendix F: Annexure 1

Questionnaire items for learners

Learners are asked to choose from the brackets what is appropriate in his/her view.

- What topics do you feel are not given enough explanation? (any topic)
- What do you think the teacher should do improve his teaching? (more practical work/must do basics/manage the classroom well)
- How often do you get involved in the lesson presentation by teacher? (always/sometimes/never)
- Rate your teacher in confidence about content knowledge in physical sciences (always/sometimes/never).
- Can you be able to explain/present clearly what your teacher has taught you? Please explain



Questions	Options(tick /write down your response in spaces provided				
1. Topics you feel need enough attention?	Any topic				
2. What should be improved by the teacher?	More practical	Basic concepts	Class management		
3.Do you get involved in lesson presentation	Always	Sometimes	Never		
4. Rate your teacher in confidence about content knowledge in physical sciences.	Always	Sometimes	Never		

5. Can you explain/present what your teacher has taught you in the class?

Appendix F: Annexure 2: Interview schedule for learners

1. What role did you play when you discovered that the teaching was disturbed by the class of physical sciences learners?
2. Do you encourage other past and current matriculants to study further?
3. How can the current situation be changed to improve physical sciences results?
4. Do you have any other input that you can add to this interview? If so, you are requested to do so.

Appendix F Annexure 3: Educator Interview schedule

- Educator Qualifications…….Gender…….
- Number of years teaching physical sciences……
- Name of institution/school
- Name……
- Interviewer…….
- Date……..

Questions for the Teachers (Structured Interview)

1. How often do you get support from the parents and DoE?
2. Are you happy with your physical sciences results for the past three years? Please elaborate.
3. What are the best ways/approaches that can be used in teaching and learning of physical sciences?
4. What methods do you use to measure yourself in succeeding in the teaching and learning of physical sciences?
5. Are there any bad practices you feel are done by other teachers that should be discarded completely? Please explain, and what could be the way forward?

Is there anything you feel should have been included in this study?

Appendix F: Annexure 4: Principals' interview schedule

School Name……Surname and initial…….

Number of years in teaching……Number of years as a principal…….

Highest Qualification…….

1. In your school you have seen physical sciences results fluctuating and later underperforming. What strategies do you have planned to avert the situation for the better?
2. Do you have any planned programmes with the stakeholders of the school? In what way can they improve the physical sciences results? Please elaborate,
3. In the planned programmes how are you going to motivate learners and deal with their ill-discipline?
4. Do you think practical work in teaching and learning of physical sciences can yield better performance in your school's results?
5. At what level have you engaged your education district in regards to the ways of addressing the performance in physical sciences in your school?
6. What other suggestions do you recommend to teachers and learners involved in the teaching and learning of physical sciences, especially for examination preparations?

Factors influencing under-achievement in physical sciences:

Lack of resources

Under qualified and unqualified educators

Absenteeism by educators and learners

Negative attitude of learners towards physical sciences

Lack of participation in science activities

Misconceptions of scientific terms

Limited time allocation in the Curriculum and Assessment Policy Statement

Socio-economic factors

Urban-rural differences