FACTORS

THAT CAUSE POOR PERFORMANCE IN SCIENCE SUBJECTS AT INGWAVUMA CIRCUIT

by

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DECLARATION

FACTORS THAT CAUSE POOR PERFORMANCE IN SCIENCE SUBJECTS AT INGWAVUMA CIRCUIT

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

November 2016

Me. M.H. Ngema

DEDICATION

I dedicate this work to my dearest mother, A.K. Ngema, who encouraged me to make education the foundation of my life, and who also supported me emotionally during the tough times of my years of study. This work is also dedicated to my son, Melokuhle Buthelezi, and my daughter, Wandisokuhle Makhanya, for their unconditional love and understanding.

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ABSTRACT

This study investigated factors that cause the poor performance of learners in the science subjects at the Ingwavuma Circuit. Using a mixed method design, samples were chosen purposefully in four high schools in the Ingwavuma Circuit. The schools identified were schools that underperformed in the science subjects in the year 2014. Grade 12 science teachers and Grade 12 science learners participated in this study. The data were collected by means of two closed-ended questionnaires. One of the questionnaires was designed for completion by the teachers (3) and one by the learners (98). In addition, structured interviews were conducted with eight teachers and eight learners. The data were analysed using SPSS and manual analysis. The data were recorded and summarized by means of descriptive statistics and was interpreted using literature review. The results of this study indicate that factors that contribute to poor performance are, namely a change in the curriculum, the time allocated for each science topic, the teachers' teaching load, resources, the educators' lack of specialized content knowledge, the medium of instruction, the involvement of the parents, poverty, and motivation. From these results recommendations for policy were suggested.

Key words: parental involvement, poor performance, science, specialised content, medium of instruction, science curriculum, change in the curriculum, motivation, poverty.

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CHAPTER 1
ORIENTATION AND BACKGROUND TO THE STUDY

1.1. Introduction and rationale for the study

Science is defined as applied knowledge. It is a subject that has an impact on our everyday activities. It is also defined as a tool that is important to both individuals and to the nation as a whole in order to survive and to meet the global economic requirements (Kibet, Mbugua, Muthaa & Nkonke, and 2012:87). This implies that science subjects continue to be of the most important subjects, as the world is currently at a stage where its wealth and economic development is highly dependent to the science workforce (Laugksch, 1999:86; Muzah, 2011:1; Kibet et al., 2012:87).

The poor performance in science subjects and the low enrollment rate in the science faculties at tertiary institutions is a threat to South Africa's development and economy (Muzah, 2011:2). This observation calls for an investigation into factors that cause the poor performance in order to make efforts to improve the science pass-rates in secondary schools can be done appropriately. This then calls for South Africa to shape its science educational policies by emulating the education systems of the best achievers using international comparison strategies (Lemmer & Van Wyk, 2010:1).

The performances of secondary school learners are determined by the matric results, and the matric results, in turn, determine whether the district performs well or poorly in education (Muzah, 2011:2). The Ingwavuma Circuit, located in the UMkhanyakude District the Northern region of KwaZulu-Natal continues to perform poorly, especially in science subjects. This presents a huge concern, as we are living in a world that requires from the students to be literate in science, since science has been identified as one of the key subjects in the global economy (Muzah, 2011:1; Adaramola, 2011:102).

It is clear that remedial measures by the Department of Education, which include visits to the school by departmental officials, addition classes and winter schools, have been nothing but a futile exercise, as the marks continue to be poor. This indicates that the root cause of the poor performance in the science subjects at the Ingwavuma Circuit has not been identified by the officials.

Research has indicated that school-based factors (the availability and use of teaching/ learning facilities), socio-economic factors (the education of the parents and their economic status), student factors (motivation and attitude), school type and the teachers' characteristics as the factors that contribute to the learners' poor performance in the science subjects (Kibet et al., 2012:87; Makgato & Mji, 2006; Amukowa, 2013; Mwaba, 2011:2).

Research findings indicate that this topic has mostly been covered outside the country and that little has been done in respect of South Africa. The findings suggest that even if the above mentioned factors were addressed they were not addressed correctly, as we are still facing the challenge of poor performance in science subjects, or that the causes have not yet been discovered, apart from those mentioned above, that affect the students. This is because in the schools in the Ingwavuma Circuit that lack resources, in one year you may find the school performing well and in the next you may find the same school not performing at all. This indicates that more research still has to be done to see if there are other factors causing the learners' poor performance in science subjects, or if the factors identified in the Ingwavuma Circuit are the same as those indicated in previous research.

This study was designed to do research on factors leading to the learner's poor performance in science in the Ingwavuma Circuit with the aim of improving the learner's performance.

1.2. The problem statement

The high failure rate of the learners, specifically in the science subjects, continues to be a threat in the Ingwavuma Circuit. Factors leading to the poor performance need to be researched, as they continue to be to the detriment of the learners of the area.

1.3. The research question

The research question for this study was: What are factors that cause the learner's poor performances in the science subjects in the Ingwavuma Circuit?

1.4. Aim of the research

The aim of the study was to investigate the factors that cause the learner's poor performances in the science subjects in the Ingwavuma circuit.

1.5. The research design and sampling methods

In this study the researcher's aim was to describe a certain phenomenon (the factors causing the learner's poor performance) from more than one viewpoint and to gather information based on the investigated phenomenon from a large number of subjects (four underperforming schools in the Ingwavuma Circuit). This study required the researcher not to go in depth of the issue per individual in multiple perspectives. Therefore the researcher considered the mixed methods research design as relevant to the research. A mixed methods design integrates qualitative and quantitative data-collection and analysis in a single study (Creswell, 2003; McMillan & Schumacher, 2010:25).

Quantitative research is a research method that uses objectivity in measuring and describing phenomena (McMillan & Schumacher, 2010:21). Quantitative research can be experimental, where there is a manipulation of the variables, or non-experimental where there is no manipulation of the conditions (McMillan & Schumacher, 2010:22; Hopkins, 2008:12-21).

The quantitative method that was used in this research was a non-experimental method where there was no manipulation of the conditions (McMillan & Schumacher, 2010:22; Hopkins, 2008:12-21), since the research needed to gather information from schools without manipulating their situation. The non-experimental method is divided into six types, namely descriptive, comparative, correlational, survey, ex post facto and secondary data-analysis (McMillan & Schumacher, 2010:23). In this research use was made of the survey method.

A survey method is described as scientific methodology that collects information from a large population for purposes of description, exploration and explanation. It uses a questionnaire or interviews to collect the data (McMillan & Schumacher, 2010:23; Livingstone, 2005:61).

Qualitative research gathers data by using less specific questions which probe for a deeper understanding of a certain phenomenon. This type of research has no predictions or expected results (McMillan & Schumacher, 2010:64). Qualitative research includes:

- Ethnography, which describes and interprets a cultural or social group within its natural setting. In this kind of research the data are collected through prolonged fieldwork, which may involve the observation of the participants, interviewing the participants or collecting artifacts (McMillan & Schumacher, 2010:23).
- Phenomenology, whereby the researcher collects data by interviewing the participants in respect of their perceptions and interpretations about a certain experience (Creswell, 2003).
- Case study, where the data are collected within a single setting over time and in depth (McMillan & Schumacher, 2010:24).
- Grounded theory, where the researcher gathers the data by conducting a number of interviews with the aim of forming a theoretical idea, or to examine a phenomenon in relation to an existing theory. This kind of research focuses on a society or social

institution and uses multiple stages of data-collection which may be revised as new categories emerge (Creswell, 2003).

The mixed methods design uses three models, which are:

- Explanatory: Here the quantitative data are collected first. After the analysis of its results the qualitative data are collected to further explore the quantitative results, using a small number of individuals (Creswell, 2003).
- Exploratory: Whereby the qualitative data are collected first from a few individuals, then the results from collected data are used to create a theme, idea, perspective or belief (Creswell, 2003).
- Triangulation: In this study both the qualitative and the quantitative data are gathered simultaneously. In this way the qualitative and the quantitative data are given equal priority. The data are integrated to provide a comprehensive understanding of the problem. Hence, this method increases the validity and credibility of the results, especially when both the qualitative and quantitative results match (Creswell, 2003).

This research was done at different schools consisting of a large number of subjects. Therefore, a close-ended questionnaire which follows a format which has prescribed answers and are prepared in advance (Dawson, 2002:31; Pathak, 2008:111) was selected to gather information. A close-ended questionnaire was selected because it is cost-effective, it makes it easier to gather standardized information from large groups who are widely-spread across a wide geographical location, it is easy to understand and to analyse the results quantitatively, it is easy to report the results and it gathers honest information from respondents as the respondents were given enough time to interact with the questions (McMillan & Schumacher, 2010:195).

An *interview* denotes interaction between two or more people for purposes of exchanging information through a series of questions and answers (Bryant, 2011). Structured

interviews were selected for this research because they made it easier to replicate the discussions and to get standardized views on a topic and to simplify the findings. It is also possible to collect information on past, present or future behavior, subjective states, opinions and attitudes (Bryant, 2011). In this research interviews were recorded as it is more reliable and allows the researcher to properly analyse the information at a later stage (Patton, 1990:348). The recorded interviews were transcribed during the analysis of the results.

1.5.1. Sampling methods

Merriam (2002) defines *sampling* as the selection of a research site, time, people or events in field research. She further explains that the number of participants in a sample depends on the questions being asked, the data being gathered, the analysis and the resources available to support the study (Merriam, 2002).

Although many sampling methods exist this study made use of purposeful sampling, which is a sampling method that involves the researcher selecting subjects with the required characteristics (McMillan & Schumacher, 2010:326). This sampling method was used because it allows the researcher to use a particular subject that will give relevant information relating to the topic. The advantages of purposeful sampling is that the participants relevant to the study are selected, therefore reducing costs and saving time. It also allows for the collection of reliable and robust data (Tongco, 2007). Purposeful sampling in this study was done by selecting four Ingwavuma Circuit schools that underperformed in science subjects in the year 2014. All the Grade 12 science teachers (Physical and Life sciences) in each of the five selected schools were given questionnaires. One Physical science teacher and one Life science teacher were interviewed. The criteria that were used to select the teachers to be interviewed in schools with more than two Grade 12 science teachers were that these teachers should have taught the subject for four years or more. All the grade 12 science learners in each of the four selected schools were given questionnaires, and two Grade 12 science learners from each of the four schools were interviewed.

1.5.2. Analysis of the data

Data analysis is a way in which the researcher makes meaning of the data collected (Zar, 1984). In this research the data were collected both quantitatively and qualitatively. Zar (1984) emphasizes the importance of excluding biasness from research, and this was done in this research by analyzing the data statistically.

The quantitative data were collected using questionnaires, and this data were analysed by using SPSS. The researcher studied the responses in the questionnaires and categorized the data into themes and then variables. There were two different questionnaires and they were both analysed separately. The data belonging to each variable were then recorded and summarized using descriptive statistics. The tables and graphs from the descriptive statistics were then interpreted by means of a review of the literature.

The qualitative data were collected by means of interviews. This data were analysed manually. The analysis of qualitative data is done to understand the sampled participant's experience in relation to the phenomenon being investigated (Thomas, 2003; McMillan & Schumacher, 2010). The researcher transcribed the information from the interviews during the data-collection this enabled the researcher to gather all information efficiently. These transcripts were then read and important categories were identified. The data were sorted and grouped according to similar concepts. This was done to organize the data into workable units (McMillan & Schumacher, 2010; Thomas, 2003). The data were then scrutinized to ascertain how one concept influenced another. Alternative explanations were searched throughout the data that were collected. This was done by describing the responses from the respondents. Patterns were sought (Thomas, 2003). The patterns were then interpreted. The findings were then reported, by the researcher in a form of a research document. Since this was a triangulation method, both the qualitative and the quantitative analysis were reported simultaneously.

1.6. Methodology

The researcher wrote a letter to the Head of the Department of Education of KwaZulu-Natal, who then permitted the researcher to conduct research in the five chosen schools. After gaining permission the following steps were followed:

- the pilot-testing of the questionnaire was done;
- the questionnaire was issued to the selected schools;
- the educators were informed about the interview dates;
- the questionnaires were collected;
- interviews were convened;
- the information gathered was analysed;
- the results were communicated.

1.7. Issues of reliability and validity

Validity in research ensures that the researcher and the participant understand each other in a way that relevant information will be presented (McMillan & Schumacher, 2010:330; Singh, 2007:77). In other words, does the research the gather relevant information? This means that the researcher has to use appropriate tools that will enable relevant information to be gathered, this also means that the tools chosen should be well understood by the participants.

Reliability and validity was ensured in the research by structuring the questions in an unambiguous manner and in the language that the participants understood (McMillan & Schumacher, 2010:331). This meant the tools (questionnaire and interview questions) were designed and then checked by local experts who included grade 12 science teachers and then sent to the supervisor to check on its relevancy to answer the research question.

The research questionnaire and interview questions were validated by being checked in terms of relevancy to answer the question by experts, namely the supervisor. The

questionnaire and interview questions were then submitted to the ethical clearance committee of UNISA. After ethical clearance of the research questionnaire and interview questions a pilot test was also done by the researcher. Pilot-testing is a method used to check if the research questionnaire and interview questions measures what it is supposed to measure and to check if the questions and overall layout is understandable and interpreted in the same manner by all the participants (McMillan & Schumacher, 2010). For the pilot-testing, ten students and five teachers from the sample were chosen to answer the questionnaires and interviews questions. The researcher then gathered the information on where the participants misunderstood the questions and then made amendments to the questionnaire and interview questions.

1.8. Definition of the terms

The key terms of the topic are:

Factors: In this study *factors* are defined as those elements that can lead to Grade 12 learners performing poorly in science subjects.

Poor performance: In this study *poor performance* means underperformance in science or not meeting the minimum requirements.

Science: A subject that has an impact in our everyday activities, a subject that is important both to individuals and to the nation in order to meet the global economic requirements (Kibet et al., 2012:87). In this study *science* means mathematics, physical science and life science.

Subject: A branch of study. For this research *subject* should be mathematics, physical science and life science. (The South African Oxford dictionary 1987:769)

Curriculum: In this research a *curriculum* is defined as "a document, a syllabus, a process for developing a plan, the plan and the execution, a system and structure of an undefined discipline" (Moore, 2015).

Parental involvement: Any manner in which parents involve themselves in their child's education which involves motivating their children to participate in extra-mural activities,

guiding them on social interactions and ensuring that they at school on time (Modisaotsile, 2012:3).

1.9. Ethical considerations

It is very important to abide by research ethics (McMillan & Schumacher, 2010:338; Wallen & Fraenkel, 2011:23; Opie 2004:25). Credible research is research that is done with permission from relevant authorities for where the research is to be conducted, for this research it is the Head of the department of education (McMillan & Schumacher, 2010:338; Wallen & Fraenkel, 2011:23). Credible research also protects the participants, adheres to the privacy and confidentiality of the participants and also takes care of the wellbeing of the participants (McMillan & Schumacher, 2010:338; Wallen & Fraenkel, 2011:23).

The ethical considerations were ensured by obtaining the permission of research from the Department of Education (Appendix A). After getting the permission of research (Appendix F), letters were sent to the schools to make them aware of the research that was going to be conducted. The schools were ensured that their names were not going to appear anywhere and that the research was not going to disturb their normal proceedings of teaching and learning. The consent (Appendix B and Appendix C) and assent (Appendix D) forms were handed to the learners and the teachers (Appendix E) in order to obtain their permission for the research (McMillan & Schumacher, 2010:48; Wallen & Fraenkel, 2011:23). After permission was granted by the learners and teachers the research was then conducted. Before this ethical clearance was applied for at the University and the committee looked at the research procedure and research tools in order to grant ethical clearance certificate (Appendix G).

1.10.Chapter outline

- Chapter 1 - Orientation and background to the study. In this chapter the topic was introduced, and the rationale for the study was outlined. The chapter outlined the

importance of the research and how it would suggest contributions to the field of science education in relation to curriculum policies and content.

- Chapter 2 - Review of the literature. The researcher will review the literature on the topic.
- Chapter 3 - The research design and methodology. This chapter describes the methods used to collect and analyse the data. It indicates the sampling methods and how the sample will be chosen.
- Chapter 4- Presentation and analysis of the results and conclusions: In this chapter the researcher reports on the results. The chapter provides the analysis of the data and conclusions.
- Chapter 5 – The findings, limitations, final conclusions and recommendations.

1.11. Conclusion

The chapter above introduced and explained the background of the study by explaining the rationale of the study being that, less research covering poor performance in science subjects has been done in South Africa .The observation of poor performance in science subjects at Ingwavuma circuit lead to formulation of the problem statement, aim and the research question. The chapter also outlined the research methodology and also briefly outlined other chapters that are going to be included in the research in order to answer the research question . The next chapter will review literature of previous research in relation to the research question.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1. Introduction

In the previous chapter the rationale for the study was introduced. The researcher explained why the topic was chosen. The research question, aim and objective of the study were also indicated. The researcher further indicated the methodology that was going to be used to gather and analyse the data.

In this chapter the researcher will present a review of the literature on the factors that influence the teaching and learning of science. This includes the science curriculum, the challenges faced by South Africa in respect of science educators, the cognitive load of a science learner, and theories that can be applied to ensure smooth communication between the school and the community. These factors will be discussed in relation to science teaching and learning, and achievement.

The factors that were identified in previous research as causing the learners' poor performance will be discussed and will shape the direction that the researcher will take in investigating the factors causing the poor performance in the Ingwavuma Circuit.

2.2.Factors influencing the effective teaching and learning of Science

This section comprises a literature review on the factors that cause the learners' poor performance in the science subjects. Before these factors are identified it is, however, imperative to pay attention to the key elements mentioned in 2.1 above that cannot be ignored when engaging in the issue of obtaining effective results when teaching science. The researcher will concentrate on the above elements because teaching and learning is an interaction between a learner and a curriculum as facilitated by a teacher within a certain community (Fosnot, 1993).

2.2.1 Challenges South Africa has to face with regards to science teachers

In the literature it is indicated that South Africa continues to face numerous challenges when it comes to science teachers, the first being that science teachers are leaving the education sector each and every year (Modisaotsile, 2012:4) simply because of the low salaries, poor infrastructure and resources, and excessive workload (Hughes, 2012:254). The SACE (2010:23) agrees with this and adds that the lack of career advancement is also a cause of science teachers exiting the Department of Education. Another challenge that has been identified is the retirement of experienced teachers (Hughes, 2012:245). This has led to the lack of mathematics and science teachers in South Africa (SACE, 2010:23) and to the employment of under-qualified science educators (James, Naidoo & Benson, 2008:2). The SACE (2010:23) adds that where there are science teachers there is the problem of quality in their subject knowledge and their teaching methodologies. This is seen as a continuous challenge because there are also fewer students enrolling for science education (Dhurumraj, 2013:18; Makgato & Mji, 2006:255). Spaull (2013:5) says that statistics indicate that between 2008 and 2011 learner enrollment in mathematics dropped from 56% to 45%. Based on research the low enrollment in science education and the presence of under-qualified teachers may lead to the students' performance in science subjects continuing to be poor, as performance is influenced by their perception of the subject teacher (Hughes, 2012:45), and content knowledge (Amukowa, 2013:92; Tsanwani, Harding, Engelbrecht & Maree, 2014:45; SACE 2010:23). Hughes (2012:345) emphasizes this when he says that, "experienced teachers are better teachers". This suggests that a science educator should be competent in respect of his/her knowledge of science and should be able to teach science in multiple authentic ways. The teachers should also be well-versed about policies, and should be able to create environments that are conducive to learning and that will suite diverse learning styles (Sanders, 2007:32-38; Van Aswegen, Fraser, Nortje, Slabbert & Kaske 1993:8). However, some researchers state that it is not experience and content knowledge alone that guarantee good performance, but also the ability of the educator to capture the attention of the young minds (Dhurumraj, 2013:18), the ability to probe them to think (Izquierdo-Aymerich & Aduriz-Bravo, 2003:34), and the ability of the teacher to take into consideration learner conceptualization in order to assist the learners to integrate existing concepts about science with new concepts

being taught (Hewson & Hewson, 1987:428). This implies that the science educator should be a constructivist and interventionist (Rosenfeld & Rosenfeld, 2008), and should be able to employ multiple teaching methods in accordance with the learner's needs (Fosnot, 1993).

2.2.2 The attitudes of the teachers and the learners towards science

Attitude is defined by Abudu and Gbadamosi (2014:035) as an idea or thought that is based on a certain situation, which can indicate a person's like or dislike of an item. They furthermore identify *attitude* in three categories which are positive, negative and neutral. This definition can be supplemented by the definition by Barros and Elia (1974) where they define *attitude* as a mental readiness for a certain action which dictates what a person will see, hear, think and do.

Research by Abudu and Gbadamosi (2014:036) regards attitude towards science as an important factor that affects the students' performances and conceptions about the subject. It is only a positive attitude that can result in a learner doing well in science, because a positive attitude leads to interest in the subject, and interest leads to commitment, and commitment, in turn, leads to a yearning for academic achievement (Osborne, Simon & Collins, 2003:1054). Osborne et al. (2003:1054) divide *attitude* into three categories, namely the enterprise of science, school science and the impact of science on the society of scientists themselves. Osborne et al. (2003:1053) and Abudu and Gbadamosi (2014:036) indicate the constructs of attitude as:

- the perception of the science teacher;
- anxiety toward science;
- the value of science;
- self-esteem in respect of science;
- motivation towards science;
- the enjoyment of science;
- the attitudes of peers and friends towards science;

- the attitudes of the parents towards science;
- the nature of the classroom environment;
- achievement in science; and
- fear of failure in the course.

Osborne et al. (2003:1054) furthermore elaborate that the attitude of an individual towards science is made up of a blend of the abovementioned constructs.

Research by Osborne et al (2003:1060) in the UK indicates that learners enrolling for science in high schools means their attitudes towards science are positive. However, the de-contextualised nature of the school science curriculum results in learners having a negative attitude towards school science (Osborne et al., 2003:1060). Research identifies biology, which is now part of life sciences, as the only subject that is perceived as relevant by the learners because it relates to life and to things they see in their everyday life. They see physics as an irrelevant subject that is dominated by equations and chemicals that they cannot identify with in their everyday lives (Osborne et al., 2003:1061; Barros & Elia, 1974). It is only a teacher with a positive attitude and commitment that can assist in driving the learners towards a positive attitude in respect of this de-contextualised school science and the lack of resources (Osborne et al., 2003:1068; Mart, 2013:440). Such teachers are teachers who are specialists in science, who understand science beyond the curriculum, and who teach science in a variety of ways, who are enthusiastic and confident about science, and who spend time beyond their duty to ensure that the learners understand the concepts of science (Osborne et al., 2003: 1068, Tsanwani et al., 2014:42). Research indicates that teachers who are not able to use a correct approach and attitude while teaching, have as a result learners having negative attitudes towards science, and this leads to poor performance (Abudu & Gbadamosi, 2014:036; Barros & Elia, 1974).

2.2.3 The science curriculum

The term ‘curriculum’ encompasses multiple meanings, but for the purpose of this study a *curriculum* shall be defined as, “a document, a syllabus, a process for developing a plan,

the plan and the execution, a system and structure of an undefined discipline" (Moore, 2015). The aim of this research is to investigate the factors causing the learner's poor performance in science at the Ingwavuma Circuit, and that cannot be done without looking closely at the current curriculum, because the curriculum is the 'goal-setter' which guides the teachers to what to teach and how to teach (Orpwood & Barnett, 1997:347). Achieving the goals and implementing the curriculum with understanding lead to good results. But in South Africa we still have the challenge of poor performance. Even in the new curriculum (CAPS) are there shortcomings in this curriculum, or is it misunderstood by the teachers?

For the reason stated above and for the fact that teaching and learning are interactions between the learners and the curriculum, facilitated by the teacher (Fosnot, 1993), this section will discuss the science curriculum as depicted in the CAPS. The researcher will look at the theoretical framework of the document and will also discuss, what is described as a relevant science curriculum.

2.2.3.1 The theoretical framework of the Curriculum Assessment Policy Statement (CAPS)

The science curriculum as depicted in the Curriculum Assessment Policy Statement (CAPS), is one that should commit to social transformation, progression, critical thinking, inclusivity, the value and awareness of indigenous knowledge systems and to credibility, quality and efficiency (CAPS 2011:4-5; Moodley, 2013:40) and it should be relevant (Stuckey, Hofstein, Mamlok-Naaman & Eilks, 2013:19; Villanueva, 2010:2).

The CAPS document in respect of the curriculum for the science subjects consists of a simplified language; this means that the document explains clearly in simple language what the curriculum seeks to achieve, and this makes it easier for the teachers to be able to interpret the document. The document is also prescriptive and informative, as it provides specific guidance on what the teacher should teach in order to fulfill the aims of the curriculum, its purpose and principles so that the teachers may not have any difficulty in implementing the curriculum effectively. However, the document does not guide the teacher content difficulty and this causes the curriculum to be taught at different difficulty

levels in different schools. However, standard testing is administered in schools (Ladwig, 2009:279). May this possibly be the cause of the poor performance of some schools?

The document opens with a well-defined background and overview of the curriculum in order that everyone interacting with it should be able to understand how to implement the curriculum. It furthermore provides the aims, the purpose and the principles of the curriculum. The aims and purposes of the CAPS (2011) commit to social transformation, progression, critical thinking, inclusivity, the value and awareness of indigenous knowledge systems, and to credibility, quality and efficiency (CAPS 2011:4-5). A challenge, however, exists when it comes to addressing some of the curriculum aims. Lelliot (2014:320) indicates that the curriculum is not played out in the classroom as it was envisaged by the developers.

Firstly, the content deals more with theory than with investigations, and the examinations weigh more than school-based assessments (Ladwig, 2009:280; Lelliot, 2014:321). This means that the teacher will spend more time teaching scientific knowledge rather than teaching scientific process skills, and doing practical investigations with learners (UNESCO, 2010:14).Inability to do practical investigation results in the curriculum being unable to achieve it aim of teaching learners critical thinking skills (CAPS 2011:4) this results in students being unable to use the inductive process of observing the natural world and drawing conclusions. Indeed, the document outlines diverse examples of investigations that could be done with each topic but teachers end up not doing the prescribed practical investigations because they weigh less when it comes to assessments (Moodley, 2013:42).

Secondly the curriculum does not explain which indigenous knowledge is to be taught; the curriculum needs to give specific examples of the indigenous knowledge to be taught. This results in the learners not losing interested in science, hence the decline in enrollments (Dhurumraj, 2013:18; Makgato & Mji, 2006:255) and the poor performance, since the students cannot relate what they learn in class to what they see in their everyday lives.

The organization of the curriculum content is properly and clearly defined into four knowledge areas in the CAPS (2011). Furthermore, the organization of the curriculum also serves as a work schedule, as the time allocated for each task is clearly outlined (Moodley, 2013:44). This means that teachers will have few problems when it comes to the preparation of the lessons as topics are not only listed but are also coupled with learning activities. The curriculum also suggests projects and practical investigations to be done with each topic (Moodley, 2013:76) as well as suggestions for resources that could be used with each topic, with the proviso of improvising (CAPS 2011:12). This means that the teacher could spend more time preparing to teach effectively than worrying about the resources. However, in under-resourced schools it may be difficult to teach some of the knowledge areas. Some resources cannot be improvised, for example the types of acids to be used in matter and materials, lack of resources affect learning negatively (Tshiredo, 2013:51). Naidoo and Green (2010) state that curriculum and social transformation go hand in hand; if social transformation is not adhered to, then the poor would be unable to meet the demands of the envisaged curriculum.

The allocation of time is done realistically in grades 7-9 but for grade 4-6 it is not practical and realistic (CAPS 2011:9) as the natural sciences and technology have been merged. There is also a concern as to whether the teachers teaching these merged subjects are able to address each area equally and effectively because failure to do so results in a negative impact towards the basic knowledge of science learnt by a learner.

Clear guidelines for assessment are given (CAPS 2011), with marks to be allocated for each task and the contribution of tasks to the overall year mark is clearly defined. The document further defines how specific aims should be incorporated into assessments; it also defines the cognitive levels for the assessments of content in each grade (CAPS 2011:10). This gives a clear guideline to learners and teachers on what will be assessed and to what depth.

However, the manner in which final assessment is weighed does not allow educators to apply the constructivist approach to teaching and learning, as they will be rushing to cover

the content for examination purposes (Ladwig, 2009:277; Lelliot, 2014:321). The document also mentions inclusivity, and addressing barriers to learning natural science (CAPS 2011:9).

2.2.3.2 The science curriculum and relevance

Research indicates that the term *relevance* in science is diverse and cannot be given a single meaning. It consists of different dimensions that have to be considered (Stuckey, Sperling, Mamlok-Naaman & Eilks, 2014). In terms of science, *relevance* is defined by means of three dimensions. (Stuckey et al., 2013:19), namely individual, societal and vocational (see the diagram below).

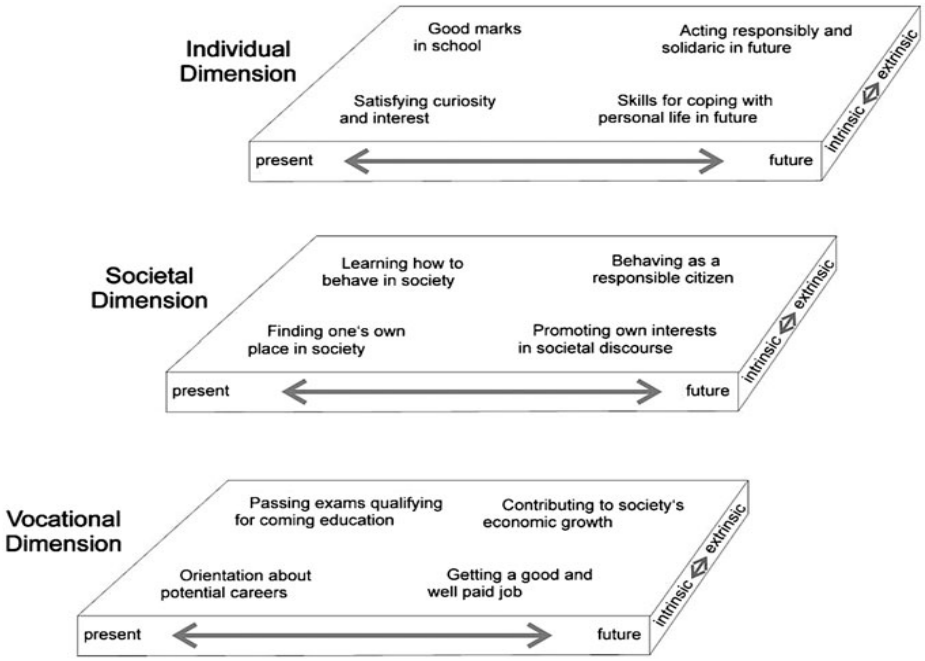

Figure 2.1: A model of the three dimensions of relevance with examples of aspects allocated in the span of both the present–future and the intrinsic–extrinsic-range.

Stuckey et al. (2014) define the three dimensions as overlapping elements that cannot be treated as a single entity. They all contribute towards making science a relevant subject in the society. In the above model dimensions are defined for the current situation of the learner and for the future situation of the learner. This means that science should be taught

so that it influences both the present and the future of a learner. The model also indicates that intrinsic and extrinsic components can affect the three dimensions. *Extrinsic* is defined by Stuckey et al. (2014) as anything that involves ethical expectations of a students' environment and by the society they live in. *Intrinsic* is defined as motivation that arises as a result of students' interest.

Stuckey et al. (2013; 2014) define the abovementioned three dimensions as follows:

- Individual: This relates to science education that matches the learner's curiosity and interest. Science education which equips the learners with the required and useful intellectual skills, which can contribute in the everyday life of a student and also in the future life of a student. The model suggests that this kind of science education can contribute to the learners receiving good marks at school, and in future the skills will assist the students in acting responsibly, and therefore having a bright future.

- Societal: This relates to science education that equips the learners with skills that enable them to participate in and contribute towards the sustainable development of the society. The model suggests that this kind of science education assists the learners towards finding their places in the society and hence learn how to behave in the society. This in future allows them to be able to promote their own interests in society and also in behaving as responsible citizens.

- Vocational: This relates to science education that prepares the learners for different careers in higher education. This kind of science education can result in the learners passing their exams well so that they can meet the requirements of the career they will choose. This in future will lead to a student getting a good job and being paid well and in turn contribute to the society's economic growth.

The model above clearly sets a standard of relevance to be covered by the science curriculum. The model further points out that if the curriculum can cover all the dimensions of relevance, learners can perform well in Science subject without even an extraneous effort of the science teacher.

2.2.3.3 How does a change in the curriculum affect the teachers and the learners?

Curriculum change is an international issue and is done to adapt to changes in the society (Moodley, 2013:201). This change happens at a fast pace (Moodley, 2013:67). This may leave the teachers and learners confused and stressed, because the resources needed for this change are not provided by the department of Education (Moodley, 2013:67). These changes are also imposed on teachers as they are not directly involved during the curriculum change process (Moodley, 2013:21; Mouton, Louw & Strydom 2012:1214). This results in the teachers not owning the curriculum; hence they may accept or reject it.

The acceptance or rejection of curriculum change relies on whether the teachers own the curriculum or not. Even though they may own the changes, when they meet challenges they select what they want (Tshiredo, 2013:100). The changes may bring about confusion to both the teachers and the learners as the teachers may not be adequately trained (Tshiredo, 2013:100). Research shows that curriculum changes come with a lot of administrative work (Moodley, 2013:67), and this overloads the teachers with work, and leads to them being demotivated and they then divert back to the traditional methods of instruction (Tshiredo, 2013:53).

2.2.4 The Cognitive Load Theory

Learner cognition influences learner motivation (Anthony & Artino, 2008) which, in turn, influences performance. In this study it is regarded as a key element towards the learner's academic achievement since it determines the success of learning. Research has indicated that learners possess different cognitive styles. This requires that the teacher has to be able to develop the way in which the students cope with particular tasks or situations by using cognitive strategies (Danili & Reid, 2006). Teaching and learning are interactions between the learner and a curriculum, facilitated by a teacher (Fosnot, 1993). The Cognitive Load Theory indicates the strategies available to teachers and addresses the diverse cognitive abilities of the learners.

Cognitive load is defined as the elements that are required to be processed by the working memory at an instance in time (Kirschner, Kirschner & Paas, 2009; Cooper, 1998). The working memory can only process a few new elements, and can only store them for a short period of time (Anthony & Artino, 2008; Merrienboer & Sweller, 2005:148; Kirschner et al., 2009; Sweller, 1994). Successful learning is determined by the ability of the working memory to process new information and to store it in schemas so that more space can be made available for new information (Anthony & Artino, 2008).

The Cognitive Load Theory suggests that the cognitive load should not exceed the capacity of the working memory (Anthony & Artino, 2008; Kirschner et al., 2009). It furthermore suggests ways that can be applied to control the cognitive load and the construction of schemata in learning (Kirschner et al., 2009). The Cognitive Load Theory requires that instructional material be equal to a leaner's cognitive resources (Cook, 2006:4). This means that whatever is taught to a student must be able to be accommodated in his or her working memory, which is limited, in as-much as that it can, at a later stage, be integrated into the long-term memory which is limitless and permanent (Cook, 2006:4; Kirschner et al., 2009). The ability to store and organize information in the long-term memory relies on the formation of schemas (Kirschner et al., 2009). When the schemas are properly constructed then a student can master the subject. This observation is supported by Sweller (1994:296) where he says that, "the intellectual mastery of any subject matter is overwhelmingly dependent on schema acquisitions and the transfer of learnt procedures which are from controlled to automatic processing".

Schemas are cognitive processes of organizing basic knowledge to already existing knowledge (Sweller, 1994:297). Schemas occur in two ways, firstly, unconsciously, which is called 'automated processing', and secondly, consciously, which is called 'controlled processing' (Sweller, 1994: 297). Cooper (1998) defines the two processes by saying that what we know enables us to easily identify or make meaning in respect of the new information presented to us. This suggests that a student with a high level of expertise in a subject will only require a few elements to store information because most elements have

already been attended to. This is different to a learner with a low level of expertise because he or she will be seeing information for the first time, and will need a working memory to attend to many elements (Cooper, 1998). This suggests that there should be a way to assist slow learners to reduce the load of working memory (Cooper, 1998). Schemas reduce the load of the working memory because they organize information into elements, which make it easier to remember (Sweller, 1994:298; Cooper, 1998). The reduction of the cognitive load of a learner can result in subjects such as science and mathematics being easily grasped by learners. But reduction of a learner's cognitive load relies on how these science subjects are taught or how the teaching and learning material has been designed. Teaching has to be done in a manner that reduces the burden placed on the learners' working memory because the working memory is increased by changing the modes of presentation (Cook, 2006:4).

The Cognitive Load Theory assumes that there are three types of cognitive loads, namely

- The intrinsic cognitive load: This type of load is determined by what a learner knows (expertise). It cannot be altered by how instruction takes place but rather, it depends on the number of elements to be processed at the same time, and also on how these elements interact (Merrienboer & Sweller, 2005:150; Cooper, 1998; Anthony & Artino, 2008:429).
- The extraneous cognitive load: This type of load is determined by how the task is presented to the learners. It can be altered by instructional intervention (Merrienboer & Sweller, 2005:150; Cooper, 1998; Anthony & Artino, 2008: 429).
- The Germane cognitive load: This type of load is determined by the construction of the schema and rule automation (Kirschner et al., 2009; Anthony & Artino, 2008: 429).

Research has identified several instructional ways to reduce the extraneous cognitive load so that the intrinsic and Germane cognitive loads increase (Kirschner et al., 2009). The instructional ways to reduce the extraneous cognitive load are the goal-free, worked examples, split attention, and the modality and redundancy effect (Kirschner et al., 2009; Anthony & Artino, 2008: 32; Cooper, 1998; Merrienboer & Sweller, 2005:151).

- The goal-free effect: Researchers believe that if learners are given goal-specific problems they focus on the goal and do not take into consideration other information. They tend to compare the stage of knowledge that they have reached to the stage that they should reach next and this causes a high extraneous cognitive load (Kirschner et al., 2009; Anthony & Artino, 2008: 432; Cooper, 1998; Merrienboer & Sweller, 2005:151). The abovementioned researchers recommend that goal-free problems should be given to the learners because they drive learners into focusing on the given information in order to use it where possible. This also allows them to work in a fast manner (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151).
- Worked examples: This effect improves the comprehension of the learners, and indicates to the learners the procedure they should follow to solve problems (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151). This effect arises because, as the learners are exposed to worked examples and their solutions, it allows them to identify types of problems, to recall the steps relevant to each type of problem, and to solve each problem without mistakes (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151).

- Split attention: This type of instruction gives the learners different teaching and learning materials to split the attention of the learner, e.g., diagrams with text that explain them, because no diagram is self-explanatory (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151). Diagrams coupled with text allow the learner to focus on two different knowledge sources, then to integrate them; that is how learning occurs (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151).

- The modality effect: Instruction is done in two teaching and learning modes simultaneously, e.g., by using auditory and visual instruction. This increases the working

memory, and therefore reduces the cognitive load (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151).

- The redundancy effect: This refers to instruction where the information is presented more than once. This reduces the cognitive load because it allows the learners to concentrate on individual parts of information presented to them (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151).
- The problem completion effect: It gives the learners partly-solved problems for them to complete. This reduces the cognitive load with the reduction of the problem size (Kirschner et al., 2009; Anthony & Artino, 2008:432; Cooper, 1998; Merrienboer & Sweller, 2005:151).

2.2.5 Effective communication between the school and the community

Numerous research findings consider parental involvement in a child's learning as a factor in a learner's academic achievement (Dhurumraj, 2013:54; Makgato & Mji, 2006:262; Lemmer, 2007:218; Sanders & Epstein, 1998:33). Academic achievement can be achieved when there is effective communication between the home, the school and the leaner. Teaching and learning is an interaction between a learner and a curriculum facilitated by a teacher within a certain community (Fosnot, 1993). Therefore communication is a key element between these three entities. In this research the Theory of Overlapping Spheres of Influence is used to describe how communication can be made effective in order to foster parental involvement.

The school is not an entity on its own; it has to share the same goals in respect of education with the community so that everyone in the community (the parents and the learners) can adopt school policies and programs and ensure that all school programs are implemented successfully, Even though goals can be shared, the reality of the matter is that the school and the community have independent practices and models in respect of learning (Epstein, 1987:130). Collaboration of the independent practices of the school and the community are

explained well in Epstein's Theory of the Overlapping Sphere of Influence. This Theory separates the family, the school and the community into three spheres which can be integrated, and which have learner education as a mutual interest (Lemmer & Van Wyk, 2010:190)(see figure 2.1.4).

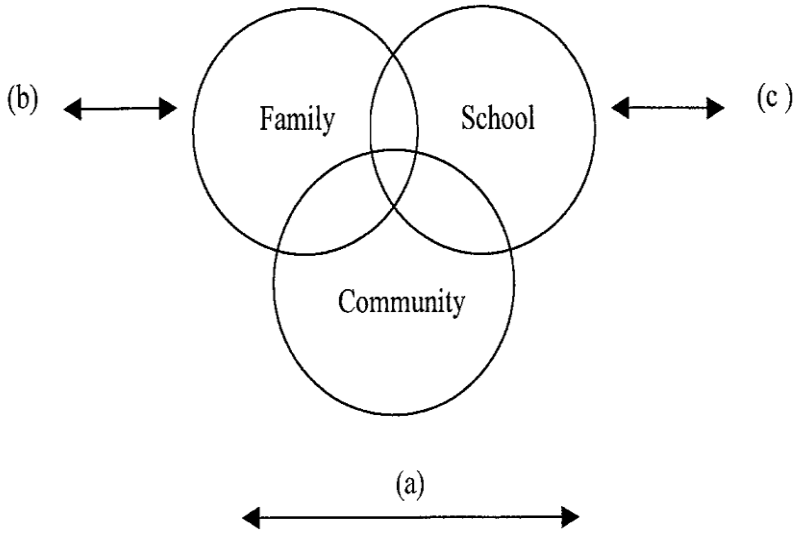

Figure 2.2: The Theory of the Overlapping Spheres of Influence

(a), (b) and (c) are the three forces that can either push the spheres together or pull them apart (Deslandes, 2001)They are (a) time; (b) characteristics, philosophies and practices of the family; and (c) characteristics, philosophies and practices of the school (Deslandes, 2001).

The Theory of the Overlapping Spheres of Influence, based on the sharing of educational goals amongst the family, the school and the community, can be applied to achieve effective communication amongst all parties involved in teaching and learning (Kavanagh, 2013:17). The Theory outlines six activities which are involved in creating a partnership between the school and the community. These activities include parenting, communication, volunteering, learning at home, decision-making and collaborating with the community (Epstein, 1996).

There are three forces that determine successful implementation of this theory namely force A, B and C shown in figure 2.2) (Deslandes, 2001). According to research, the three forces

that have been hindering an effective partnership between the school and the community are the following:

- Force A (time): Most parents work long hours and are not able to support their children in respect of their schoolwork or to attend meetings, because they leave early for work and come back late and tired (Modisaotsile, 2012:3; Makgato & Mji, 2006:264).
- Force B (characteristics, philosophies and practices of the family): Where most parents are characterized as uneducated, not familiar with the current syllabus and not proficient with the medium of instruction (Kgaffe, 2001:135; Mahomed, 2004:4; Makgato & Mji, 2006:263). Hence they cannot contribute effectively towards their children's education. They therefore distance themselves from participating, as they regard themselves as lacking in efficacy (Kavanagh, 2013:262; Makgato & Mji, 2006:263).

- Force C (characteristics, philosophies and practices of the school): The schools only reduce parental involvement to support roles and volunteering and this leads to the parents losing interest in participating in the schools' activities (Kavanagh, 2013:265; Kgaffe, 2001:137).)Where they are involved in educational roles, there are challenges, such as the lack of school policy on parental involvement (Kgaffe, 2001:136) and the lack of training on how the educators should involve the parents in the schools (Lemmer, 2007:226; Kavanagh, 2013:250).

The success of implementing this theory lies in the educators applying a new thinking approach about communication, connections and coordinated actions to be conducted with the families and the community partners of the school to help the students succeed to their full potential (Epstein & Sheldon, 2006). Effective parental involvement means that the parents will be directly involved in their children's learning, and that the community will also ensure that the school runs smoothly with minimal hindrances. In that way the school will only carry the burden of teaching, and everything else, such as learner's social problems will have been taken care of by the community.

2.3 Previous research

Poor performance in science continues to be a challenge faced internationally and also locally. It will continue to be a challenge unless the cause is discovered. The factors contributing towards the learners' poor performance in mathematics and science will be discussed below.

2.3.1 Teaching methods

The way in which a lesson is presented determines it effectiveness and the level of understanding by the learners who are being taught (Mwenda, Gitaari, Nyaga, Muthaa & Reche, 2013:95). In trying to make the pedagogy of science knowledge similar and effective across the nation, the National Research Council of the National Academy of Science in 1996 defined the standards of science teaching as follows:

i) The teachers of science guide and facilitate the learning. They should

- focus on and support learner inquiries while interacting with the learners;
- orchestrate discourse among the students about science ideas;
- challenge the students to accept and share the responsibility for their own learning;
- recognize and respond to student diversity and encourage all the students to fully participate in the learning of science;
- encourage and model skills of scientific inquiry to learners as well as the curiosity openness to new ideas and data and skepticism that characterize science (Kennedy, 1997:1).

ii) The teachers of science develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning. They should

- display and demand respect for the diverse ideas, skills and experiences of all the students;
- enable the students to have a significant voice in decisions about the content and context of their work and require from the students to take the responsibility for the learning of all the members of the community;
- nurture collaboration among the students;

structure and facilitate ongoing formal and informal discussions based on a shared understanding of the rules of scientific discourse;

- model and emphasize the skills, attitudes and values of scientific inquiry (Kennedy, 1997:2).

Years after the above standards have been set in relation to teaching science practicing of outdated teaching methods which results in passive learning which denies students a chance to develop scientific skills are still employed when teaching sciences (Makgato & Mji, 2006:254; Muzah, 2011:197). Application of outdated teaching methods contributes directly to the poor performance of learners in the science subjects (Makgato & Mji, 2006:253).

In their research findings Makgato and Mji (2006:253) argue that poor teaching methods have a direct influence on the poor performance of learners in the science subjects. The poor teaching methods are a result of the apartheid regime and also the belief that "one teaches the way one is taught" simply because even when educators use different teaching methods when they come across a challenge they teach in the way they were taught (Makgato & Mji, 2006:262). Does this mean the some lecturers use outdated teaching methods? Makgato & Mji (2006:262) then recommend that educators should, from time to time, attend refresher courses presented by different people so as to incorporate different methodologies so that the educators can learn new methods of teaching (Makgato, 2007:263).

Muzah (2011:196) agrees with Makgato and Mji (2006:253) in saying that the teaching methods used by some science teachers reduces science teaching to preparation for examinations and tests rather than enhancing the learner's abilities to explore ideas by means of hands-on activities. Muzah (2011:196) further emphasizes that science learning is still done by means of parrot learning which results in the subject being uninteresting. Muzah (2011:197) further explains that the educators are passive when teaching meaning that they do not stimulate the learners in a way that should enable them to extract knowledge from their environmental surroundings and from empirical data. Muzah (2011:201) then recommended that science should be made practical so that the learners may relate it to their daily situations.

Alternatively, findings by Mwenda et al. (2013:96) indicated that the most used teaching methods were demonstrations, followed by class discussions. Even though these methods were used the learners still performed poorly. These findings do not point to poor teaching methods as contributing to poor performance. However, recommendations by Mwenda et al (2013) are similar to those of Makgato and Mji (2006) that there should be regular seminars to equip the teachers with diverse methods of teaching (Mwenda et al, 2013:98).

2.3.2 The training of educators and their content knowledge

There exists a correlation between the teacher's content knowledge and student academic performance (SACE, 2010:23). Mwenda et al. (2013:95) and the SACE (2010:23) state that teachers play a central role in the effective dispensation of the curriculum. This requires them to be well-trained in order to dispense the curriculum effectively, this is emphasized by Spaull (2013:24), Ihejieto and Nwokedi (1993:512) and Ogbonnaya (2011:131) when they say “quality of education cannot exceed the quality of a teacher”. Research shows that learners taught by unqualified teachers or qualified teachers who do not understand the nature of science that has to be taught produce poor results (Dekkers & Mnisi, 2003:32; Ogbonnaya, 2011:130; Lebata, 2014:23).

Research also shows that there are still large numbers of under-qualified or unqualified teachers who teach science subjects (Cho, Scherman & Gaigher, 2012:167; Makgato & Mji, 2006:254; Makgato, 2007:91; Modisaotsile, 2012:2). Under-qualified teachers are not able to use the scientific equipment and therefore cannot do science practical investigations with learners because they are deficient in practical investigation skills (Muwanga-Zake, 2000:4). Muzah (2011:190) also agrees with the fact that under-qualified teachers who only studied science at standard grade in high schools and who did not specialize in science during their training lack the scientific knowledge. This level of education results in the teachers being unable to expose learners to efficient scientific content because they only teach what they know (Muzah 2011:190), Muwanga-Zake (2000:6) calls these teachers 'below-average' teachers and further stipulates that they themselves struggle in understanding science concepts. Under qualified science teachers, teach science by the use of textbooks only and cannot do practical investigations even in schools with laboratories (Muwanga-Zake, 2000:6). This nature of teaching also leads to failure in the exams because some of the content was not taught to the learners (Ogbonnaya, 2011:132) or because the teachers cannot teach the nature of science and about the nature of science. Abd-El-Khalick (2012) explains that teaching the nature of science assists both the learners and teachers in developing an understanding of how scientific knowledge is generated.

In addition to the challenge of the lack of qualified teachers, South Africa still faces a problem of qualified teachers who cannot teach their subjects. There also exists the need to define the kind of content needed by the science teachers. Researchers have been arguing about the types of content knowledge needed by the science teachers. Most of them, however, agree with the view that content knowledge and pedagogical skills go hand in hand (Sheperd, 2013:21; Kennedy, 1997:5). Turnuklu and Yesildere (2007:12), as well as Ihejieto and Nwokedi (1993:511), support the view of content knowledge being coupled with pedagogical skills in order for success in teaching. Ihejieto and Nwokedi (1993:511) further suggest that content knowledge and pedagogical skills should be included in the educator's training. Even though this has been suggested, findings by Ball, Thames and Phelps (2008:1) still show that less attention is being given in terms of teaching teachers need to understand subjects they teach. Ball et al (2008:1) categorise the content knowledge that the educators should have into four types, indicated in figure 2.3 below.

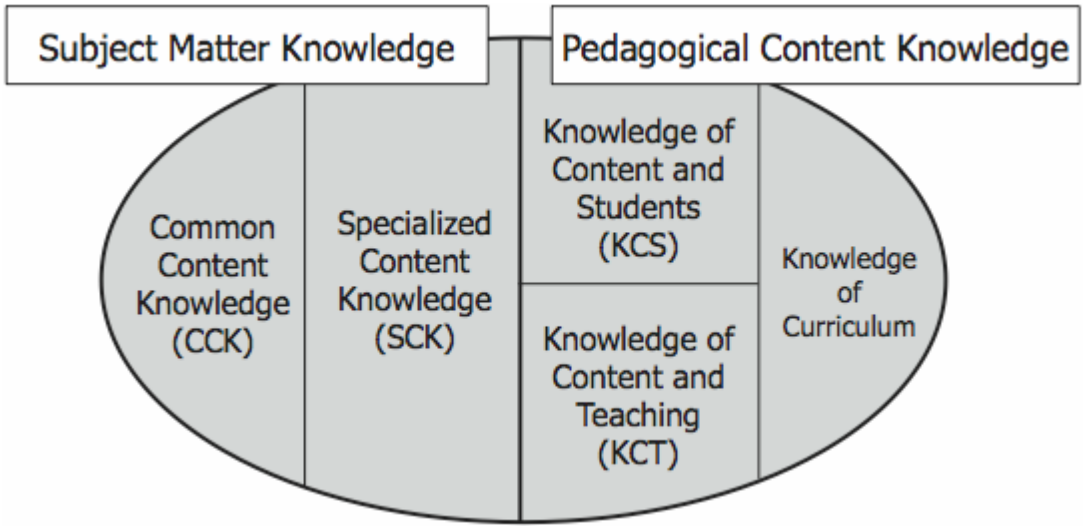

Figure 2.3: A model of Shulman's Content Category Scheme (1985) compared to Ball, Thames and Phelps (2008) scheme.

- CCK (Common Content Knowledge): This is the kind of knowledge which a teacher must have in order to teach (Ball et al. 2008:6). In terms of science this denotes terminology, scientific notation and curriculum knowledge.

- KCS (Knowledge of Content and Students): This refers to the knowledge of the content and of the students' abilities (Ball et al., 2008:6). This knowledge will assist teachers in assigning tasks that are motivating and interesting, equivalent to the learners' cognitive abilities.

- KCT (Knowledge of Content and Teaching): This refers to the knowledge that a teacher needs to be able to understand the subject and the pedagogical issues affecting them (Ball et al., 2008:9). This requires from the science teacher to be able to use the correct instructional methods according to the students' learning methods.

- SCK (Specialised Content Knowledge): This denotes knowledge beyond what is required in the curriculum (Ball et al., 2008:9). This means the science teacher should specialize in their subjects so as to be able to explain content that is beyond the curriculum when the need arises.

2.3.3 Resources

The challenge of a lack of resources in schools is a matter of concern worldwide. The lack of resources, such as textbooks, physical infrastructure and laboratory equipment has led to the learners losing interest in the subject, and hence poor performance (Mwenda et al., 2013:98; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013:105; Mwaba, 2011:33). The above statement is supported by the findings of Onwu (1999) where he compared schools with resources with schools with no resources, and found that schools that lacked resources performed poorly. The lack of resources leads to a failure to enhance effective learning, as the subject then only remains taught in theory (Makgato, 2007:91; Dhurumraj, 2013:51). It also limits written work as the teachers cannot give homework because the learners share books (Onwu, 1999). Muzah (2011:192), Makgato (2007:96), and Dhurumraj (2013) believe that the availability of practical lessons clarifies and reinforces scientific concepts. It further enhances the learner's interest in science, increases their manipulative skills and memory of the content, makes the subject relevant, helps learners to acquire skills, it promotes discipline, and also assists them in solving problems.

However, the subject remains to be teacher-centered, and instructed in a talk-and-chalk method which bores and demotivates the students (Onwu, 1999; Lebata, 2014:80). Therefore, research indicates that for the effective teaching and learning of science adequate and relevant resources need to be available, as they make up an essential component (Dhurumraj, 2013:49). Yara and Otieno (2010:126) indicate that the availability of teaching resources enhances the effectiveness of the schools as they can bring about good academic performance in the students.

2.3.4 Medium of instruction

Science is a subject that requires one to grasp the concepts and to be able to communicate them in writing. Science also requires from one to be able to analyse data from diagrams and to communicate them in words, and also to know the theories and be able to apply them (Hlabane, 2014:25). It is clear that this subject requires from one to be able to read, write and communicate (Hlabane, 2014:25; Quinn, Lee & Valdes, 2012).

This has been a challenge to second language learners as they are not proficient in English, which is the medium of instruction (Setati, 2011:2; Zisanhi, 2013). The lack of proficiency in the medium of instruction results in the learners developing anxiety and a negative attitude towards people who speak the language; in this case it is the teachers (Zisanhi, 2013). A negative attitude towards the teacher will affect the learner's performance as they will be resistant to what the teacher teaches. The lack of proficiency in English also results in the learners being unable to communicate their ideas (Setati, 2011:26; Hlabane, 2014:14). It is imperative for the learners to understand the medium of instruction because they are expected to read the texts and be able to analyse and come to conclusions (Quinn et al., 2012; Hlabane, 2014:1). They can only do this if they understand the medium of instruction. The lack of proficiency in English also leads to poor performance because the learners have to understand the concepts in order to apply them in solving problems (Hlabane, 2014:22). The learners are also examined in English, and if they cannot understand the question they cannot give the correct answer (Setati, 2011:31; Lebata, 2014:24; Hlabane, 2014:32). This indicates the important role played by language in learning (Ferreira, 2011:102).

Spurlin (1995) and Ferreira (2011) state that some science learners have difficulty in understanding the language of instruction. They are, however, tested in that language, and the text books are written in that language, which makes it even more difficult for the learner to study at home language, discourages them. Spurlin (1995) also ascertained that science language on its own should be taught and tested. The learners should not be scared off by the scientific terms and once they are used to science language. Spurlin (1995) suggests that students will be able to understand the science language and do well.

Even though research suggests that proficiency in the medium of instruction results in good academic performance (Spurlin, 1995), Setati (2011:3) and Hlabane (2014:2) disagree with this finding by saying that science is a language on its own and a learner need to be proficient in both science terminology and English the medium of intsruction in order to succeed academically.

The use of other official languages cannot be considered as a solution to the difficulty students face in understanding the medium of instruction because they cannot express most science terms (Hlabane, 2014:75). It may also lead to the misinterpretation of a word, e.g., gas and air are "umoya" in Zulu. How can one distinguish between the two or how can one express O_2 in Zulu.? This example clarifies that even though code switching is suggested to assist second language learners (Hlabane, 2014:3; Setati, 2011:3), there are some words that cannot be expressed. This also shows that science terms and English should be taught to learners so that they are able to express themselves and are able to analyse scientific information because there is no other way to teach it other than in English in order for them to succeed academically.

2.3.5 Absenteeism

Absenteeism or being absent means not being in a particular place at a particular time as expected (Ejere, 2010:11). Weideman, Goga, Lopez, Mayet, Macun and Barry (2007:65) define *absenteeism* as being absent for the entire day, or being absent for part of the day (Weideman et al., 2007:65). When addressing the issue of absenteeism, it is imperative to look at both the teacher and the learner absenteeism, because learning involves both a learner and a teacher. Therefore, absenteeism of teachers affects the performance of learners(Ejere, 2010:115; Kgaffe, 2001:78; Finlayson, 2009:5).

Weideman et al. (2007:4) categorise the causes of absenteeism into the following three, namely

- personal factors: illness, age, gender and learning difficulties;
- socio-economic factors: food insecurity, transport problems, the impact of HIV and AIDS, teenage pregnancy and child labor;
- school factors: poor learner-educator relationships, poor school facilities.

The causes of absenteeism mentioned above apply to both the teachers and the learners and varies according to the individual. No matter the nature of the cause, absenteeism negatively affects the learners' performances. Mwenda et al., 2013; Amukowa, 293:97 regard the chronic absenteeism of the learners as a factor that results in the reduction of the learner's learning time, and they are therefore unable to pass the grade, as they lack the knowledge of what was taught during their absence (Muzah, 2011:200; Cho et al., 2012:169; Kgaffe 2001:79; Finlayson, 2009:5). The absenteeism of a teacher from school or class may be the cause of the learner's poor performance, as they do not cover the syllabus, they do not honor due dates, and do not give remedial teaching in respect of poor performance (Lebata, 2014:78). The teacher's absenteeism also damages his or her credibility (Lebata, 2014). Consistent absenteeism of the teachers may also increase the learner's absenteeism as they believe that when a teacher is absent no learning will take place (Lebata, 2014). The teacher's absenteeism results in their not marking the learner's work. This may demotivate the learners, and their demotivation in turn, may affect their academic performance.

2.3.6 Parental involvement

Research indicates that the parent's involvement in teaching and learning plays an important role in their children's academic performance (Dhurumraj, 2013:54; Makgato & Mji, 2006:262; Sanders & Epstein, 1998:33), in their self-esteem, school attendance and social behavior (Lemmer, 2007:218).

Research also indicates that the role of the parents in schools has been practiced (Lemmer, 2007:218), however, there are challenges because the parents are only involved in support roles and volunteering. They are not involved in activities related to teaching and learning of their children (Lemmer, 2007:218; Kavanagh, 2013:265; Kgaffe, 2001:137) hence the poor performance. Lemmer, (2007:218) Researchers indicate that the gap of parental involvement is caused by different perceptions of parental involvement, and also by the fact that teachers have not been trained to how to involve the parents in supporting their children's learning (Kgaffe, 2001:129; Kavanagh, 2013:250; Lemmer, 2007: 226).

Even though the parent's involvement may be viewed differently by different individuals but in this research the definition by Modisaotsile (2012:3) will be used, which defines it as an activity where the parents are full supportive on their children's education, not only in assisting with homework but also in motivating their children to participate in extramural activities, guiding them in respect of social interactions around others and ensuring that their child is at school on time and at their best behavior.

Such activities of parental involvement mentioned by Modisaotsile (2012:3) can assist a child in succeeding academically. In addition to the roles mentioned by Modisaotsile (2013:3) the parents should be involved in policy issues in the form of membership of the School Governing Bodies. However, their involvement in school governing structures in most cases is just an obligatory exercise without contribution because parents are not trained in respect of education policies (Modisaotsile, 2012:4; Kgaffe, 2001:131).

At times the parents consider themselves not to be efficacious in being involved in their children's education because they do not know most of the current syllabus and some have a challenge in using the medium of instruction (Mahomed, 2004:4; Kavanagh, 2013:262). Another issue, especially in the rural areas, is that most children are in the care of grandparents who are old and cannot participate in school activities (Kgaffe, 2001:135).

Fostering a healthy and active relationship between the school and the parents can lead to parents striving for the goal of quality education for their children (Lemmer, 2007:218; Sanders & Epstein, 1998:33).

2.3.7 Large classes

It is a reality that many schools in South Africa still face the challenge of large classes (Yara & Otieno, 2010:127). According to South African education Post Provision Norm policy stated by the Education Labour Relations Council in Resolution 4 of 1995 the ratio

of teacher to learners is 1:40. Large classes are those consisting of more than 45 learners. Research has identified numerous challenges faced by teachers in large classes and which have a negative impact on teaching and learning, and therefore affecting the learner's performance.

According to research findings, large classes force the teachers to make use of a teacher-centered teaching approach since letting students lead teaching and learning becomes impossible because of the fact that the teacher cannot attend to each learner individually (Akinsolu & Fadokun, 2009; Setati, 2011:96; Yelkpieri, Namale, Esia-Donkoh & Ofosu-Dwamena, 2012:327; Mwenda et al., 2013:97; Dhurumraj, 2013:62). This means that science cannot be taught well in large classes because it is a subject that requires a constructivist approach and that also requires an individual student to be fully interactive with the learning material assisted by a teacher. Research also indicates that practical investigations are hard to do in large classes (Akinsolu & Fadokun, 2009). This may be due to the lack of adequate science material and space to accommodate the learners (Yelkpieri et al., 2012:327; Bakasa, 2011:79; Dhurumraj, 2013:62; Cho et al., 2012:170).

Students in large classes are disadvantaged. Those who sit at the back often cannot hear the teacher (Yelkpieri et al., 2012:327) and quiet students are neglected (Akinsolu & Fadokun, 2009). The quiet students cannot concentrate as there are many disruptions (Bakasa, 2011:79; Yelkpieri et al., 2012:326). These things result in student teachers being demotivated to teach, especially science subjects which require a lot of attention from the learners.

Mathematics and science requires a lot of practicing. This means that there should be a lot of written work that is assessed and remedial measures to the assessed work to be provided if the learners have problems. However, this type of assessment becomes a problem in large classes because thee teachers have a high workload and cannot regularly assess the learners (Yelkpieri et al., 2012:326; Akinsolu & Fadokun, 2009), nor give constructive feedback on

time (Yara & Otieno, 2010:127). The delay in feedback results in the learners not knowing where they have problems. It affects knowledge of the work already done. This means that the learners proceed to the next section of the work without meeting the outcomes of the work done previously.

In large classes the teacher is unable to focus on individual differences (Yelkpieri et al., 2012:327). This means that the section in the CAPS document that requires inclusivity and indigenous knowledge cannot be adhered to, and this can disadvantage the slow learners and minimize the chance for learners to associate science with their individual cultures.

2.3.8 Poverty

Poverty is defined by Lacour and Tissington (2011:522) as, "the extent to which an individual does without resources, resources being financial, emotional, spiritual, physical resources, support systems, relationships, role models and knowledge of hidden rules". Research shows that poverty is a contributing factor towards the academic achievement of the learner.

Chinyoka and Naidu (2014:223) are of the opinion that the home environment has an impact on the academic performance of the child because the home is where the child receives his initial education and socialization. Findings by Unity, Osagiobare and Edith (2013:152) indicate that children from poor families lack cognitive competence simply because they did not get early education, and this leads to a low vocabulary, IQ, and social skills.

Research aligned with the definition of poverty by Lacour and Tissington (2011) shows that the lack of the resources contributes towards poor academic performance. Spaull (2013:16), Chinyoka and Naidu (2014:223) and Unity et al. (2013:151) concur with the view that educational/academic achievement is indeed affected by socio-economic status

or poverty. This also aligns with lack resources as defined by Lacour and Tissington (2011). Research indicates that poor parents often received little or no education (Chinyoka & Naidu, 2014:223). This results in them being unable to assist their children with their schoolwork. Research also shows that the homes of the poor are often overcrowded with children of different sexes sharing a room. The learners often do not having adequate space to study or to do homework, nor interact with their peers at home in respect of schoolwork (Chinyoka & Naidu, 2014:228; Wadesango, Chabaya, Rembe & Muhuro, 2011:150). These conditions result in poor academic performance because in these conditions the learner does not do his/her homework or tasks, and cannot study.

Other research findings indicate that children from poor families face emotional trauma because there is a lack of emotional nurturing. Therefore they feel alienated from other people, inadequate, depressed, and they often suffer from anxiety. This can result in aggressive behavior or social withdrawal, which can affect their academic achievement (Unity et al., 2013:152). Learners from poor families are also faced with many chores (Chinyoka & Naidu, 2014:228; Yara & Otieno, 2010:128). This leaves them tired with little or no time to study, hence contributing towards poor performance, especially in mathematics and science, which needs a lot of practise. Learners from poor families may also be faced with a lot of movement from one town to another due to their parents looking for jobs and this affects the learning of the child because every time they move it means they have to adapt to new settings and teaching methods (Chinyoka & Naidu, 2014:230).

Students from poor families lack proper sanitation. This may affect female learners in a sense that during their periods they are unable to attend school. This means there will be a consistent absence, hence poor performance. Research also indicates that learners from poor families have emotional instability because during infancy they did not get raised in a manner that builds emotional and social stability. Hence their ability to build social skills with other children is affected. This, in turn, affects their academic achievement, because such learners are easily frustrated and this leads to them being unable to complete challenging tasks or to work with their peers (Unity et al., 2013:153). Learners from poor

families are prone to acute and chronic stress. This affects the development of their brains and also their academic achievement (Unity et al., 2013:156).

Learners from poor families are also faced with health and safety issues. This leads to school absences, tardiness, illness in class, and undiagnosed or untreated health problems (Unity et al., 2013:157). This can affect their performances since they spend most of the time away from school. Research findings also point to the absence of parental supervision. Children-led or grandparents-led families are an occurrence in poor families, and this results in the learners not having an elder supervising them (Wadesango et al., 2011:151). The learners from these kinds of families end up being involved in criminal and drug activities. This leads to absence from school or negative behavior towards teachers and peers. Poor performance can also be a result.

The findings of research also imply that students from poor homes are more likely to perform poorly in science subjects (Villanueva, 2010:23; Howie, 2003:10). This is because they cannot afford learning aids such as extra classes and extra textbooks other than those provided by the school (Dhurumraj, 2013:62; Amukowa, 2013:97). They are also faced with many chores after school hours, and thus cannot concentrate on their studies (Amukowa, 2013:97).

2.3.9 The motivation of the teachers

Woolfolk (2013:430) defines *motivation* as "an internal state that arouses, directs and maintains behavior". Motivation can be divided into intrinsic or extrinsic motivation (Woolfolk, 2013:430); extrinsic motivation being motivation caused by external factors other than the task at hand, e.g., punishment, rewards, etc. (Woolfolk, 2013:430); with intrinsic motivation being motivation caused by interest in the task at hand (Woolfolk, 2013:430). Research shows that teacher motivation is very important towards the academic achievement of a learner, as it motivates the learners because a motivated teacher has a passion for his/her job (Mart, 2013:438; Chux, Saphetha, Henrie & Robertson, 2013:838;

Makgato, 2007:99). Tsanwani et al. (2014:48) agree with this when they say that in order for learners to succeed in science they should be motivated and interested in what they do, and the environment in which teaching and learning take place should be conducive to learning.

However, research indicates that the motivation of the teacher is still a challenge worldwide (Vassallo, 2014:105; Mbajiorgu, Oguttu, Maake, Heeralal, Ngoepe, Masafu & Kaino, 2014:139; Basson & Kriek, 2012:116; Modisaotsile, 2012:2). Educator motivation is influenced by various factors. The model below (figure 2.4) lists the different factors contributing towards teacher motivation.

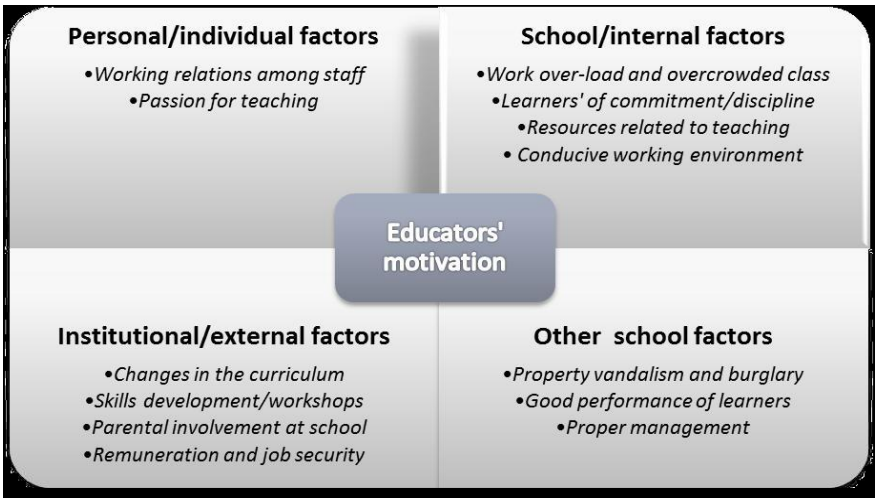

Figure 2.4: A model of factors influencing the teachers' motivation

The factors above are divided into individual, internal, institutional and other school factors. They will be discussed here in relation to science subjects and science teachers. They will not be discussed individually as they overlap.

Research shows that passion for teaching is a motivational factor and results in the teacher being dedicated to his or her schoolwork, and hence producing good marks (Mart, 2013:437). Science subjects need a lot of passion on behalf of the teachers as they should

take their time in guiding the learners through the challenging concepts of science which are seen as difficult, boring and irrelevant. They should make them interesting (Lebata, 2014:80). However, science educators have often lost their passion for the subject due to conditions which may be, for example, the lack of growth opportunities in the education sector, low salaries, poor working conditions, work overload, cultural barriers, the lack of recognition, communication barriers with learners, the lack of mutual cooperation (Chux et al., 2013:848; Mbajiorgu et al., 2014:139; Vassallo, 2014:105; Muzah, 2011:199). The abovementioned challenges lead to teachers being dissatisfied with their jobs and this can lead to a high rate of absenteeism, an increase in emotional disorders, and in leaving the profession (Vassallo, 2014:105). This can affect teaching and learning because when a teacher is absent the learners fall behind with their work, and when the teachers leave the profession there will be shortage of science teachers. This can result in the learners losing interest in the subject, and hence performing poorly.

2.4 Conclusion

In the next chapter the researcher will discuss the research design, the methodology and the data-collection which outlines the methods used to collect and analyse the data. The chapter will also describe the sample and explain how the sample will be chosen.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

A *research design* is a framework or structure according to which research will be done in such a way that relevant information is collected using the minimum money and time (Kumar, 2002:37).

In this chapter the researcher will discuss the research design, the method of data-collection, the sampling method, the research tools, the method of data-analysis and ethical considerations. The research methods and the research design were used to answer the research question: What are the factors that cause poor performances in science subjects at Ingwavuma circuit?

3.2 The research design

In this study the researcher's aim was to describe the phenomena (the factors causing poor performance) from more than one viewpoint and to provide information from a large number of subjects (four underperforming schools in the Ingwavuma Circuit) and this required the study not to go into depth in respect of the issue at hand. The mixed methods research design was considered relevant for this study. A mixed methods design integrates qualitative and quantitative data-collection and analysis in a single study (Creswell, 2003; McMillan & Schumacher, 2010:25). Concurrent triangulation method was used, in this method both qualitative and quantitative data are equally important. In this method mixing occurs during the discussion of results (Creswell 2008). The researcher chose the mixed method design because the method of collecting data both qualitatively and quantitatively increases the validity of results (Creswell 2008).

Quantitative research is the type of research method that uses objectivity in measuring and describing a phenomenon. It also reaches many people, and contacting them is easier (McMillan & Schumacher, 2010:21; Dawson, 2002:15). Quantitative research can be experimental which entails the manipulation of variables, or non-experimental where there is no manipulation of the conditions (McMillan & Schumacher, 2010:22; Hopkins, 2008:12-21).

Qualitative research gathers data by using less specific questions which probe for a deeper understanding of a certain phenomenon. This type of research has no predictions or expected results (McMillan & Schumacher, 2010:64). Qualitative research includes:

- Ethnography, which describes and interprets a cultural or social group within its natural setting. In this research data are collected through prolonged field-work which may involve the observation of the participants, interviewing the participants or collecting group artifacts (McMillan & Schumacher, 2010:23).
- Phenomenology, whereby the researcher collects data by interviewing participants about their perceptions and interpretations about a certain experience (Creswell, 2003).
- Case study: The data are collected within a single setting over time and in depth (McMillan & Schumacher, 2010:24).
- Grounded theory: The researcher gathers data by conducting a number of interviews with the aim of forming a theoretical idea or to examine a phenomenon in relation to an existing theory. This research is focused on a society or social institution and uses multiple stages of data-collection which may be revised as new categories emerge (Creswell, 2003).

The mixed methods design uses three models, which are:

- Explanatory: Here the quantitative data are collected first. After the analysis of its results then qualitative data are collected to further explore the quantitative results, using a few individuals (Creswell, 2003).

- Exploratory: Whereby the qualitative data are collected first from a few individuals. From its results a theme, idea, perspective or belief is built in order to design a quantitative study (Creswell, 2003).
- Triangulation: In this study, both qualitative and quantitative data were gathered simultaneously. This method gave qualitative and quantitative data equal priority. He data were then integrated to provide a comprehensive understanding of the problem at hand. Hence this method increases the validity and credibility of the results, more especially when both the qualitative and quantitative results match (Creswell, 2003).

In this study the researcher collected the quantitative data using questionnaires, and the qualitative data by means of interviews (Creswell, 2003), methods where there were no manipulation of the conditions (McMillan & Schumacher, 2010:22; Hopkins, 2008:12-21). The researcher gathered information from the teachers and the learners at the schools without manipulating their setting.

The non-experimental method is divided into six types, namely descriptive, comparative, correlational, survey, ex post facto and secondary data-analysis (McMillan & Schumacher, 2010:23). The researcher made use of the survey method, which is described as a scientific method that collects information from a large population for purposes of description, exploration and explanation (McMillan & Schumacher, 2010:23; Livingstone, 2005:61).

3.3 Methods of data-collection

The tools that were used in this research were closed-ended questionnaires which were given to 8 Grade 12 science teachers (Appendix J) and to 98 Grade 12 science learners (Appendix K) in the four schools that participated in the research. Structured interviews were conducted with 3 teachers who taught Physical science or Life science in Grade 12 (Appendix H), and a sample of 8 Grade 12 learners (Appendix I).

3.3.1 Questionnaires

A *questionnaire* is a tool for collecting information which is made up of a set of written questions or pictures that requires a response given in various options (McMillan & Schumacher, 2010:195; Kumar, 2002:72; Wellington, 2015:110; Opie, 2004:25). Questionnaires can consist of closed-ended, open-ended or both (Dawson, 2002:30).

According to Dawson (2002:31), open-ended questionnaires are used in qualitative research and closed-ended questionnaires are used in quantitative research. Closed-ended questionnaires follow a format which has prescribed answers and are prepared in advance (Dawson, 2002:31; Pathak, 2008:111).

A closed-ended questionnaire has disadvantages and advantages. The advantages are that it saves time because it is easily administered and the answers are recorded quickly. It is easy to code; the respondents answer similar questions and all the questions have to be answered. The disadvantages include that no new issues are dealt with, and the respondents cannot voice their own opinions (Dawson, 2002:88; Pathak, 2008:111).

Since this research was done at five different schools and there was a large number of subjects, therefore a structured closed-ended questionnaire was selected by the researcher to gather information. It is cost-effective. It is easier to gather standardized information from large groups who are spread across a wide geographical location. A close-ended questionnaire is easy to understand, it is easy to analyse the results quantitatively, and it is easy to report the results. It gathers honest information from the respondents, and enough time was given to the respondents to interact with the questions (McMillan & Schumacher, 2010:195; Pathak, 2008:109). The researcher delivered the questionnaires by hand to the identified schools. This is called ‘face-to-face’ delivery. This method was chosen because it allows for information in respect of the questionnaires to be clarified to the teachers and learners before they complete the questionnaire. The face-to-face delivery resulted in a high response rate (Wallen & Fraenkel, 2011:81).

3.3.2 Interviews

An interview is an interaction between two or more people for purposes of exchanging information through a series of questions and answers (Bryant, 2011; Kumar, 2002:72). Interviews can be structured, semi-structured or unstructured (Dawson, 2002:26):

- Structured interviews: In this type of interview the researcher prepares questions beforehand, and they are arranged and asked in a particular order (Dawson 2002). Identical questions are asked for each individual, and the researcher does not probe the participants but only clarifies instructions (Taylor & Bogdan. 1998).
- Semi-structured interviews: This is a type of interview where the researcher compares and contrasts specific information with information that was gained by means of other interviews. The interview uses an interview schedule with topics or questions to be discussed. However, the order in which the questions are asked is not fixed but is determined by the conversation between the researcher and the participant (Dawson, 2002; Woods, 2011).This type if interview makes use of flexible questions. The role of the researcher is to probe the participants for more information (Taylor & Bogdan, 1998).

- Unstructured interviews: Are also called 'in-depth' or 'life history' interviews. These interviews seek to discover an understanding of the participants' viewpoints about a certain situation. In these interviews the participants are free to talk about their experiences without being given direction by the researcher. The only time where the researcher guides the participants is when they are talking about issues that are irrelevant to the topic (Dawson, 2002; Taylor & Bogdan, 1998).

Structured interviews were selected for this research because they made it easier to replicate discussions and to get standardized views on the topic. It was easy to simplify the findings. The interviews were recorded rather than relying on written notes, as recorded

information proved to be more reliable and allowed the researcher to properly analyse it at a later stage (Patton, 1990:348; Dawson, 2002:66).

According to McNamara (1999), interviews are used to get the story behind a participants experience and to get in-depth information about the topic. Woods (2011) agrees with this by stating that a lot of relevant information about people's experiences are collected by directly questioning or talking to them. Only a small number of individuals were interviewed about the same topic so as to get more viewpoints about the questions that needed further explanation. The interviews were conducted simultaneously with the issuing of the questionnaires. The researcher conducted interviews with teachers (Appendix H) and learners (Appendix I). The teacher interview consisted of 16 questions while the learner interview had 10 questions.

Interviews were conducted in English in a classroom in the school; the teachers and the learners were interviewed separately. After each interview the researcher listened to the tape recording and transcribed the whole interview which was then typed and stored on the computer for long-term storage and for accessibility.

3.4 Sampling methods

Merriam (2002) defines *sampling* as the selection of a research site, time, people or events in field research. The number of participants in a sample depends on the questions being asked, the data being gathered, and the analysis and resources available to support the study (Merriam, 2002; Dawson, 2002:46)

Although there are many sampling methods, purposeful sampling was chosen. Purposeful sampling is a sampling method that involves selecting subjects with the required characteristics, being those that the researcher can get the most relevant information from (McMillan &

Schumacher, 2010:326; Dawson, 2002:49). The table below, derived from Patton (1990:169-186) and Patton (2001), defines the 16 types of purposeful sampling.

Table 3.1: Types and definitions of purposeful sampling

Type	Definition
Random sampling	The researcher chooses participants or subjects without taking into consideration the features of the locality or the context.
Convenience sampling	The researcher chooses participants or subjects based on their being easily accessible, and because of and economic considerations.
Maximum variation sampling	The researcher chooses varied participants or subjects with a certain aim. The variation dimension is directed by the researcher's interest in the topic.
Homogenous sampling	The researcher selects participants or subjects that are similar without any variation in form.
Critical case sampling	The researcher chooses important cases not based on quantity but based on the quality of information they have in respect of the topic.
Theory-based or theoretical sampling	The researcher chooses to research a certain phenomenon being driven by the existing theory with the aim of discovering more about the theory.
Confirming and Unconfirming cases	Research is done by comparing the data that has already been collected and analysed, with an aim of confirming or rejecting it.

Extreme or deviant cases	The researcher directs the research based on unusual manifestations of the phenomena. They can either be extremely good or extremely bad.
Typical cases	The researcher directs research towards usual phenomena.
Intensity sampling	The researcher chooses cases based on how they intensify the topic of interest.
Politically important cases	The research is directed on phenomena from political sites.
Purposeful random sampling	The researcher chooses the subjects or the participants systematically based on the topic of interest in order to enhance credibility
Stratified purposeful or quota sampling	The researcher chooses participants or subjects based on the different levels or dimension of the topic of interest so as to compare the differences.
Criterion sampling	The researcher chooses participants or subjects based on certain criteria.
Opportunistic or emergent sampling	The researcher decides on the method of sampling during the data-collection based on the knowledge gained while in the field.
Snowball or chain sampling	The researcher identifies or uses people with the required information about the topic of interest.

The advantage of purposeful sampling includes that participants who are relevant to the study are selected, therefore reducing costs and saving time. It also allows for the collection of reliable and robust data (Tongco, 2007).

This research applied criterion sampling using the criteria of poor matric science results because the research wanted to investigate the factors that caused poor performance in science subjects. The sample was therefore chosen using poor performance in matric specifically using grade 12 science teachers and grade 12 science learners. This sampling method was chosen because it allowed the researcher to use a particular subject of respondents that gave information that was relevant to the topic. This was done by selecting the last five Ingwavuma Circuit schools that have underperformed in the science subjects in the matric results of 2014 however only 4 participated. All the Grade 12 science teachers (Physical sciences and Life sciences) in each of the four participating schools were given the questionnaires. One Physical sciences teacher and one Life sciences teacher were to be interviewed in each participating school. Amongst the criteria that were used to select the teachers to be interviewed in the schools with more than two Grade 12 science teachers were that these teachers should have taught the subject for 4 years or more the reason behind the experience was to get more insight on the topic from teachers with expertise, this resulted in only 3 teachers being interviewed as most of the teachers in most schools had an experience that was less than 4 years.

3.5 Data-analysis

Data-analysis is a way that the researcher makes meaning of the data collected (Zar, 1984). In this research the data were collected both quantitatively and qualitatively. Zar (1984) emphasizes the importance of excluding biasness from the research.

The quantitative data were collected by means of questionnaires. The data were analysed using SPSS. The responses from the questionnaire were studied and categorized into themes and then to variables. The teacher's questionnaire and the learner's questionnaire were analysed separately. The data belonging to each variable were then recorded and summarized using descriptive statistics. Descriptive statistics summarise data and makes

clear of any trends and patterns from the data (Jaggi 2003). The type of descriptive statistic used in this research was frequency distribution which is defined as an organised visual representation of the number of individuals per category or scale of measurement (Manikandan 2011). This research used frequency distribution because it gave a clear picture of how individual responses from each category of the questionnaire were distributed it further simplified the information in forms of graphs and tables which made it easier to see the patterns and trends derived from a lot of respondents. The tables and graphs from the descriptive statistics were then interpreted using literature review, existing knowledge and expertise about the topic.

The qualitative data were collected by means of interviews. This data were analysed manually. The analysis of the qualitative data was with a view to understanding the participant's experience (Thomas, 2003; McMillan & Schumacher, 2010). The researcher transcribed the information collected from the interviews. These transcripts were then read and important categories were identified; and data were sorted and grouped according to similar concepts - this was done to separate the data into workable units (McMillan & Schumacher, 2010; Thomas, 2003). The data were then scrutinized to find how one concept influenced another, and alternative explanations were searched for. This was done by describing the responses from the respondents. Patterns were sought from this (Thomas, 2003) and were then interpreted. The findings were then reported. Since this was a method of triangulation both the qualitative and quantitative analyses were reported on simultaneously.

3.6 Methodology

The researcher wrote a letter to the Head of the KwaZulu Natal Department of Education requesting permission to conduct research at the four chosen schools. After receiving permission the following steps were followed:

- the pilot-testing of the questionnaire was done using 10 grade 12 science from one of the four chosen schools and 5 grade12 science educators from 3 of the four chosen schools. During the pilot testing the researcher observed and asked where the individuals

experienced problems. This resulted in addition of some questions ,rephrasing of some questions and correction of grammar.

- The questionnaire was then submitted to the ethics team of UNISA , once it was approved it was duplicated and then taken to participating schools by the researcher. Questionnaires were answered by learners and teachers during extra mural activity time in the presence of the researcher. The presence of the researcher ensured that clarifies were given where needed and also ensured that all questionnaires were collected. The length of the questionnaires was 30 minutes.
- The educators and learners that were selected for interviews were informed about the dates and time for the interviews. Each interview took 30 minutes. Interviews were conducted by the researcher with each individual.
- After conducting all the interviews the information that was gathered was analysed using SPSS for questionnaire responses and data coding for interviews. Data from interviews and questionnaires were analysed separately and then integrated during discussion of the results.
- The results were communicated to the department and university in a form of a dissertation.

3.7 Issues of reliability and validity

Validity in research ensures that the researcher and the participant understand each other in a way that relevant information will be presented (McMillan & Schumacher, 2010:330; Singh, 2007:77). In other words, does the research the gather relevant information? This meant that the researcher had to use appropriate tools that were going to enable relevant information to be gathered, this also meant that the tools chosen should be well understood by the participants.

Reliability and validity was ensured in the research by structuring the questions in an unambiguous manner and in the language that the participants understood (McMillan &

Schumacher, 2010:331). This meant the tools (questionnaire and interview questions) were designed and then checked by local experts who included grade 12 science teachers and then sent to the supervisor to check on its relevancy to answer the research question.

The research questionnaire and interview questions were validated by being checked in terms of relevancy to answer the question by experts, namely the supervisor. The questionnaire and interview questions were then submitted to the ethical clearance committee of UNISA. After ethical clearance of the research questionnaire and interview questions a pilot test was also done by the researcher. Pilot-testing is a method used to check if the research questionnaire and interview questions measures what it is supposed to measure and to check if the questions and overall layout is understandable and interpreted in the same manner by all the participants (McMillan & Schumacher, 2010). For the pilot-testing, ten students and five teachers from the sample were chosen to answer the questionnaires and interviews questions. The researcher then gathered the information on where the participants misunderstood the questions and then made amendments to the questionnaire and interview questions.

3.8 Ethical considerations

It is very important to abide by the research ethics (McMillan & Schumacher, 2010:338; Wallen et al., 2011:23; Opie, 2004:25). Credible research is done with permission of all relevant participants protects the participants, adheres to the privacy and confidentiality of the participants, and also takes care of the wellbeing of participants (McMillan & Schumacher, 2010:338, Wallen et al., 2011:23).

Ethical consideration was ensured by obtaining permission from the Department of Education and the District attached in Appendix A. After receiving permission which is attached as Appendix F, letters were sent to the identified schools to make them aware of the research that was going to be conducted. The schools were ensured that they were going to be kept anonymous and that the research was not going to disturb their normal teaching

and learning proceedings. Consent (Appendix B) and assent forms (Appendix C and Appendix D) were handed to the learners and the teachers (Appendix E) in order to gain their permission in respect of the research (McMillan & Schumacher, 2010:48; Wallen et al., 2011:23).Where learners were younger than 18 a letter of consent was written to their parents/ guardians in order to gain permission.

3.9. Conclusion

This chapter described the research and explained why it was chosen, sampling methods used in the study were also discussed in detail. The chapter further described the data-collection instruments and the rationale behind their selection. The researcher also described the methodology she was going to follow to gather and analyse data. The chapter also clarified how validity and reliability was ensured and also explained how the ethical considerations were adhered to during the collection of the data.

In the next chapter the researcher will present the results, an analysis of the results and the conclusions.

CHAPTER 4

PRESENTATION AND ANALYSIS OF THE RESULTS, AND CONCLUSIONS

4.1 Introduction

The purpose of this study was to investigate factors that cause the poor performance in science subjects of learners in the Ingwavuma Circuit. The study made use of a mixed methods design to determine the factors that cause the learners' poor performance in the science subjects.

In this chapter the researcher reports on the presentation, and analysis of the data, and the conclusions. It contains the responses from the teachers and the learners on what they perceived as the contributing factors to the poor performance. The responses are contained in the teacher's and the learner's questionnaires, and from the interviews with them. The data presentation will be done in two sections, section A for the questionnaires and section B for the interviews.

SECTION A:

4.2 Introduction

A questionnaire (see Appendix K) was given to the learners and was self-administered. Their responses were analysed statistically and presented in a form of bar graphs or tables. For the tabling of the results the respondents were asked to respond with 'yes/no', and some other tables in appendix K required from the learners to indicate their responses by means of 'strongly disagree', 'disagree', 'neither disagree nor agree', 'agree' or 'strongly agree'. 'Strongly disagree' and 'disagree' were grouped as negative responses while 'agree' and 'strongly agree' were grouped as positive responses. The results were presented using descriptive statistics.

The questionnaire (Appendix K) was divided into five categories. These categories included sections on biographical background, socio-economic background, learning, teaching and school activities, school resources, infrastructure and class size, and attitudes and beliefs.

Ninety (98) questionnaires were distributed to Grade 12 science learners who were doing both physical sciences and life sciences and 98 were returned. The physical science and life science classes had the following number of learners 25 learners in school A, 18 learners in school B, 12 learners in school C and 43 Learners in school D. It was possible to get a 100% return rate because the researcher was present during the completion of the questionnaires and ensured that all the questionnaires were collected from all participants after completion. All the learners responded, but some questions were not answered, even though clarification was given where they did not understand. Due to ethical considerations the researcher could not force the participants to answer the questions they did not feel comfortable to answer.

4.3 Biographical background of the Grade 12 science learners

This section provided information about the learner's backgrounds. The learner's backgrounds were investigated in order to ascertain if their backgrounds had an impact on their learning in one way or another (see section A of appendix K). Eight (8) aspects were included in this section, namely gender, age group, the learners being parents or not, the learners having parents or not, the guardians of the learners, the number of people sharing the home with the learner, the distance from the home to the school, and the mode of transport used by the learners to get to school. The results on the biographical background of the learners are presented in table 4.1.

Table 4.1: Biographical background of the Grade 12 Science learners

VARIABLE	COUNT	%

Gender		
Girl	53	54.1
Boy	45	45.9
Total	98	100
Age group		
15-20 years	62	63.3
21-25 years	33	33.7
26-30 years	3	3.1
Total	98	100
Has child or not		
Yes	25	25.5
No	73	74.5
Total	98	100
Parents alive		
Both	56	57.1
Mother only	18	18.4
Father only	16	16.3
None	2	2.0
Total	92	93.9
If there are no parents who is the guardian?		
Grandparents	13	13.3
Older siblings	6	6.1
Younger siblings	1	1.0

Extended family	1	1.0
Total	21	21.44
Number of people sharing the home		
3	8	8.2
4	12	12.2
5	26	18.4
More than 6	52	53.1
Total	98	100
Distance from home to the school		
Less than 5 km	47	48
5-10 km	23	23.5
11-15 km	12	12.2
16-20 km	6	6.1
21-25 km	10	10.2
Total	98	100
How do you get to school?		
Walk	95	96.9
Hitchhiker	3	3.1
Total	98	100

The responses for table 4.1 indicate that science as a subject is not dominated by males in this study 53 of participants were females and 45 were males (see table 4.1). Having science being dominated by females, especially in the rural areas, indicates that the rural society have accepted science they no longer regard it as a foreign subject that they can't relate

with. However having science taught in rural areas may be a challenge because the rural society still believes in giving the household chores to the woman, and science by its nature is a subject that needs a lot of practice, and this alone can affect the learner's performance. Research findings by Chinyoka and Naidu (2014:225) and Yara and Otieno (2010:128) indicate that the females in the rural areas have many chores to do. This limits their study time, hence their poor performance in science.

Education in the rural areas of Ingwavuma is now considered a priority. This is indicated by the responses of learners where the ages of 62 out of 98 learners ranged from 15-20 years, 33 out of 98 ranged from 21-25 years and only 3 out of 98 ranged from 26-30 years. These age ranges, according to Piaget's theory of learning belongs to a stage where a learner understands the world through hypothetical thinking and scientific reasoning and their cognitive development enables them to acquire and use rules in complex situations (Piaget, 1970). This means that the participants are cognitively ready and should perform well in science.

Table 4.1 also indicates that teenage pregnancy is not much of an issue in the Grade 12 classes of the Ingwavuma Circuit because only 25 of the learners out of 98 indicated having children, and the majority 73 indicated that they were not parents. Therefore teenage pregnancy cannot be regarded as a major factor however it may have a minor impact on the performances of the learners in this Circuit.

The above results indicate that 56 out of 98 learners had both their parents alive while only 18 out of 98 learners had only their mothers alive and 16 out of 98 learners had only their fathers alive; only 2 out of 98 indicated to be orphans (see table 4.1). The parents are the providers for their child; they also have to discipline and motivate their children. The results of this study indicate that the participants possessed a high possibility of being disciplined, since they had parents that supervised their actions. A highly disciplined and motivated learner, according to Modisaotsile (2012:3), is one that has a parent. According

to Maslow's Hierarchy of Needs these results indicate that the majority of participants enjoy their love and belongingness needs being met; this is because they have parents (Tay & Driener, 2011). This may possibly motivate them to do well in school.

Even though only 2 of the 98 participants indicated that they were orphans,13 stated that they lived with grandparents, 6 replied that they lived with older siblings,1 answered that they lived with their younger siblings, and 1 indicated that they lived with their extended families. These figures indicate that only 2 ou of 98 learners were not under the supervision of parents. Hence the participants, according to research by Modisaotsile (2012:3), Tay and Driener (2011), are highly disciplined and motivated. They are also are expected to do well because their needs for love and belongingness are being met.

The results of variable 6, 7 and 8 on table 4.1 imply that most learners come from large families; and they walk to school. In variable six, 8 out of 98 participants replied that they lived with three people at home, 12 participants lived with four people, 26 participants lived with five people and 52 participants lived with more than six people. In variable seven, 47 out of 98 participants answered that they walked less than 5km., 23 participants walked 5-10km., 12 participants walked 11-15km., 6 participants walked 16-20km. and 10 participants walked 21-25km. According to the responses above, 95 participants walk to school and only 3 participants hitchhike. This then attests to the fact that learners who walk distances longer than 5 kilometres may be very tired when they reach school because walking strains them.

From these results one can conclude that the learners in the Ingwavuma Circuit come from big but poor families who cannot even afford transport for their children to school. The number of persons in their families may mean that their parents spend most of the time ensuring that they are provided for in terms of basic needs, but this may also mean that there is no time to assist the learners with their schoolwork.

4.4 Socio-economic backgrounds

Section B of the questionnaire examined the socio-economic backgrounds of the learners. The following aspects were investigated: the employment status of the parents, the sector where the parents are employed, the education level of the parents, the size of the home where the learner lives, the location of the school, and the items found at the learners place during the schooling period.

4.4.1 The employment status of the parents

Figure 4.1 indicates the employment status of the parents of the learners.

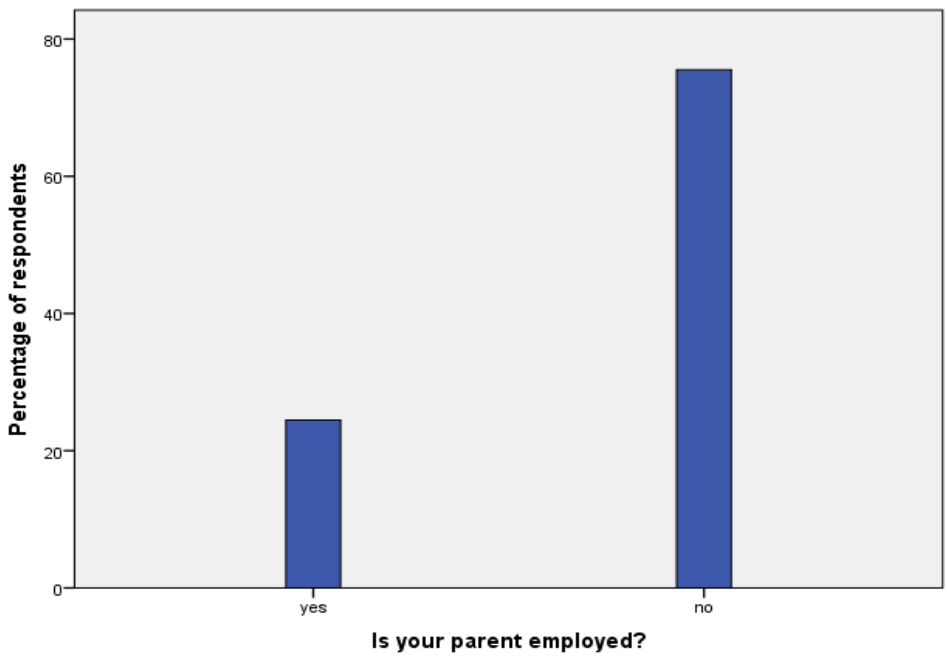

Figure 4.1: The employment status of the parents

Figure 4.1 shows that 71 out of 94 learners stated that their parents were unemployed, and only 23 learner stated that their parents were employed. This implies that the majority of the learners come from poor families where there is no constant income. Poverty has been identified as a factor that contributes towards the poor academic performance of the learners (Chinyoka & Naidu, 2014:225). This also implies that since there is no constant income, the learners may struggle to afford educational trips or extra study material.

4.4.2 The sector where the parent is employed

Figure 4.2 indicates the different sectors where the parents of the participants are employed.

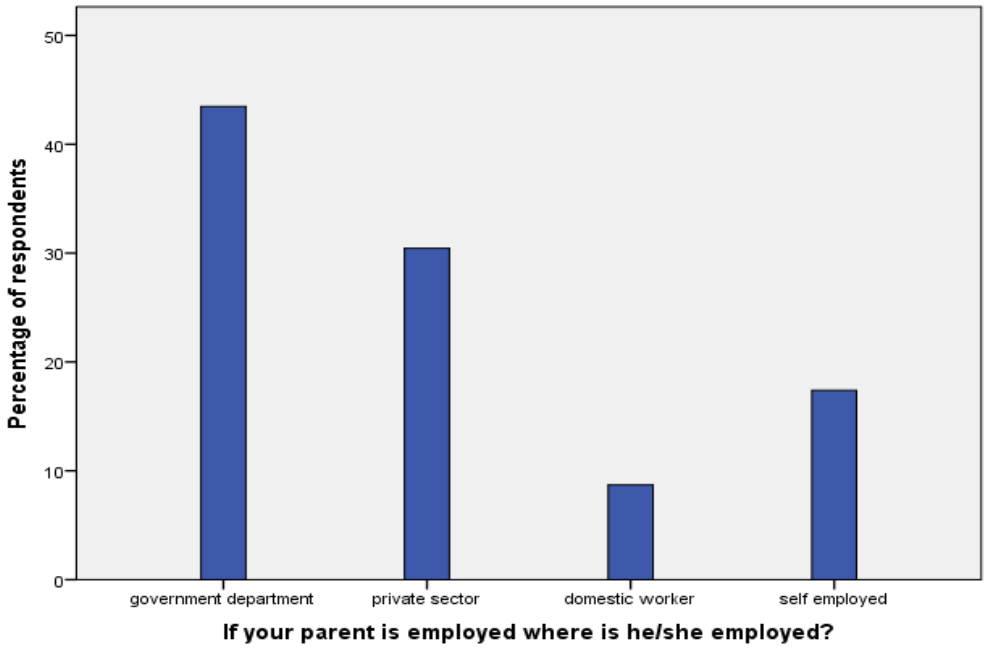

Figure 4.2: The sector where the parent is employed

Variable 10 wanted to assess the employment sector of those parents that were employed. The feedback from the participants indicated the same number as those who said that their parents were employed in variable 9, which is 23 . Of that number 10 of participants mentioned that their parents were employed by the government, 7 indicated that their parents were employed in the private sector, 2 replied that their parents were domestic workers and 4 mentioned that their parents were self-employed. This emphasizes the incidence of poverty mentioned in variable 9, because most of these parents did not have a formal or consistent income (see figure 4.2).

4.4.3 The education levels of the parents

The results in figure 4.3 illustrate the education level of the participant's parents.

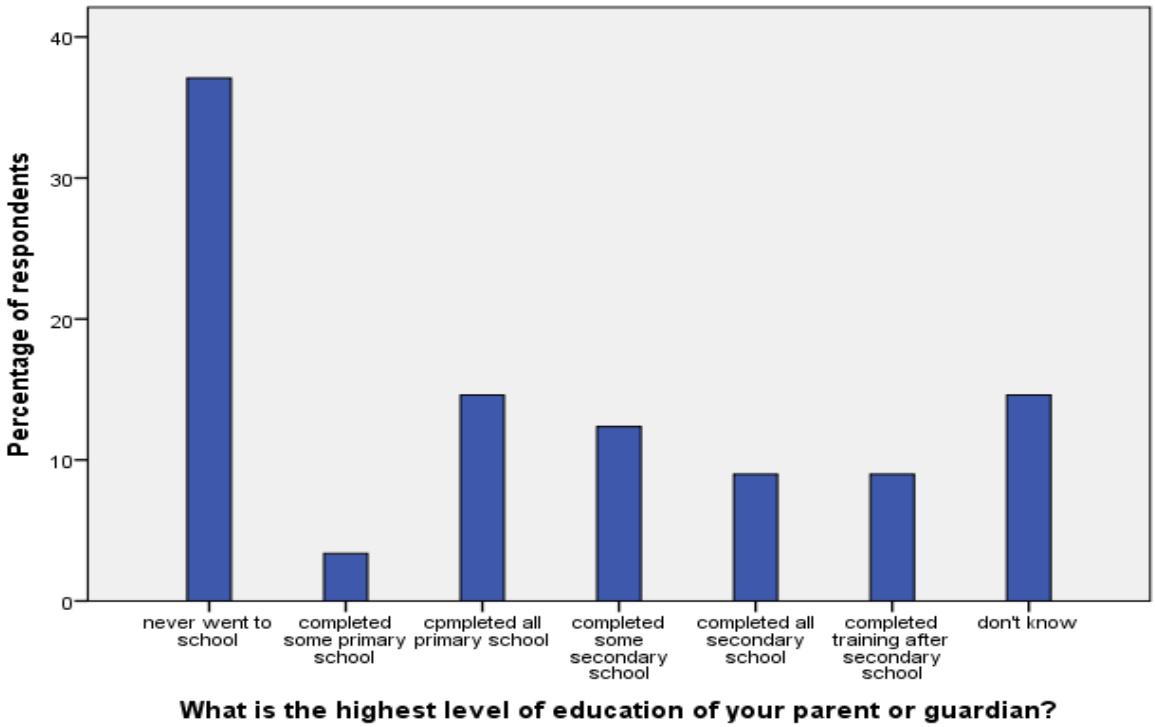

Figure 4.3: The parents' education level

Figure 4.3 indicates that 89 out of 98 learners responded. From these responses 33 learners stated that their parents never went to school; and from those who were identified as educated only 8 completed training after secondary school. The indicate that 3 parents partly completed primary school,13 completed all their primary school, and 11 completed some secondary school. These findings suggest that the illiteracy level of parents in the Ingwavuma Circuit was high. Hence they could not assist their children educationally, because they were either not knowledgeable of the syllabus or of the medium of instruction. Mahomed (2004:4) and Kavanagh (2013:262) state that this situation could affect the performance of a child.

4.4.4 The size of the home where the learner lives

Figure 4.4 indicates the size of the home where the participant lives.

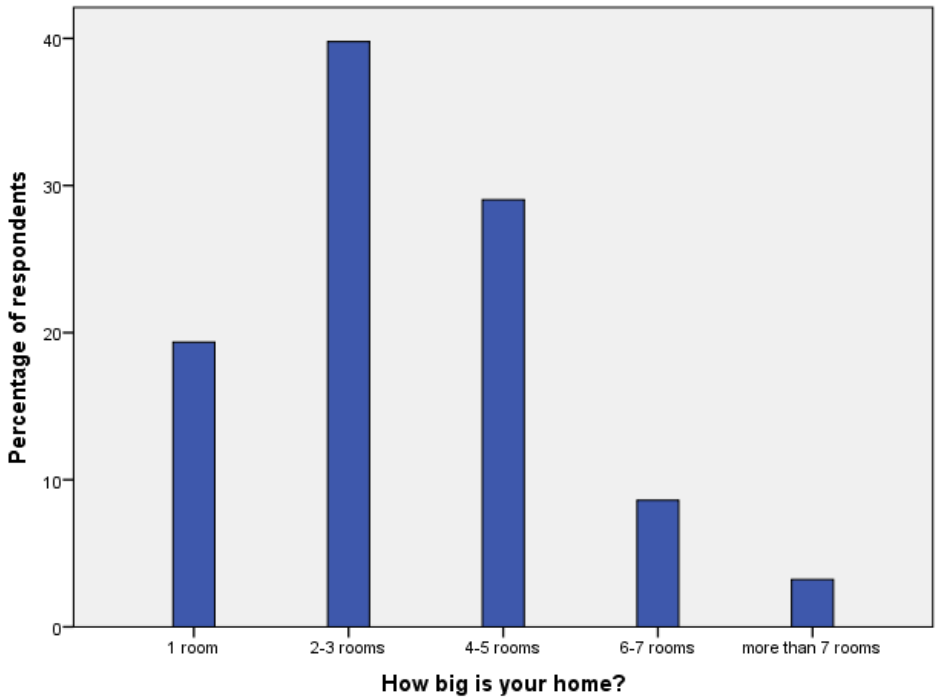

Figure 4.4: The size of the home where the learner lives

This variable (V12) investigated the size of the home where the learners live. 93 of the learners responded and 5 did not respond. Out of those who responded, 18 indicated that they lived in a one-room house, 37 indicated that they lived in a 2-3-room house, 27 indicated that they lived in a 4-5-room house, 8 indicated that they lived in a 6-7-room house, and 3 indicated that they lived in a more than 7-rooms house (see figure 4.4). These findings illustrate that most of the learners lived in overcrowded homes since in variable 6 above 52 learners indicated that they lived with more than 6 people at home. Research indicates that in overcrowded homes the learners do not have a space to study or to do homework. They are also unable to interact with their peers at home in respect of their schoolwork (Chinyoka & Naidu, 2014:228; Wadesango et al., 2011:150).

4.4.5 The location of the school

Variable 13 (V13) was aimed at ascertaining the location of the schools where the research was conducted. 98 (100%) indicated that their schools were in rural areas. The fact that the schools were located in rural areas has its own implications. The literature indicates that the rural schools still face the challenges of a lack of resources and infrastructure, this has a direct influence in the quality of education offered to the learners (Gardiner, 2008:7).

4.4.6 Resources available the learners' homes

Table 4.2 indicates the items that may assist the learner when studying at home. The learners had to indicate with a 'yes' if the resource was available, or with a 'no' if the resource was not available.

Table 4.2: Resources available at the learner's home

Variable	Yes	No
14.1 Water	63	34
14.2 Electricity	69	28
14.3 Radio	30	63
14.4 DSTV	7	87
14.5 TV only	21	62
14.6 Computer with internet	11	73
14.7 Study	31	45
14.8 Motor car	20	64

Looking at table 4.2 it seems that the resources that were indicated as highly available were, namely water indicated by 63 participants and electricity indicated by 69 participants.

Resources that were the least available were a radio stated by 30 learners, DSTV stated by 7 learners, TV stated by 21 participants, a computer with internet indicated by 11 learners , a study indicated by 21learners and a motor car indicated by 20 learners. The findings as shown in table 4.2 indicate that the learners do not have luxury resources to enhance their learning at home. They therefore are unable to improve their knowledge except when they are at school. This may lead to them losing interest in their schoolwork and then performing poorly (Mwenda et al., 2013:98; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013:105; Mwaba, 2011:33).

4.5 Learning, teaching and school activities

In section C of the questionnaire (appendix K) the learners were requested to rate the teacher's competencies in respect of teaching science, their own competencies in respect of science, their parent's involvement, absenteeism and class size.

4.5.1 The Grade 12 science teachers

Table 4.3 below shows how the science teacher teaches, from the learner's point of view. The learners had to indicate with a 'yes' where the teacher did what was investigated in the variable, or a 'no' where the teacher did not do what was investigated in the variable.

Table 4.3: The assessment of the Grade 12 science teacher by the learners

ITEMS	YES	No
15.1. Is your teacher always in the class on time?	75	22
15.2. Does your teacher use all the allocated time for teaching?	67	29
15.3. Would you say your teacher knows his /her subject well?	72	24
15.4. Does your teacher use different teaching methods?	84	12

15.5. Does your teacher make use of prior knowledge before every new chapter?	76	20
15.6. Does your teacher explain the same thing in different ways to help you understand?	84	13
15.7. Does your teacher ask you the same question in different ways?	85	11
15.8. Does your teacher give your class tests?	94	2
15.9. Does your teacher use the test results to give the learners extra help?	65	17
15.10. Is your teacher approachable?	78	16
15.11. Does your teacher motivate you to learn?	91	5
15.12. Does your teacher organize extra lessons for you?	88	9
15.13. Does your teacher care if you understand the lesson or not?	84	12
15.14. Does your teacher invite science teachers from other schools to teach your class?	84	12

The responses of the learners, according to Table 4.3, indicate that the science teachers from the investigated schools are competent, in the following manner: The teacher is in class on time (75); he/she uses the allocated time for teaching (67); he/she has knowledge of the learning area (72); he/she uses different teaching methods (84); he/she uses prior knowledge (76); he/she explains the same thing in different ways (84); he/she asks the same question in different ways (85); he/she gives class tests (94); he/she uses the test results for diagnosis (65); he/she is approachable (78); he/she motivates the learners (91); he/she organizes extra lessons (88); he/she ensures that the learners understand (84); he/she networks with other science teachers (84). The responses from learners indicate that their teachers are competent, dedicated and are able to use multiple teaching methods. These results differ from the findings by Makgato and Mji (2006:254) and Muzah (2011:197) where they say that the teachers make use of outdated methods. This then means that

according to learner's perspectives these teachers meet the competency requirements as stated by Sanders (2007:32-38) and Van Aswegen et al. (1993) who indicated that a science teacher should be competent and should be able to teach in multiple authentic ways.

4.5.2 The Grade 12 science learners

Table 4.4 indicates the learner's self-assessment in respect of learning and school activities. The learners had to indicate with a ’yes’ or a ‘no’ to each variable; ‘yes’ meaning he or she agreed with what the variable investigated, and ‘no’ meant he or she did not agree with what the variable investigated.

Table 4.4: The Grade 12 learner's self-assessment of learning

ITEMS	Yes	No
16.1. Did you go to a crèche?	62	36
16.2. Are you always on time?	85	13
16.3. Would you define the science lessons as interesting?	75	21
16.4. Do you understand the language of teaching well?	77	20
16.5. Do you understand the science language?	90	8
16.6. Do you do your homework every day?	72	24
16.7. When you do not understand the teacher do you ask?	81	13
16.8. Do you have access to the library?	9	85

The results in Table 4.4 indicate that 62 out of 98 learners went to a crèche; 85 are always on time ; 75 define science as interesting ; 77 understand the language of teaching ; 90 understand the science language ; 72 do their homework every day ; 81 ask if they do not understand the teacher . The results in table 4.3 also show that only 9 learners have access

to the library . These results indicate that a large number (62) of the learners had early childhood education which is deemed as an important factor in laying the foundation of intelligence, personality, social behavior and the capacity to learn in a child (Unity et al., 2013:152). The results also suggest that the learners are always on time, and this implies that they are always ready to learn. The responses also show that most of the learners understand both the teaching and science language and regard science as interesting. This means they are able to grasp the science concepts and are able to communicate them in words (Hlabane, 2014:25). It also means that they understand the questions and are able to give answers (Setati, 2011:31; Lebata, 2014:24; Hlabane, 2014:32).

4.5.3 The language used by the teacher in teaching science

Variable 17 (V17) investigated the language that was used by the science teachers. The results are shown in figure 4.5.

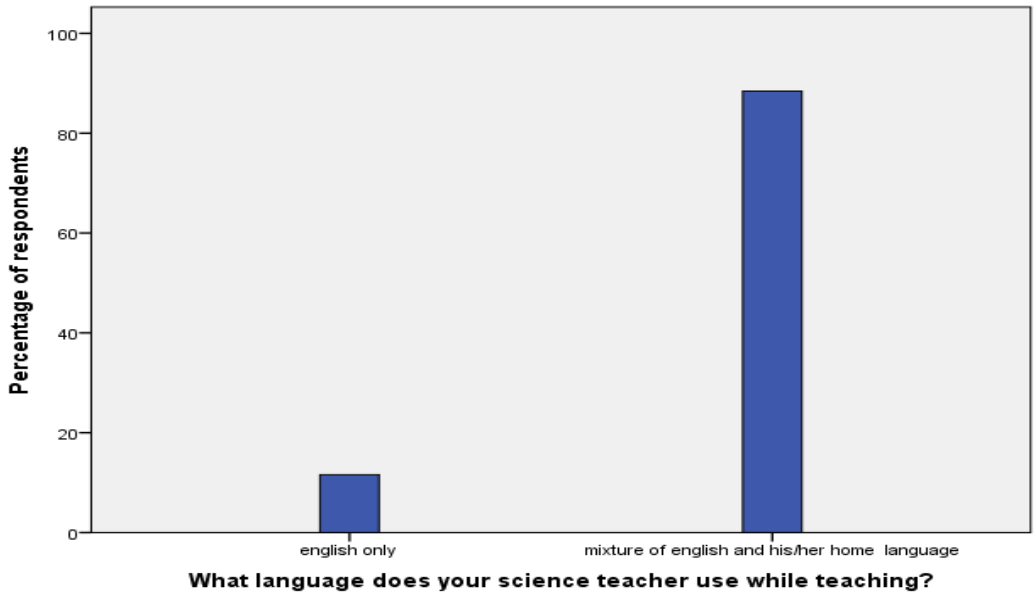

Figure 4.5: The language used by the teacher in teaching science

Out of the 95 responses, 11 learners indicated that their science teacher used English only during the lesson, and 84 learners indicated that their teacher used both English and his/her (teacher) home language during lessons (see figure 4.5 above). It is evident that the

teachers of the four selected schools used code switching while teaching, hence the responses of the learners in variable 16.4 where they replied that they understood the language of teaching language. This does not, however, mean that they understand English. Research recommends code switching as it assists second language learners in understanding during teaching and learning (Hlabane, 2014:3; Setati, 2011:3). However, the same code switching cannot be done during exams as they are only written in English and this may be a disadvantage to the learners.

4.5.4 The language preferred by the learners

Variable 18 (V18) investigated the type of language that the learners preferred during their science lessons. Of the 96 responses, 12 learners preferred English only as the language of teaching. A higher percentage of learners 79 learners preferred a mixture of English and their home languages, while 5 learners preferred their home language only (see figure 4.6 below).

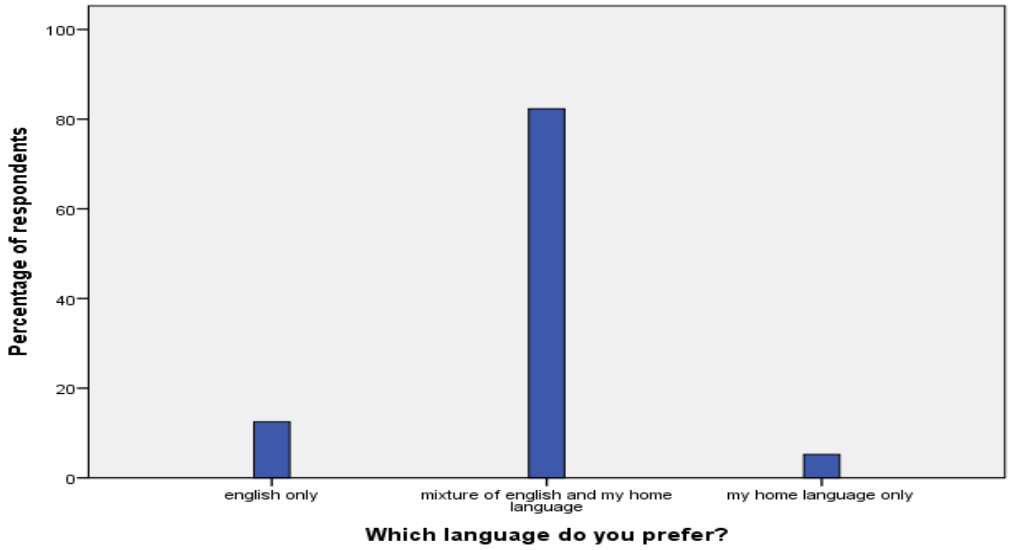

Figure 4.6: The language preferred by the learners in the science classes

This figure suggests that the learners preferred the language used by their teachers (code switching), as mentioned in variable 17. This means that the learners are not proficient in

English and hence will be unable to understand exam questions especially during final exams where invigilators are not allowed to clarify even a single term to the learners.

4.5.5 The frequency of the learner's absenteeism

Variable 19 (V19) investigated how frequent the learners were absent from class. Out of 95 who responded, 19 learners indicated that they were absent at least once a month, 4 learners indicated being absent more than once a month, and 72 learners indicated that they were never absent (see figure 4.7).

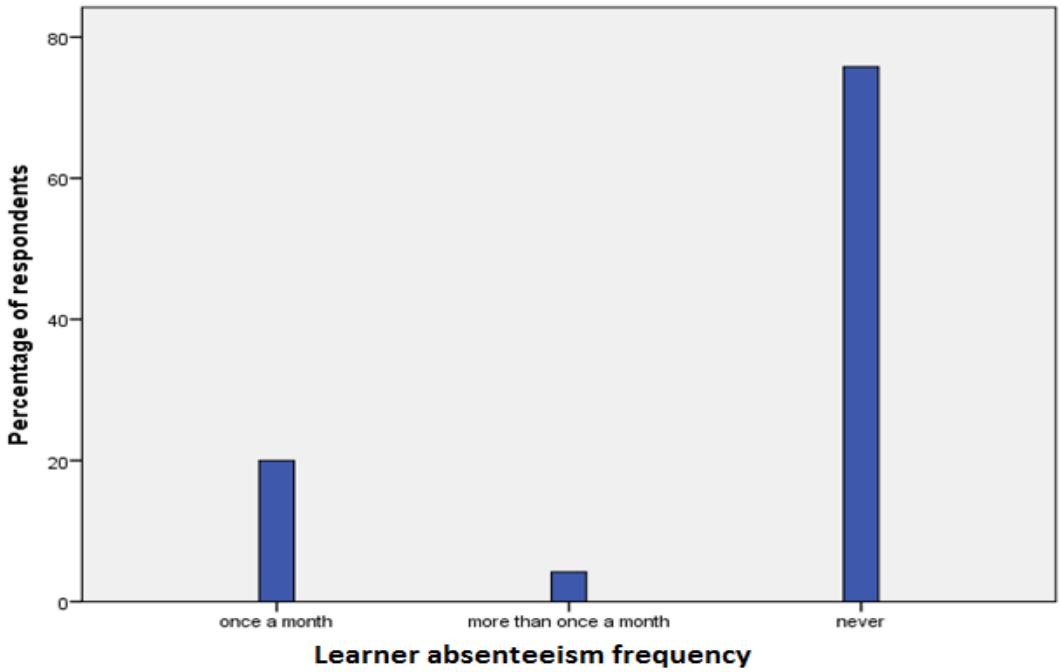

Figure 4.7: The frequency of the learner's absenteeism

The majority of the learners were always in class and at school. Hence they were able to attend all the lessons, and they have an opportunity of attending all the lessons.

4.5.6 Reasons for the learner's absenteeism

Variable 20 (v20) investigated the reasons that led to the learners being absent. Out of the 50 that responded, 39 replied that they were absent because of illness, 4 mentioned that

they had to take care of their siblings, 2 stated that they went absent because they had to do chores, and 5 indicated that they had to take care of the a sick child (see figure 4.8 below).

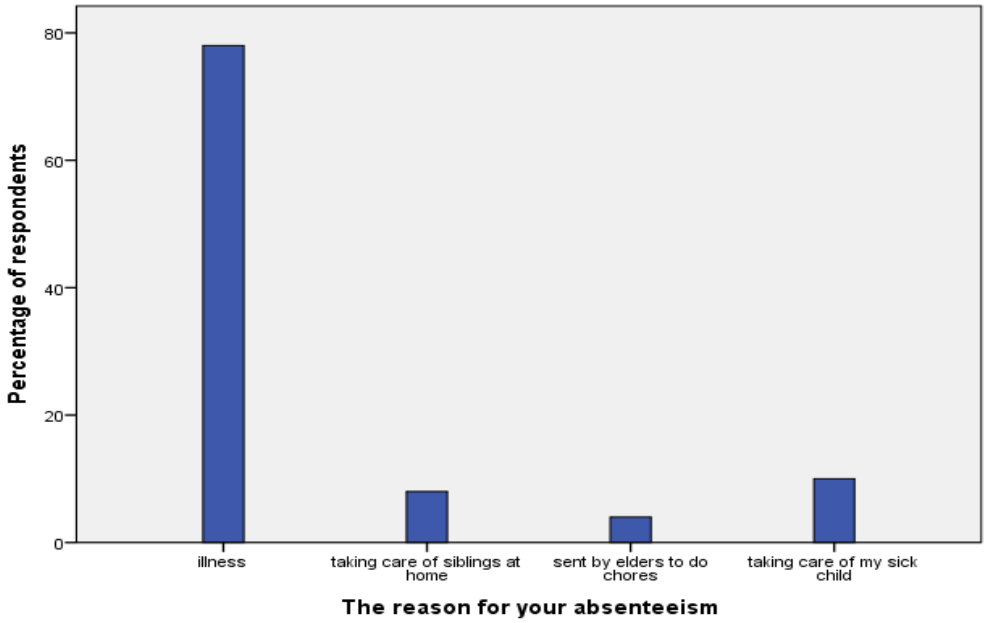

Figure 4.8: The learner's reasons for being absent

These findings are similar to the findings by Weideman et al. (2007) where they pinpoint illness and socioeconomic factors such as poverty as the reasons for their absenteeism. However, in variable 19 only 23 learners indicated being absent from school.

4.5.7 The learner's frequency of studying

92 learners responded to this question. The findings indicate that 78 of the learners studied every day, 10 studied once a week, 1 studied once a month and only 3 never studied at all. This shows that the learners are motivated to interact with it every day (see figure 4.9 below).

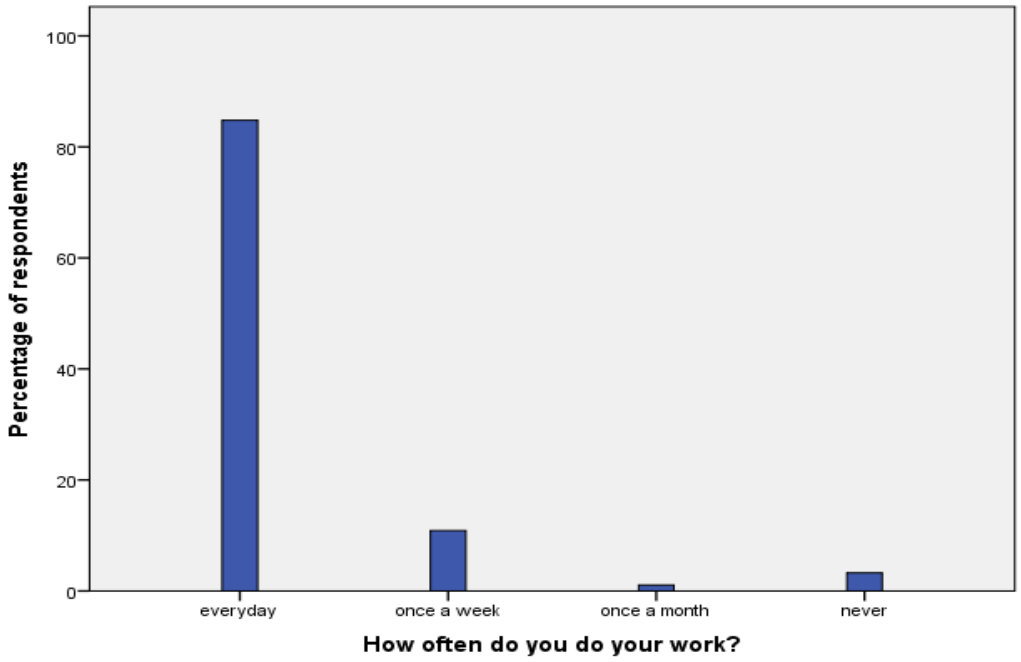

Figure 4.9: The learner's frequency of studying

The results in the graph above show that 78 learners study every day and only a few (3) responded by saying that they never studied their work. This may mean that studying everyday has an impact on learner's results.

4.5.8 The parent's involvement in their child's learning

The findings in variable 22 show that 37 learners indicated that their parents were only involved in their child's learning by means of attending parent's meetings; 30 assisted with their child's homework; while 20 of the parents were not involved in their child's learning (see figure 4.10).

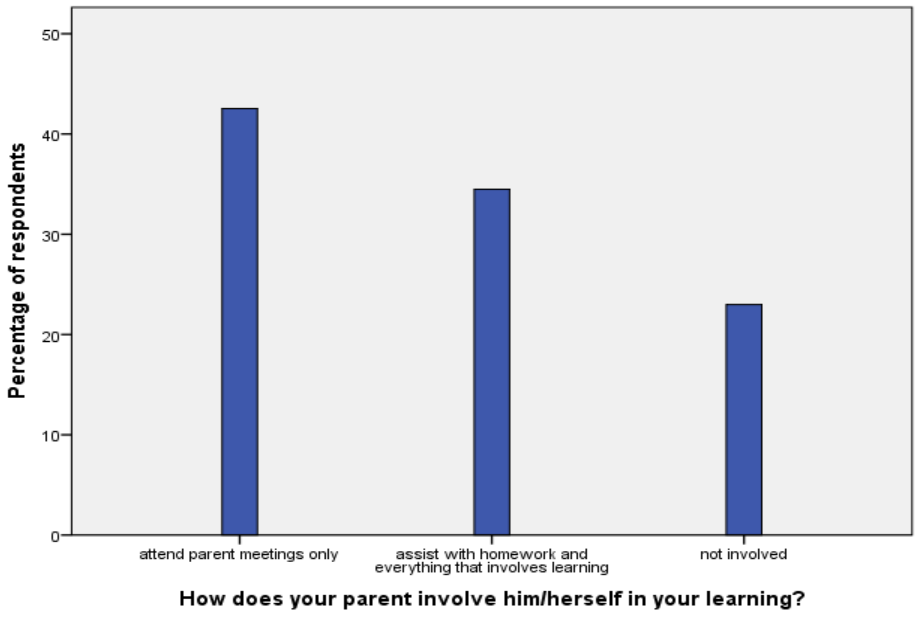

Figure 4.10: The parent's involvement in their child's learning

Even though some parents were involved in their children's learning, there isn't any policy regulations that stipulate to what extent they should be involved, and how they can actually assist in improving the performance of their children and that of the school (Kgaffe, 2001:136).

4.5.9 The number of learners in the class

An investigation into the number of learners in the classes of the schools that were investigated indicates that most schools that were investigated were not overcrowded, where 41 of the learners stated that there were 56-65 learners in class, a lesser number (24) indicated having a small number of learners in their class, namely 26-35, and 30 responded by saying that they had less than 25 learners in their class (see figure 4.11).

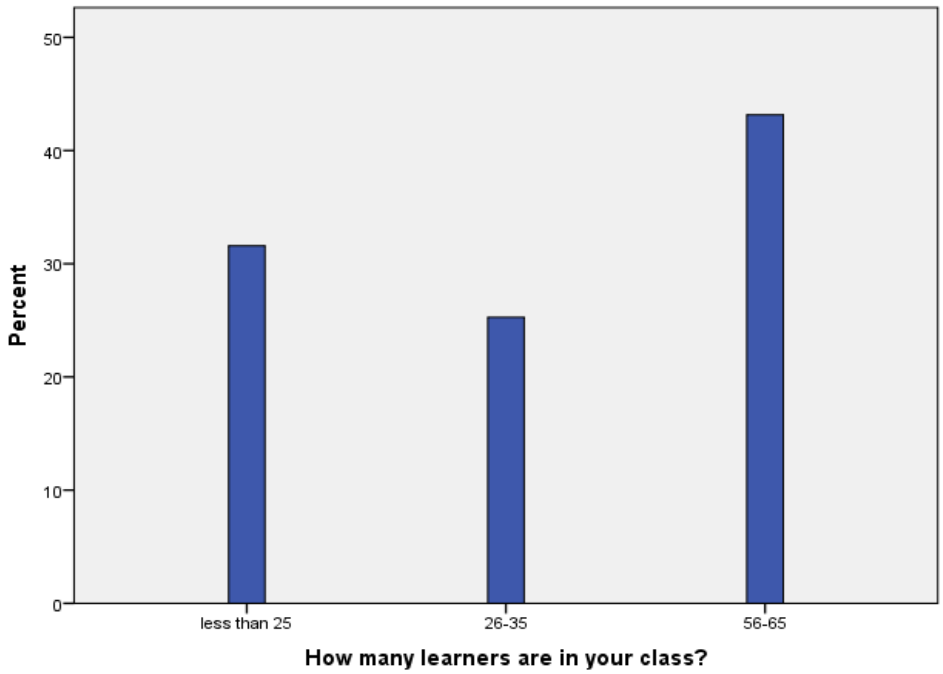

Figure 4.11: The number of learners in the Grade 12 science classes of the schools that were investigated

This means that the majority of the teachers were forced to make use of a teacher-centered method when teaching because they are unable to attend to the learners individually. Akinsolu and Fadokun (2009), Setati (2011:96), Yelkpieri et al. (2012:327), Mwenda et al. (2013:97) and Dhurumraj (2013:62) all agree with the above statement where they indicated that large classes force a teacher to use teacher centered methods. By its nature science needs to be practiced regularly, and this requires a lot of written work that should be assessed constantly. The number of learners taught by the teachers clearly indicates that the above cannot be practiced successfully. This leaves the learners at a disadvantage (Yelkpieri et al., 2012:326; Akinsolu & Fadokun, 2009; Yara & Otieno, 2010:127).

4.5.10 School resources, infrastructure and class size

Variable 24-35 (V24-V35) investigated factors such as resources and infrastructure that could have an effect on learning. The learners were asked to respond with a 'yes' (available) or 'no' (not available).

Table 4.5: School resources, infrastructure and class size

ITEMS	YES	No
24. Does the number of learners in the class have a negative effect on your learning?	30	54
25. Do you have desks for everybody?	72	25
26. Do you have enough textbooks?	54	43
27. Is there a library at the school?	36	61
28. Is there a science laboratory at the school?	36	60
29. Do you have a computer laboratory?	30	67
30. Does the school have water?	62	36
31. Does the school have electricity?	80	17
32. Does the school have enough classrooms?	40	57
33. Does the school have toilets?	61	34
34. Does the school have a Code of Conduct?	60	31
35. Do you know the members of your school's School Governing Body?	89	8

The responses of the learners indicated that the following were available at their school: desks for everybody (72), enough textbooks (54), water (62), electricity (80), toilets (61), a Code of Conduct (60), knowledge of the members of the School Governing Body (89).

Only a few learners indicated having the following available: a school library (36), a science laboratory (36), and a computer laboratory (30). Only 30 learners indicated that the number of learners in their class had a negative effect on their learning.

4.6 Attitudes and beliefs

The questions in variable 36-46(v36-v46) were asked in order to ascertain the attitudes and beliefs that the learners had towards science. A variety of aspects were listed in table 4.6 below and learners had to choose between the options 'strongly disagree' and 'disagree' for a negative attitude and belief, and use 'strongly agree' and 'agree' for a positive attitude and belief.

Table 4.6: The learner's attitudes and beliefs towards science

ITEMS	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
36. Science is a subject related to everyday life	7	4	14	32	31
37. The science teachers at my school know how to teach the subject	11	4	10	33	30
38. My teacher makes the science lessons interesting	19	10	11	33	20
39. Science is important in life	15	0	11	25	40
40. Science is a manageable subject	14	9	19	36	13

41. Practical work helps me to understand science better	17	8	13	28	25
42. The availability of resources makes learning easier	14	4	11	32	27
43. Discipline during lessons results in good marks	13	6	7	29	37
44. My parent's involvement in my schoolwork motivates me	14	14	13	23	27
45. Changes in the curriculum affect my learning	15	19	12	20	18
46. My home environment contributes towards my school performance	17	14	9	33	19

The positive attitudes were as follows: Science is a subject related to everyday life (63); the science teachers at my school know how to teach the subject (63); my teacher makes the science lessons interesting (53); science is a subject related to everyday life (63); science is important in life (65); science is a manageable subject (49); practical work helps me to understand science better (53); the availability of resources makes learning easier (59); discipline during lessons results in good marks(65); my parents' involvement in my schoolwork motivates me (50); changes in the curriculum affect my learning (38); my home environment contributes towards my school performance (52).

A few learners were uncertain about the following aspects: Science is a subject related to everyday life (14); the science teachers at my school know how to teach the subject (10); my teacher makes science lessons interesting (11); science is a subject related to everyday life (06); science is a manageable subject (19); practical work helps me to understand science better (13); the availability of resources makes learning easier (11); discipline during lessons results in good marks(07); my parent's involvement in my schoolwork

motivates me(13); changes in the curriculum affect my learning (12); my home environment contributes towards my school performance (9). (see table 4.6 above).

4.7. Data-analysis of the Grade 12 science teacher questionnaires

The questionnaires (Appendix J) were given to the teachers and were self-administered. The responses were analysed statistically and presented in the form of bar graphs or tables see results below. The respondents were asked to respond by indicating 'yes' or 'no'. In other instances the learners were asked to rate their responses by means of 'strongly disagree', 'disagree', 'neither disagree nor agree', 'agree' or 'strongly agree'. 'No', 'strongly disagree' and 'disagree' were grouped as negative responses while 'agree' and 'strongly agree' were grouped as positive responses. The results were presented by means of descriptive statistics.

Appendix J was divided into three categories, namely biographical background, resources and infrastructure, teaching and learning.

4.7.1 Biographical background of the Grade 12 science teachers

Section A of the questionnaire (appendix J) investigated the background of the science teachers in order to establish how competent they are for their job. The backgrounds of the science teachers that were explored were their gender, home language, science teaching experience, Grade 12 science teaching experience, subjects taught, the location of the school, professional qualifications, major subjects in professional qualifications, academic qualifications in the science stream, the number of days absent per year, the reasons for the absence, and the number of children in the science class. The findings are recorded in table 4.7 below.

Table 4.7: Biographical background of the Grade 12 science teachers

Variable	Count	%
1. Gender		
Male	6	75
Female	2	25
Total	8	100
2. Home language		
Zulu	8	100
3. Science teaching experience		
1-3 years	1	12.5
4-6 years	2	25
7-8 years	3	37.5
More than 8 years	2	25
Total	8	100
4. Grade 12 Science teaching experience		
1-3 years	2	25
4-6 years	1	12.5
7-8 years	3	37.5
More than 8 years	2	25
Total	8	100
5. Subjects taught		
Science only	3	37.5

Science and two other subjects	5	62.5
Total	8	100
6. Location of the school		
Rural	8	100
Total	8	100
7. Professional qualifications		
Diploma in Education	5	62.5
Bachelor of Education	1	12.5
Post Graduate Certificate in Education	1	12.5
Honours Bachelor of Education	1	12.5
Total	8	100
8. Major subjects in professional qualifications		
Science only	5	62.5
Science and Mathematics	2	25
Science and other non-science subject	1	12.5
Total	8	100
9. Academic qualifications in the science stream:		
Bachelor of Science	2	25
Diploma in Science	1	12.5
None	5	62.5
Total	8	100
10. Number of days absent per year		

0-10	8	100
Total	8	100
11. Reason for absence		
Study leave	3	37.5
Family Responsibilities	5	62.5
Total	8	100
12. Number of children in the science class:		
Less than 25	4	50
26-35	2	25
56-65	2	25
Total	8	100

The question on variable (V1) was asked in order to find out the number of males and females teaching science and to further establish if this contributes towards learner performance. The findings in table 4.7 indicate that the science teaching field is still dominated by males because 6 of respondents were males while 2 were females. The responses in variable 1 indicate that the majority of the learners were females. This may have a negative effect on learning, just as the findings of Nichols, Tippins and Roychoudhury (1995:899) indicate that male teachers seem to be intimidating, and this results in the female learners being afraid to ask when they do not understand something.

Variable 2 (V2) was explored to discover the dominating home language of the science teachers. All the teachers 8 indicated that Zulu was their home language. This is also the language of the learners, and this makes code switching easier, because the learners understand the teacher's language. This then explains why the majority of the learners, in

variables 17 and 18, preferred a mixture of English and their home language as the language of teaching.

The findings of variables 3 and 4 indicate that the teachers that were partcipants had experience in both teaching science, (3) had 7-8 years and (2) had more than 8 years further than that (3) had 7-8 years of teaching science in grade 12 and (2) indicated to have more than 8 years teaching grade 12 science. The results furthermore indicate that only a few teachers had less experience in both teaching science in general and in teaching science in Grade 12, where (1) had 1-3 years' experience, (2) had 4-6 years' experience of teaching science, and on the other hand (2) had 1-3 years' experience, and (1) had 4-6 years' experience in teaching science for Grade 12. According to research, experience has a positive impact on the learner's performance (Hughes 2014:45). The teachers with relevant experience are able to adapt their learning in respect of the learner's challenges. However, this kind of experience would have been excellent if the curriculum had stayed the same during all their years of teaching experience.

Variable 5 (V5) sought to establish the number of subjects taught by each science teacher in order to determine the load of work each teacher had. The results show that from the science teachers that participated (5) were overloaded with work because they were expected to teach science and two other subjects, while only (3) taught science only. This means that the teachers were not able to assess regularly, and to regularly give feedback, and hence could not provide spot-on remedial measures of learner performance for each chapter. This is a disadvantage to the learners because they would not know where they experience problems.

Variable 6 (V6) was investigated to ascertain the location of the school where the teachers taught so as to paint a picture of the context they are situated in. The results show that 8 responded. All of them indicated that the schools where they taught were in rural areas. The fact that the school is located in a rural area has its own implications. The literature

states that rural schools still face challenges such as the lack of resources such as water, electricity and classrooms, yet they make use of the same curriculum as the schools that are fully resourced. This has a direct influence on the quality of education being offered to the learners (Gardiner 2008:7).

The findings of variables 7, 8 and 9 depict that 5 of the science teachers had a diploma. Only a few had qualifications higher than a diploma, where 1 had a bachelor of education degree, 1 had a postgraduate certificate in education, and 1 had an honors bachelor of education. Even though the results above state that the teachers were professionally qualified, it is still a fact that most of their qualifications are at entry level and did not have deep content knowledge on science this may affect the performances of the learners. Spaul (2013:24) agrees with the latter statement that teachers with entry level knowledge may have a negative effect on learner performance where he says that, "quality of education cannot exceed the quality of a teacher".

Even though findings show that the teachers had science as a major subject for their professional qualifications, where 5 did science only and 2 did science and mathematics but only a few had academic qualifications is science which were recorded as follows 2 had a B.Sc. in science and 1 had a diploma in science. According to Ball et al. (2008), teachers with only diplomas in education know common content knowledge which they only had to know in order to teach whereas they categorised teachers with higher degrees and academic qualifications in science as having specialized content knowledge than beyond what the curriculum needs which enables teachers to explain complex content to learners.

When exploring absenteeism in variables 10 (V10) and 11, the researcher discovered that the teachers were absent 0-10 days in a year, namely either because of study leave (3) or family responsibilities (5). These results also show that only a few teachers were busy with studying.

Variable 12 (V12) was investigated to establish the sizes of the classes that the science teachers taught. The results show that 8 teachers responded, and out of these 4 indicated having less than 25 learners in their science classrooms, 2 indicated having 26-35 learners in their classrooms, and 2 (25%) indicated having 56-65 learners in their classrooms. These responses show that some schools were overcrowded while some were not. The consequences of overcrowding include the teacher making use of teacher-centered methods when teaching because of his/her inability to attend to learners individually. Akinsolu and Fadokun (2009), Setati (2011:96), Yelkpieri et al. (2012:327), Mwenda et al. (2013:97) and Dhurumraj (2013:62) all agree with the above statement where they indicate that large classes force a teacher to use teacher-centered methods. Science by its nature needs to be constantly practiced and this requires a lot of written work that should be assessed constantly. The number of learners taught by the teachers clearly indicates that the above cannot be practiced successfully. This leaves the learners with a gap of not knowing where to improve because they are not given constant feedback (Yelkpieri et al., 2012:326; Akinsolu & Fadokun, 2009, Yara & Otieno, 2010:127).

4.7.2 Resources and infrastructure

Variable 13-23 (V13-23) were investigated to establish if the schools had enough teaching and learning resources. The teachers responded by a 'yes' to indicate the availability of a certain resource, and a 'no' to indicate the shortage of a certain resource. All the (8 (100%)) teachers responded.

Table 4.8: The availability of resources and infrastructure for the Grade 12 science teachers

ITEMS	Yes	No
• **Is there electricity at your school?**	6	2

• **Is there water at your school?**	2	6
• **Is there a science laboratory at your school?**	2	6
• **Is there a library at your school?**	3	5
• **Is there access to the internet at your school?**	2	6
• **Is there adequate science equipment at your school?**	2	6
• **Are there adequate classrooms at your school?**	2	6
• **Are there adequate teachers at your school?**	3	5
• **Are there adequate desks and furniture at your school?**	3	5
• **Are there different kinds of teaching aids at your school?**	3	5
• **Does every science learner have an individual science textbook?**	3	5

The results in table 4.8 indicate that only electricity was shown as the resource which was the most available (6). The rest of the resources were indicated as lacking in most schools, namely water (2) , a science laboratory (2) , a library (3), access to the internet (2), adequate science equipment (2), adequate classrooms (2), adequate teachers (3), adequate desks (3), different kinds of teaching aids (3) and science learner's individual textbook (3). Resources that were identified as lacking makes teaching boring, because there would be no practical work, and this means that science would only be taught by means of theory. This leads to the learners losing interest in science, and hence poor performance (Mwenda et al., 2013:98; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013:105; Mwaba, 2011:33; Onwu, 1999). This also limits teachers from giving learners homework as they either have to share or have no textbooks (Onwu, 1999).

4.7.3 Teaching and learning

Variable 24-60(v24-v60) were investigated in order to ascertain the quality of the teaching and learning of science and the expertise of the teachers. In these variables the teachers had to do self-assessment.

In the Table 4.9 below a variety of aspects are listed and teachers had to use 'strongly disagree' and 'disagree' for a negative response, and 'strongly agree' and 'agree' for a positive response.

Table 4.9: The teacher's self-assessment on the teaching and learning of science

ITEMS	1	2	3	4	5
24. I know the policy of my subject and comply with it when teaching	0	0	0	5	3
25. I know my subject content beyond what is required in the curriculum	0	0	1	4	3
26. I find it easy to teach the CAPS	0	0	1	6	1
27. The school science curriculum is relevant to life	0	0	5	1	2
28. The language used in the textbooks is understandable for the learners	0	4	1	2	1
29. I am always in class on time	0	0	0	4	4
30. My lessons are always planned	0	0	1	4	3
31. My lessons are driven by objectives and outcomes	0	0	0	3	5
32. My lessons start with prior knowledge	0	0	0	5	3
33. I am able to relate my lessons to the students' real life situations	1	0		4	2
34. I deliver my lessons in diverse styles	0	1		7	0

35. I use different learning aids when presenting my lessons	0	0		5	1
36. I am always confident in respect of the presentation of my lessons	0	0		4	3
37. I create an agreeable learning environment for the learners	0	0		6	1
38. I inspire my learners to love science	0	0		3	3
39. I teach the learners so that they can understand even when I fall behind schedule	0	0		3	4
40. I frequently assess my students	0	0		6	1
41. I give the students constructive feedback	0	0		4	4
42. I use different methods of questioning for assessment	0	0		4	4
43. I allow the students to do research for their own information	0	1		3	3
44. I am able to discipline my students	0	0		3	5
45. I mediate learning - I do not lecture	0	0		3	5
46. I involve the parents in their child's learning	0	2		2	1
47. I am able to capture the attention of the learners throughout the lesson	0	0		5	2
48. Most of my assessments are practical investigations	0	5		0	1
49. I allow the students to make their own notes	0	0		5	3
50. I am able to identify the students with problems and assist them individually	0	0		5	2
51. I ask for help from colleagues on some topics	0	0		1	6
52. I teach all the topics as required irrespective of my being comfortable with them	0	0		3	5

53. The time allocated to cover a topic in the work schedule is realistic	0	5		2	1
54. My teaching load is fair	2	2		1	2
55. The Department effectively supports science educators	0	0		7	1
56. The Head of the Science Department gives the necessary support	1	0		4	2
57. The Department provides opportunities for professional growth	0	6		1	1
58. I am satisfied with my salary	6	0		0	0
59. The unavailability of resources have a negative effect on learning	1	1		4	1
60. The big number of students negatively affects learning	0	0		4	1

The following were the positive responses received: knowledge of subject policy (8); knowledge of the subject content beyond the curriculum (7); easy to teach CAPS (7); always in class on time (8); lessons are always planned and are driven by objectives and outcomes (7); lessons are driven by objectives and outcomes (8); lesson starts with prior knowledge (8); ability to relate the lessons to the learner's real life (6); deliver lessons in diverse styles (7); use different learning aids when presenting a lesson (6); always confident about lesson presentation (7); able to create comfortable learning environment (7); inspire learners to love science (6); teaching for learners to understand (7); frequently assess learners (7); giving learners frequent feedback (8); using different questioning methods for assessment (8); allowing learners to do research for information (6); ability to discipline learners (8); mediate learning instead of lecturing (8); able to capture learner's attention (7); allowing learners to make their own notes (8); ability to identify learners with problems (7); ability to ask for help from colleagues (7); teach all topics as required irrespective of comfortability (8); Department effectively supports science educators (8); Head of Department gives the necessary support (6); unavailability of resources has a negative effect on learning (5); big number of learners affects learning negatively (5).

Negative responses were received in respect of the following: school science curriculum is relevant to life (3); language used in the textbooks is understandable for learners (3); involving parents in their child's learning (3); most assessments are practical investigations (1); time allocated in work schedule is realistic (3); teaching load is fair (3); Department provides opportunities for professional growth (2); satisfied with my salary (2).

Even though there were negative and positive responses some teachers were neither positive nor negative on some aspects, for example: knowledge of subject content beyond the curriculum (1); easy to teach CAPS (1); school science curriculum is relevant to life (5); language used in textbooks is understandable for the learners (1); lessons are always planned and are driven by objectives and outcomes (1); ability to relate lessons to learner's real life (1); using different learning aids when presenting a lesson (2); always confident of lesson presentation (1); able to create agreeable learning environment (1); inspire learners to love science (2); teaching for learners to understand (1); frequently assess learners (1); allowing learners to do research for information (1); involving parents in child's learning (3); able to capture learner's attention (1); most assessments are practical investigations (1); ability to identify learners with problems (1); prepared to ask colleagues for help (1); teaching load is fair (1); Head of Department gives necessary support (1); satisfied with my salary (2); unavailability of resources have a negative effect on learning (1); big number of learners affects learning negatively (3).

SECTION B:

4.8 Introduction

The researcher conducted interviews with the teachers (Appendix H) and with the learners (Appendix I). The interview with the teachers (Appendix H) consisted of 16 questions while that of the learners (Appendix I) consisted of 10 questions.

Structured interviews were conducted in English in a classroom at the school; the teachers and the learners were interviewed individually. The entire interview was taped using a voice recorder. After each interview the researcher listened to the tape and transcribed the whole interview which was then typed and also stored on the computer.

The data from the interviews were analysed manually to understand the participant's views and experiences as it relates to science teaching and learning. The researcher transcribed the information from the interviews, and these transcripts were then read and important categories were identified. The data were sorted and grouped according to similar codes. This was done to separate the data into workable units (McMillan & Schumacher, 2010; Thomas, 2003). The data were then scrutinized to ascertain how the codes influenced each other, and alternative explanations were searched for. This was done to describe the responses of the respondents, and patterns were sought.

4.8.1 Interviews with the learners

Interviews were conducted with two grade-12 science learners who were randomly selected from each of the four schools. Eight learners that were selected and each of them were given a letter from A to H for purposes of anonymity. Selected learners that were below the age of 18 were given consent forms so that they could be signed by their parent/guardian. The responses were categorised according to 5 themes, namely learner performance, socio-economic status, attitude towards science, medium of instruction, and parental involvement.

4.8.1.1 The learner's performances

The responses of the learners to questions 1 and 10 (appendix I) rated their performance in science as poor, and linked their poor performance to a lack of practical lessons, the science language, unfinished syllabus, the big load of work for one hour, and staying far from the school. Their responses were as follows:

Not good because we didn't do all science practical investigations, we also don't finish chapters. However we try to work hard in order to perform well

I am not good in science because I am far from school, I don't get time for evening classes. Even though I gather with other learners from other schools but it does not make any difference for me because I am not close to my teacher who can give me a clear picture about what we learn in class.

They must reduce the amount of things we learn in one hour it becomes boring and we can't concentrate.

No it is not good to me but I am trying all my best to improve my results but most science words are hard to understand and that gives me problems during tests.

From the above responses one could come to the conclusion that the time allocated to each science lesson is not enough, hence the teachers inability to cover the syllabus with the learners and this means that in order to cover the syllabus, information taught will be greater than the learner's cognitive workload because they will be required to absorb a lot of information at once. This hinders the learner from absorbing all the work, and leads to difficulty in understanding the subject, and then to poor performance (Cook, 2006:4). The responses of learners as indicated above also means that learners do not understand the science language, and they need a lot of time to grasp the scientific concepts. The learners also singled out practical investigations as an aid that might make their lessons understandable because practical investigations clarify and reinforce the scientific concepts and enhance the learner's interest (Makgato, 2007:96; Dhurumraj 2013).

4.8.1.2 The socio-economic status of the learners

Findings from question 4, 5 and 8 indicated that the leaners came from poor homes because of the fact that their parents were unable to afford extra lessons. They had to do chores after school. Their parents were uneducated.

Below are some of the learner's responses:

I do household chores when I come from school before studying.

No, they are not an affordable option for me, I use those provided by my teacher.

In my family most of my siblings are educated even though my parents are not but they are the ones that motivate me to do well.

The statements above indicate that poverty was a challenge for these students. Their parents could only afford the basic resources for school, and could not enhance their children's learning through extra lessons. This left them with the option of relying on their teachers alone and who also did not have enough time to give them extra attention that they need. Further than that at home their study time is allocated to doing chores this, according to Chinyoka and Naidu (2014:228), Yara and Otieno (2010:150) leads to poor performance even though the learners don't see it as a problem to them but research regards science as a subject that needs to be practiced constantly (Yelkpieri et al., 2012:326; Akinsolu & Fadokun, 2009; Yara & Otieno, 2010:127) .

4.8.1.3 Attitude towards science

The learner's performance is influenced by their perceptions of the subject teacher (Huges, 2014:45). If they have a good perception they acquire a positive attitude towards the subject and towards their peers (Abudu & Gbadamosi, 2014:036). The results of question 2, 3, and 9 (Appendix I) indicate that all the learners described their teachers as dedicated, humble and going the extra mile in order for them to understand the lessons. The learners also pointed out that when a teacher is dedicated, humble and goes an extra mile with their work it has a good impact on their learning. Teachers with a character mentioned above motivates the learners to do well, because they are not afraid to ask where they don't understand and they are also afraid to disappoint their teachers who have given a lot of

their time and effort in ensuring that they do well. This positive attitude from teachers also leads to positive peer relations amongst the learners which make it easy for them to form study groups. If learners are motivated and have a positive attitude even if there is no teacher the learners are able to work together. Indeed, a good relationship amongst the learners means that they are easily disciplined and they also have self-discipline. The learners also indicated that practical lessons enhance their learning positively because doing practical investigations make the lesson fun and easy. This leads to them having a positive attitude towards the subject, as indicated below:

My teacher is a humble teacher, disciplined and he motivates me, he is friendly to learners and always wants to see us successful so he has a good impact on my learning.

My relationship with my classmates is very good because we help each other while studying and we motivate each other so that we can do well. We even have formed a theme which says "Education must be a first priority, let us leave what will damage our future".

We do not have a science lab but our teacher tries to do some practical investigations and when he does, I understand what he teaches better, I wish most science work was done in practical investigations because it makes it fun and easier.

4.8.1.4 Medium of instruction versus science language

When the learners were asked to identify if there was a difference between the medium of instruction and science language, all of them stated that there was a difference. They further explained that the science language comprises of difficult terms that are hard to understand. Science terms could not be found even in a dictionary, they then indicated that this difficulty gave them a challenge in tests because at times an English word had a different meaning in science see responses below:

Yes, big difference between English and science terms. Science has difficult words which may be the same word in English but mean different thing in science and this sometimes confuses me.

Yes. Science has bombastic words you can't even find in a dictionary but I have to try to understand them because we live in a science world.

The results from the learner's questionnaires indicated that all learners use the medium of instruction (English) as a second language. Furthermore a majority of learners prefer being taught using code switching which is the language that is used by teachers according to findings of this research. Even though research by Hlabane (2014) and Setati (2011:3) regard code switching as a form of assistance to second language learners in the exams it cannot be applied. Inability to apply code switching in exams means that learners face problems in understanding the questions or expressing themselves in the tests and exams because they are not proficient in English (Zisanhi 2013) and also find the science language a challenge.

4.8.1.5 Parental involvement

The majority of responses to question 7 (Appendix I) tells that their parents/siblings were unable to assist them with their science homework because the parents did not study science at school, and also because the syllabus was no longer the same these findings go hand in hand with the findings of Mahomed (2004:4) and Kavanagh (2013:262). See responses below:

No, they are not able to because none of them studied science.

Inability of parents to assist learners with school work means that learners can only get assistance from their teachers and if they have a challenge at home no one can assist them.

4.8.2 Interviews with the teachers

All the Grade 12 science teachers were selected and interviewed from each of the four schools. Only three were able to participate in interviews instead of 8 these 3 teachers were

assigned numbers 1-3 for anonymity sake. The responses to interviews were categorised into 5 codes which includes parental involvement, the science curriculum, the medium of instruction, teaching and learning and attitudes and motivation.

4.8.2.1 Parental involvement

The responses of teachers to questions 6 and 7 (Appendix) describe the parents as involved and having a healthy relationship with them. However, they defined this involvement as limited and meaningless because most of the parents are uneducated, cannot read and write, and they do not even understand their role in their children's education. (See some of the responses below).

Parents of this area are willing to come when invited however they do not understand their role in their children's learning

No, most of the parents did not have formal education so they cannot help their children in doing their school work and some do not provide time for learner to do work after school.

The findings above characterize the majority of the parents as uneducated and unfamiliar with the syllabus and the medium of instruction. This makes it difficult for them to participate in a way that is required by the teachers. But no matter how the minimal parental involvement is, it is regarded as influential in the learner's performance (Dhurumraj, 2013:54; Makgato & Mji, 2006:262). The education level of parents only means that the parents are limited in seeing if their children have what they need for school and are there on time. Much of the burden is on teachers to assist the learners with their work.

4.8.2.2 The science curriculum

Questions 8 and 14 (Appendix I) referred to the science curriculum in respect of the issues relating to time and the change of curriculum. The results show that the teachers were mostly concerned about the time allocated to the lot of work they had to cover and the constant changing

of the curriculum which did not allow them to adapt. This left them confused (Moodley, 2013:67). These were some of their responses:

There is a lot of content to be covered and little time. The days we use for workshops and meetings or any other event during learning hours is not considered in this time.

These changes are confusing sometimes but as an educator, a life-long learner I have to adapt through research and reading more textbooks and contents.

The results above show that the teachers were not given adequate time to grasp the new curriculum and they were not adequately trained to implement it. They are rather left alone to find their own way. This raises two questions: What happens in respect of lazy teachers? What does this mean for the learners?

4.8.2.3 The medium of instruction

The findings from question 12 (Appendix I) indicate that English as the medium of instruction is a barrier to the majority of the learners, because the majority of the learners were not proficient in English. This is a challenge for them and can affect their performances negatively because they are unable to understand the examination questions, nor are they able to communicate their answers in a logical way as science requires one to grasp the concepts and be able to communicate them in writing. It also requires one to analyse the data and to make meaning from the diagrams (Hlabane, 2014:25). (See the responses below).

The language used for teaching is not understandable to most learners and this makes it difficult for them to understand exam questions because we are not expected to explain anything to them during exams.

The responses from teachers mean that the lessons are not conducted in English alone because the teachers have to explain the concepts in the learner's home language. This may even cause more confusion because some words do not even exist in the learner's home language.

4.8.2.4 Teaching and learning

For the sake of this interview the teaching and learning concepts discussed in questions 4, 5, 9, 10, 11, 13 and16 (Appendix I) were based on factors contributing to poor performance; the number of learners in a class; practical lessons; teaching methods; teaching aids; knowledge of the student's abilities and experience; and content knowledge. The teachers deemed both experience and content knowledge as important because it enables them to identify problem areas, and it also allows them to invent a strategy to unpack the subject in different ways. (See the responses below, which show that the teachers were able to use different teaching methods as required during the lesson and the individual learner).

Different methods being coordinated or being determined by the lesson and learners potential at that time method are changed frequently to cater for the individual differences.

Both because knowledge enables me to unpack the lesson in a way that students understand and experience enables me to identify where learners lack and be able to assist them.

Even though the teachers were able to identify the needs of individual learners, the lack of resources hindered them from using different teaching aids. They were limited to only charts and could not even do practical investigations which they regard as a tool that consolidates the theory and makes the lessons interesting. (See below).

Wall charts and I believe they assist to improve learner performance as they (charts) simulate the real life situation. I cannot even do practical investigations for my learners because we don't have necessary aids.

Practical investigations and they are so useful as they consolidate the theory learnt in class in making the lesson more meaningful.

The responses above mean that the lessons are limited to theory only. However, because they have small numbers in their classes they use constructivism to make the lessons interesting. Even though they were able to use constructivism to make lessons interesting they described factors such as a lack of motivation, a lack of parental involvement, the medium of instruction, poverty, the lack of studying and absenteeism as hindrances to their teaching.

4.8.2.5 Attitudes and motivation

The teacher's responses depict that the learners, especially the girls, consider science as an abstract subject and they have a negative attitude towards it. (See the responses to question 2 (Appendix I))

Boys are well motivated and have a positive attitude towards science they perform better, girls have a negative attitude towards science and this results in poor performance.

Most learners look at science as a difficult and abstract subject and this leads to poor performance in class since they become afraid to take chances and make initiative in the subject.

The responses above mean gender may have a negative impact to performance of female learners. If the majority of the learners have a negative attitude towards science they will not perform well because it is only a positive attitude that brings about good performance. The results show that it is not the learners only who are not motivated in class but the teachers also lack motivation because of the nature of the environment they teach in.The environment where they are teaching has many challenges, such as demotivated learners, a lack of resources, and low wages (Mbajiorgu et al., 2014:139; Vassalo, 2014:105; Muzah, 2011:199). (See the responses to questions 3 and 15 (Appendix I) below).

Only few learners are motivated, it is not easy to motivate somebody who is not motivated internally

No, not exactly because everything here needs to be a lot of effort. There is lack of resources and one cannot be innovative enough when teaching science, and we get paid peanuts for such a difficult job.

4.9 Discussion of the results

The factors that were investigated in this research include gender, age, early parenting by learners, medium of instruction, the training of the educators and science subject content, teaching methods, resources, absenteeism, parental involvement, class size, motivation, the science curriculum, the teacher's attitudes, the learner's attitudes, the location of the school, and the socio-economic backgrounds of the learners. These factors were investigated in different aspects in order to establish if they contribute towards the poor performance of the learners in science in the Ingwavuma Circuit.

The factors that were seen as contributing to the poor performance of the learners are discussed below.

4.9.1 The science curriculum

The concept of 'curriculum' may have different meanings. For the purpose of this study a *curriculum* is defined as "a document, a syllabus, a process for developing a plan, the plan and the execution, a system and structure of a defined discipline" (Moore, 2015).

A variety of aspects were investigated in relation to the curriculum. The findings indicated that changes in the curriculum, the time allocated for each topic, and assessment methods were the factors contributing to the learner's poor performance.

4.9.1.1 Changes in the curriculum

Curriculum change is an international practice and is done to adapt to changes in the society (Moodley, 2013:201). Findings of this research show that both the learners (Table 4.6) and the teachers are affected by curriculum change. The teachers in their responses argued that changes in the curriculum do not allow them time to adapt. It happens in a fast pace and this leaves them confused (Moodley, 2013:67). The curriculum change is imposed on the teachers as they are not directly involved during the curriculum change process (Moodley, 2013:21; Mouton et al., 2012:1214). The teachers also stated in their responses that they do not receive adequate training when a new curriculum is introduced. They have to navigate through the curriculum by themselves even when they have challenges.

With regards to this issue this is how the teachers responded in the interviews.

Teacher 1*: Some changes need time but we are coping.*

Teacher 2: *These changes are confusing sometimes but as an educator, a life-long learner I have to adapt through research and reading more textbooks and content.*

Teacher 3: *I am currently getting used to these changes but need more guidance in order to be able to implement this curriculum in confidence.*

This means that some teachers who cannot make it their responsibility to be informed about the new curriculum end up being not well informed. This can lead to them not teaching in a manner that is required, and to them not covering all the topics introduced in the new curriculum. The results from the interviews with the teachers also indicate that the teachers relate changes in the curriculum to teaching experience, which they regard as an important factor that enables them to choose effective teaching methods that matches with leaner needs and a tool that allows them to identify strategies to assist learners with needs. The teachers argue that changes in the curriculum require for them to adapt to new strategies. Hence teaching experience can only be considered as a number of years and not as contributing to effective teaching. Therefore the changing of the curriculum affects the most teachers negatively. If teachers are affected negatively by curriculum change this will also have a negative impact on learners, because teaching and learning is an interaction

between a learner and a curriculum facilitated by a teacher (Fosnot, 1993). The findings of this research correlate with the findings by Moodley (2013:100), namely that teachers are not adequately trained in respect of the new curriculum before it is implemented and this leaves most of the teachers confused and demotivated. Hence changes in the curriculum can be identified as a factor that has a negative impact on the learners' performance in science.

4.9.1.2 Time allocated for each topic

Time allocation is done in a realistic manner for grades 7-9 but for grades 4-6 it is not practical and realistic (CAPS 2011:9). The findings of this research show that teachers find it difficult to teach prescribed work in the allocated time which is one hour per lesson as it required them to cover a lot of work (Table 4.9 and interviews) .Their responses were as follows:

Teacher 1: *No. There is a lot of content to be covered and little time. The days we use for workshops and meetings or any other event during learning hours is not considered in this time.*

Teacher 3: *No, there is a lot of work and little time allocated.*

Learner's responses for interviews also correlate with teachers responses as they stated that a big load of work covered in one hour and an unfinished syllabus lead to learner's poor performance.

This is how a number of them responded when asked what should be done to improve their learning.

Learner E: *There must be extra lessons and practical investigations and teachers should make science fun. They must reduce the amount of things we learn in one hour it becomes boring and we can't concentrate.*

Learner F: *The teachers must make us love science and they must teach us how to absorb all this work in a short time. They must teach us how to remember all this work because at times I forget some of the things.*

Learner G: *Science have a lot of work if teachers can teach us how to absorb all that work and be able to remember it in exams then we can improve. Otherwise our teachers are putting all effort in making sure that we understand it is just that there is too much work.*

Learner H: *Experiments and extra classes are a way to go. And a way of reducing that work that we do in one hour.*

The findings above mean that both the teachers and the learners are not coping with the load of work covered in one hour. The results above also mean that the allocation of time for this subject is not done realistically as the teachers end up not covering the syllabus.

Other researchers say that the learners are being overwhelmed by information in a short period of time, this results in poor performance because the working memory can only process a few new elements and can be stored for a short period of time (Anthony & Artino, 2008; Merrienboer & Sweller, 2005:148; Kirschner et al., 2009). Successful learning is determined by the ability of the working memory to process new information and stores it in schemas so that more space can be made available for new information (Anthony & Artino, 2008).

The time allocated for each science subject can therefore be considered as contributing to poor performance, because this means teachers have to rush to cover the syllabus and leaners will be left behind without understanding the work taught. If they teach for learners to understand work rather than to cover the syllabus then a lot of time will be lost and they will not cover the syllabus.

4.9.1.3 Assessment methods

The findings show that science is not assessed by practical investigations, because the responses from both learner questionnaires (Table 4.3) and teacher questionnaires (Table 4.5) indicate that there are no science labs. Lack of science labs result in science being assessed only theoretically. This is how learners responded regarding practical investigations:

Learner D: *No, I don't because we never done practical investigations at school.*

Learner E: *Yes, I think so but we don't do them at school we have no science lab.*

However, some teachers indicated that they did do practical investigations in interview responses. That means they did practical investigations theoretically since there were no science labs at their schools.

In the absence of practical activities science learners may not be stimulated in a way that enables them to extract knowledge from their physical surroundings and they will not be able to work with empirical data (Muzah, 2011:197), hence they perform poorly in science. The absence of practical investigations also disadvantages learners because exams always have a portion of practical questions. Even improvising in this case does not assist because in exams only original science material are tested on and improvising material are not used. So if the learner has never seen that kind of material they struggle to answer questions based on practical investigations.

4.9.1.4 The teacher's teaching load

The findings of this research show that science teachers have a big load of work to do (Table 4.9) science by its nature requires a lot of time because teachers have to also give extra lessons to learners as there is little time allocated for this subject and they also have to prepare for practical investigations. However, teachers also teach subjects other than

science (Table 4.7). This means that the teacher has to allocate time amongst different subjects for lesson preparation and cannot concentrate fully on his/her science learners and this result in poor performance of learners.

Yelkipieri et al. (2012:326), in their findings reinstate the above findings when they describe mathematics and science as subjects that require constant practicing. This means a lot of work should be given to learners and in order for that work to be regarded as effective to learners. Science has to be assessed regularly and constructive feedback be given to learners so that they see where they lack, but from the findings above which state that teachers are overloaded, constant practice that is constructively assessed by teachers themselves is impossible. Inability to assess science regularly and lack of constructive feedback means the learners may continue to the next chapter without even knowing how to improve where they lack which might result in poor them performing poorly.

4.9.2 Resources

Research results (Table 4.5) in the learner's questionnaire and (Table 4.8) in the teachers' questionnaire indicate that a great challenge exists when it comes to the resources in the schools. This makes it difficult for a teacher to be innovative. It also makes it difficult for the learners to do research or even to study beyond what is done in the classroom.

Teachers had the following comments about resources.

Teacher 2: *Wall charts and I believe they assist to improve learner performance as they (charts) simulate the real life situation. I cannot even do practical investigations for my learners because we don't have necessary aids.*

Teacher 3: *I use only wall chart, I would like to use DVDs but because of lack of `resources at school I am unable to. This makes teaching science abstract.*

The results of this study confirm the findings by Mwenda et al. (2013:93), Muwanga-Zake (2000), Makgato and Mji (2006), Amukowa (2013:105) and Mwaba (2011:33) who found that the lack of resources such as textbooks, physical infrastructure, teachers and laboratory equipment have led to the learner's poor performance. Even though Mwenda et al. (2013:98), Muwanga-Zake (2000), Makgato and Mji (2006), Amukowa (2013:105), and Mwaba (2011:33) said that a lack of resources lead to the loss of interest in the subject, in this research the learners rated science as an interesting subject (Table 4.4) and the teachers indicated that they were able to capture the learner's interest (Table 4.9) despite the lack of resources.

The question is, how do they make science interesting and how do they capture the learner's interest?

4.9.3 The educator's training and science content knowledge

The results of teacher questionnaire show that most of the science teachers have only a limited number of years' experience in teaching both sciences in general and grade 12 science (Table 4.7). The findings also show that most science teacher's level of education is limited to a teaching diploma (Table 4.7). Only one teacher has a science academic qualification (Table 4.7). Even though the results above indicate that the teachers are professionally qualified it is still a fact that most of their qualifications are at entry level. This may affect the performance of the learners. Spaull (2013:24) says that, "The quality of education cannot exceed the quality of a teacher".

Even though the findings show that the majority of the teachers had science as a major subject for their professional qualifications this according to Ball et al. (2008), says that teachers with only diplomas in education know common content knowledge which they only had to know in order to teach. Whereas he categorised teachers with higher degrees and academic qualifications in science as having specialized content knowledge curriculum

needs beyond which enables teachers to explain complex content to learners. See the Model of Shulman's content category scheme.

4.9.4 Medium of instruction

The responses from the learner's questionnaires indicate that the learners experienced problems with the language of instruction. Most of them preferred their home language and English as a teaching language. They also emphasized this in the interviews where they identified the science language and English as different languages. The learners furthermore stated that science was a difficult subject to understand in the absence of a teacher when they try to study alone.

Learner B: *Yes, there is a difference even though it's hard I do understand some of the words, but they are easily forgettable.*

Learner C: *Yes, there is with the teacher explaining I do understand but in tests I do get a challenge.*

Learner D: *Yes, big difference. Science has difficult words which may be the same word in English but mean different thing in science and this sometimes confuses me.*

Learner E: *Yes, Science has bombastic words you can't even find in a dictionary but I have to try to understand them because we live in a science world.*

Learner F: *Yes, I try to understand even its hard.*

Learner G: *Yes, science language is hard for me but have to study hard to understand it.*

The findings of this study correlate with the findings by Setati (2011:2) and Zisanhi (2013) who identified that second language learners had a challenge with English. This lack of proficiency in English means that these learners are unable to express their ideas or the concepts. It means that in the exams they have challenges since nobody explains to them where things are unclear. In their responses the teachers also identified the medium of instruction as a challenge for their learners (see below).

Teacher 1: *It affects learners a lot, but it must not be changed because we don't have science words in our home language e.g. acceleration, velocity, voltage and this might confuse learners. Even when I try code switching there are words that I cannot explain in Zulu and I can see that this leaves my learners very confused science language must be taught.*

Teacher 2: *Language (English) is a learning barrier as most learners are struggling to understand it. It prevents them to receive the whole content of the lesson. Let alone the science language.*

Teacher 3: *The language used for teaching is not understandable to most learners and this makes it difficult for them to understand exam questions because we are not expected to explain anything to them during exams.*

The responses above make it clear that the learners often do not understand the science language and have a challenge with English. This means they are not able to perform well in tests and the exams.

4.9.5 Parental involvement

The section on parental involvement is categorized into different categories, namely parenting, communication, volunteering, learning at home, decision-making and collaborating with the community (Epstein, 1996). The results from the interviews with the teachers, and the learners and the learner's questionnaires indicate that parental involvement in Ingwavuma is limited to their only attending parent's meetings. They cannot assist their children with their homework (Figure 4.10; Table 4.6) simply because they do not understand the syllabus. This means that they do not know where and how to assist the children.

The responses of the teachers and students in interviews were as follows:

Teacher 1: *No, only parents who ensure that learners are at school studying during study time after school*

Teacher 2: *No, most of the parents did not have formal education so they cannot help their children in doing their school work and some do not provide time for learner to do work after school.*

Teacher 3: *Only a few parents are educated and most do not even know how to read and write and therefore cannot assist their children with schoolwork.*

Attendance of school meetings by parents show that the parents do support the education of their learners but cannot do more than that because they are not equipped to do so .Limitation of their support on the learning of their children according to the theory of overlapping spheres is caused by characteristics, philosophies and practices of the family (Kgaffe, 2001:135; Mahomed, 2004:4; Makgato & Mji, 2006:263). Results from the interviews and the questionnaires, mean that the parent's contribution is limited in respect of their child's education. Research makes it clear that parental involvement in teaching and learning plays an important role in the children's academic performance (Dhurumraj, 2013:54; Makgato & Mji, 2006:262; Lemmer, 2007:218; Sanders & Epstein, 1998:33). This leads to poor performance because it means at home the children cannot be assisted educationally.

4.9.6 Socio-economic background of the learners

Poverty is defined as "the extent to which an individual does without resources, resources being: financial, emotional, spiritual, physical resources, support system, relationships, role models and knowledge of hidden rules"(Lacour & Tissington, 2011:522). The results from the questionnaires and the interviews show that most learners come from under-resourced homes with uneducated parents (Table 4.1; see the responses in the interviews with the teachers and the learners).

Learner C: *We are below middle-class, we are not financially viable. This result in inability to afford some schooling material needed for my education.*

The research findings also show that the parents of the learners cannot afford any other assistance except that of the teacher. This is caused by a lack of financial resources.

Learner A: *No, they are not an affordable option for me; I have best science teachers in my school who give me enough knowledge.*

Learner B: *No, I am assisted by other people who studied science.*

Learner C: *No, I ask for assistance from my teacher.*

Learner D: *No, I haven't done extra lessons in science subjects outside school.*

Learner E: *No, they are not an affordable option for me, I use those provided by my teacher.*

Learner F: *No.*

Learner G: *My teacher is always there to assist me.*

Learner H: *No, I am assisted by my teacher.*

This kind of economic background means that learners are disadvantaged in many ways. They cannot afford extra study material nor extra lessons and because of space at their homes they cannot even interact with peers. According to the teacher's interview responses this discourages the learners because they are unable to enhance their learning outside the school and hence they lose interest in learning. Inability to afford extra lesson outside school hours also means that if the teacher is not available for extra lessons then the learners only get education during school hours and not more than that and this can contribute to poor performance. The findings of this research correlate with the findings by Villanueva (2010:23) and Howie (2003:10) which state that students from poor homes are more likely to perform poorly in science subjects. This is because they cannot afford other learning aids such as extra classes and textbooks other than those provided by the school (Dhurumraj, 2013:62; Amukowa, 2013:97).

4.9.7 Motivation

The results from the interviews and the questionnaires (Table 4.9) show that most teachers lack motivation. Teachers are affected by both institutional internal factors and external factors from the department of educations. See responses below:

Teacher 1: *No, not exactly because everything here needs to be a lot of effort. There is lack of resources and one cannot be innovative enough when teaching science, and we get paid peanuts for such a difficult job.*

Teacher 3: *Partly motivated, availability of resources and a better salary can make me fully motivated.*

The responses above indicate that the science teachers of Ingwavuma are faced with a lot of challenges when it comes to teaching science, which results in them having to exert a lot of effort. The effort they put in is not supported by the Department in forms of salaries or support for professional development (Table 4.9), if a teacher develops him/ herself it becomes their own business.

According to Lebata (2014:80), science subjects need a lot of passion on behalf of the teachers. They have to make the time to guide the learners through the challenging concepts of science which are seen as difficult, boring and irrelevant. The teachers have to make the subject interesting. However, the results above show that most science educators have lost their passion for the subject. This is due to the lack of growth opportunities in the education sector, low salaries, poor working conditions, work overload, cultural barriers between them and learners, lack of recognition, communication barriers between them and learners, lack of mutual cooperation between teachers and learners. These results of this research are similar to the findings by Mbajiorgu et al. (2014:139), Vassallo (2014:105) and Muzah (2011:199). The abovementioned challenges lead to the teachers being dissatisfied with

their jobs. This can lead to the high rate of absenteeism in the teachers, an increase in emotional disorders, and in leaving the profession (Vassallo, 2014:105). Absence of teachers and having teachers leave the department can affect teaching and learning. When the teacher is absent the learners fall behind with their work. When the teachers leave the profession there will be a shortage of science teachers.

4.10 Conclusion

This chapter presented the data, and the analysis of responses from the teacher's and the learner's questionnaires and the interviews with the teachers and the learners were presented. Only those factors that were regarded as having a negative impact were discussed in detail. The findings in this chapter were also compared with research done previously.

The research findings in this study produced similar results as research done previously by other researchers but in a different context. However, the findings of this study are related to teaching and learning of science at the Ingwavuma Circuit.

In the next chapter a summary of the findings will be presented. Recommendations from the study and for future research will be suggested.

CHAPTER 5

FINDINGS, LIMITATIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter the researcher presents a summary of the findings. She furthermore discusses the limitations of the study and includes recommendations from the study in relation to the improvement of the learner's performance in the science subjects. The chapter also recommends further research that can be done in respect of the poor performance of learners in the science subject in the rural areas.

5.2 Summary of the findings

This study explored the factors leading to the learners' poor performance in the science subject at the Ingwavuma Circuit.

It sought to answer the question "What are the factors that cause poor performance in science subject at Ingwavuma circuit?"

The investigation was done because science is regarded as a subject that is in demand in respect of our global wealth and economic development (Laugksch 1999:86; Muzah, 2011:1). Learners in the Ingwavuma Circuit regard this subject as very difficult and also perform poorly. This made the need to discover factors behind their poor performance a very important exercise. Remedial measures by the Department, which include school visits by the departmental officials, and extra classes and winter schools, have been nothing but a futile exercise, as the learner's marks continued to be poor. This shows that the root cause of the learner's poor performance in the science subjects at the Ingwavuma Circuit has not been identified by the officials.

Research findings have identified school-based factors (the availability and the use of teaching/ learning facilities), socio-economic factors (the education level of the parents and their economic

status), student factors (entry behavior, motivation and attitude), the school type, and teacher characteristics as factors that contribute to poor performance in the science subjects (Kibet et al., 2012:87; Makgato & Mji, 2006; Amukowa, 2013; Mwaba, 2011:2).

When the research findings were analysed it became clear that this topic has mostly been covered outside the country. Very little research has been done in South Africa. Furthermore, the findings suggest that if the abovementioned factors were addressed they have not been addressed efficiently. We are still facing the challenge of the learners' poor performance in the science subjects. Otherwise, there may other factors that have not yet been identified that affect the students' performance. This may be because in schools in the Ingwavuma Circuit that lacks resources in the one year you may find the school performing well and in the next year you may find the same school not performing at all.

The main findings as indicated in section 4.5 aimed to answer the research question, "What are the factors that cause the learners' poor performance in the science subjects at the Ingwavuma Circuit?" The major factors that were discovered to be the cause of the learners' poor performance were, curriculum factors (changes in the curriculum), school factors (the time allocated for each science topic, the teachers' teaching load, the lack of resources, the medium of instruction,), teacher characteristics (the teachers' lack of specialized content, motivation), socio-economic factors (parental involvement, poverty)and minor factors were learner factors (absenteeism, early parenthood by lelearners, gender).

5.2.1 Curriculum Factors

5.2.1.1 Changes in the curriculum

The research revealed that changes in the curriculum interfere with the teaching experience of the teacher because each and every new curriculum has specific teaching strategies. Teaching experience is also an important factor that enables teachers to choose the effective teaching methods that match the leaners' needs, and are tools that allow them to identify strategies to assist the learners with special needs. Every time a new curriculum is introduced the teachers have to adapt to new strategies. Hence, experience can only be considered as a number of years

and not as contributing to effective teaching. This study regards changes in the curriculum as having a negative impact on teachers, whether they agree with it or not. In reality, new topics are introduced and you cannot teach the new curriculum in the previous manner. If the teachers are affected negatively by changes in the curriculum this will also have a negative impact on the learners, because teaching and learning is an interaction between a learner and a curriculum facilitated by a teacher (Fosnot, 1993). The findings of this research mentioned above correlate with the findings by Moodley (2013:100) who said that the teachers are not adequately trained in respect of the new curriculum. This leaves teachers confused and demotivated, because implemening the new curriculum requires thorough training about the effective methods to disseminate information to learners effectively. If teachers cannot disseminate the information in the curriculum effectively to learners, learners may perform poorly.

5.2.2. School factors

5.2.2.1. Time allocation

The results from this study indicate that the time allocated to teach and learn science is not enough. The teachers stated that science concepts needed more time to be explained. While, on the other hand, the learners complained that they needed more time to grasp all the information. This simply means that one hour per day is not enough to teach all the abstract science knowledge. These findings take us back to the Cognitive Load Theory which states that being overwhelmed by information in a short period of time results in unsuccessful learning, because the working memory can only process a few new elements and can store them for a short period of time only (Anthony & Artino, 2008; Merrienboer & Sweller, 2005:148; Kirschner et al., 2009). Successful learning is determined by the ability of the working memory to process new information and to store it in schemas so that more space can be made available for new information (Anthony & Artino, 2008).

5.2.2.2. Assessment methods

The study indicated that science is being assessed theoretically. Even the experiments are done theoretically. This means that learners do not interact with the scientific material and are not

allowed to discover the concepts by themselves. They do not do experiments. This means that science loses it exciting nature, and hence bores the learners (Muzah, 2011:197). This also suggests that learners would struggle with the section that tests experiments in the exams because they have never seen the material and have never done that experiment. The learners in this study also emphasized that experiments make it easier for them to grasp certain concepts and assessing science theoretically means that they are robbed of that chance.

5.2.2.3 The teachers' teaching load

The results from this study indicated that the teachers at the Ingwavuma Circuit are overloaded; they not only teach science but also other subjects. This suggests that these teachers need a lot of time to prepare, and have little time to assist the learners with extra classes. This leaves the teacher overworked because science needs a lot of practice. This indicates that the learners should be assessed regularly (Yelkpieri et al., 2012:326). They should be given constructive feedback so that they see where they experience problems. From the findings above, which state that the teachers are overloaded, constant practice that is constructively assessed by the teachers is sometimes impossible. The lack of constructive feedback means that the learners are unable to see what work they lack in or get adequate time to practice what they have learnt. This has an effect on their performance.

5.2.2.4 Resources

This research indicated that the learners of the Ingwavuma Circuit lack the necessary resources to aid them in their studies. These resources range from resources at home and at school. Nowadays the social media, TV and radios broadcast academic programs which may assist the learners in their work. However, the majority of the learners in the Ingwavuma Circuit do not have these resources at home, meaning they only interact with academic matter at school. The schools also often lack resources such as individual textbooks for the learners, and science laboratories. This poses a threat to successful learning because it limits the written work as teachers cannot give homework because the learners have to share books (Onwu, 1999). It also means that the subject is theorized and no practical investigations are done. Muzah (2011:192),

Makgato (2007:96) and Dhurumraj (2013) believe that the availability of practical lessons clarifies and reinforces the scientific concepts. Practical investigations further enhances the leaner's interest in science, increases their manipulative skills, it makes the subject relevant, it helps them to acquire skills and promotes discipline towards learning and it also helps them to solve problems. However, this subject continues to be teacher-centered and instructed in a talk- and chalk-method which bores and demotivates the students, leading to their poor performance (Onwu, 1999; Lebata, 2014:80). Thus, the learners in the Ingwavuma Circuit have limited contact with science, and lack the necessary skills of solving problems which they can acquire during practical lessons.

5.2.2.5 Medium of instruction

The vocabulary of science and English are identified as different languages. The learners in the Ingwavuma Circuit have a challenge with these two languages because they prefer being taught by means of code switching. Exams and tests are written using both English and science languages and during assessment no code switching is done. This disadvantages the learners because they may not understand the questions nor be able to express themselves efficiently. Science is a subject that requires one to grasp the concepts and be able to communicate them in writing. It also requires one to analyse data from diagrams and communicate them in words, and to know the theories and be able to apply them (Hlabane, 2014:25). Therefore, a lack of proficiency in English also results in the learners being unable to communicate their ideas (Setati, 2011:26; Hlabane, 2014:14).

5.2.3 Teacher characteristics

5.2.3.1 The educator's lack of specialized content

The findings from this study indicate that the teachers in the Ingwavuma Circuit only have knowledge limited to teaching the syllabus and hence cannot extend their clarification further to the children rather than what is in the syllabus. Such a lack of specialized content knowledge is a disadvantage.

5.2.3.2 Motivation

The teachers in the Ingwavuma Circuit are faced with many challenges when it comes to teaching science which results in them working overtime. The department does not recognise this dedication and effort in a form of salaries or by supporting teachers towards professional development. Research shows that teacher motivation is very important towards the academic achievements of the learners as it motivates the learners, because a motivated teacher has a passion for his/her job (Mart, 2013:438; Chux et al., 2013:838; Makgato, 2007:99). According to Lebata (2014:80), the science subjects need a lot of passion and dedication from the teachers as they should take their time in guiding learners through challenging concepts of science which are seen as difficult, boring and irrelevant and they should make them interesting However, the results of this research show that science educators have lost passion for the subject. Teachers have lost passion for teaching science due to lack of growth opportunities in the education sector, low salaries, poor working conditions, work overload, cultural barriers, lack of recognition, communication barriers, lack of mutual cooperation. The results of this research are similar to the findings by Mbajiorgu et al. (2014:139), Vassallo (2014:105), and Muzah (2011:199).Lack of motivation from teachers can result in the learners becoming demotivated and losing interest in the subject, and hence perform poorly in science subjects.

5.2.4 Socio-economic factors

5.2.4.1 Parental involvement

Parental involvement in the Ingwavuma Circuit is limited because the parents only attend parent meetings. They cannot to assist their children with their schoolwork (Figure 4.19; Table 4.5) because they are not understand the syllabus and this leaves them not knowing where to assist. Results about parental involvement show that the community in the Ingwavuma Circuit do share a common goal with their schools but are their involvement in the schools is limited by factors which are characterized as characteristics, philosophies and practices of the family see the theory of overlapping spheres(Kgaffe, 2001:135; Mahomed, 2004:4; Makgato & Mji, 2006:263) . This limitation of parental involvement has a negative effect on a learner’s education.

5.2.4.2 Poverty

Many of the learners in Ingwavuma Circuit live in overcrowded homes, with very few resources. Their parents are uneducated and unemployed. These findings of this research confirm the findings from previous research which state that poor parents have little or no education (Chinyoka & Naidu, 2014:223). This results in parents being unable to assist their children with schoolwork. Research by Chinyoka & Naidu (2014:228) and Wadesango et al., (2011:150) also show that poor homes are usually overcrowded, with the same sexes sharing a room. This can result in the learners not having adequate space to study or to do their homework nor interact with their peers at home in relation to school work. The learners often can only afford the basic schooling material and nothing more. The learners cannot be helped by their parents, nor can their parents afford tutors for extra lessons when they struggle. The only chance they have for learning is at school which is of limited hours. Therefore poverty contributes negatively towards their performance.

5.2.5 Learner factors

5.2.5.1 Absenteeism

Results show that only a few learners absent themselves from school. Even though they may be a few, but this has a negative impact on their performance. When learners are absent teaching and learning continues and this results in absent learners being left out and they lack the knowledge that was taught during their absence (Muzah 2011:200, Cho et all, 2012:169)

5.2.5.2 Early parenthood by learners

This study shows that a minority of learners get pregnant during matric. Even though pregnancy affect a minority, it may have a negative impact on their teaching and learning. A learner who is a parent is required to take care of a child and also study, this can result in study time being reduced as the learner plays a parental role. Less time spent on studying compromises the quality of a learner's performance.

5.2.5.3 Gender

The majority of learners in science classes are girls. Teacher's responses in the study indicated that girls experienced difficulties during science lessons because they are afraid to ask questions and they also see science as an abstract subject. This has a negative impact on their performance.

5.3 Limitations of the study

Even though the findings answered the research questions, the study had limitations. It included the sample size, the research tools and the components that were investigated in the Department of Education were not varied.

The study was done in only four schools, which is a small number of high schools in the Ingwavuma Circuit. Only a limited number of educators participated in the study. These limitations were due to the researcher's time constraints, budget constraints, and the vastness of the area.

The study only investigated the school component, namely the teachers and learners. It did not involve other components of the Department, such as the district curriculum component which includes the subject specialists and the subject advisors. Therefore information that was gathered was only from the school perspective and lacks information from science subject specialists

5.4 Recommendations from the study

- When a new curriculum is going to be introduced, the teachers should be trained on how to disseminate it through courses that include training on the content, teaching style, approach and the learning material to be used. The courses should be made compulsory and be part of the department of education's policy. The courses should be implemented a year in advance before the actual curriculum change takes place. This will allow the teachers to be able to meet the objectives of the new curriculum. Efficient training of

teachers before the implementation of the curriculum will mean that the learners will get the quality education in terms of the curriculum.

- The teachers should be trained on methods that should be applied to teach in a manner that matches the cognitive load of science learners, teachers should also be provided with material that enables them to teach in a manner that matches a learner's cognitive load. The ability of teachers to teach in a manner that reduces the cognitive load of a learner will enable the learners to grasp all the concepts and content taught in one hour effectively and hence improve their performance in science.
- Science teachers should only be given science subjects that they specialized with during their training. Their workload should be given in consideration to the time they need to prepare thoroughly for the science lessons. The workload should also be given in consideration to the time they need to assess the subject continuously and effectively. If teachers get adequate time to assess learners they will be able to know where individual learners lack then they will be able to use diagnostic assessments to improve the performance of learners.
- The Department should outsource funds and partner with non-government organization in order to build science laboratories and library centers, tutors and lab technicians should be stationed in each circuit or district. Subject specialists and advisors that are currently in district offices should be used as technicians and tutors and they should be stationed at the science laboratories. This will cut the costs of purchasing science material for individual schools. The department of education should then formulate policies on how the center operates ensuring that all schools are catered for. The centers should also work as centers for tutors where other teachers can be used to assist learners with work. This will assist in performing of practical work or teaching of extra work. It will also minimise the costs of building individual science labs in schools.
- Tertiary institutions should include the actual subject content that the teacher will be specializing in during the teacher training modules for the first 3 years then the fourth year be training on teaching methods. This means that science teachers should do B.Sc. in their first 3 years. This will equip the science teachers with extensive science teaching knowledge and hence contribute towards the learners' improved performance in science.

- Science literature/ language should be included as a subject as early as in the GET phase. Knowledge of science language in the early stages of schooling will assist the learners in grasping the scientific concepts as they will no longer struggle with neither the scientific terminology nor struggle with understanding questions. The learners will be able to express themselves using science terms and this will improve their performance in science.
- The Department of Education should have a program that allows parents to be involved academically in the schools, such as academic committees that assist in actual teaching and learning. The teachers should be trained how to involve the parents academically.
- The science teachers in the rural areas should receive incentives. This will not only motivate them but will also attract other good science teachers from the urban areas to teach science in the rural areas. Science teachers should also be given bursaries to further their studies part time and should have their salary notch raised as they improve their qualifications. The Department should recruit science teachers from science faculties and give them bursaries to enroll for post graduate certificate in education (PGCE). This will lead to employment of good science teachers in the department of education.

5.5 Recommendations for further research

- Do research on the involvement of subject specialists and advisors in improving science results.
- Do research on the designing of science teaching and learning material that follows the Cognitive Load Theory and how to utilize the material for learners of different cognitive abilities.
- Do research on the tertiary curriculum for science educators in order to improve on the content they should be trained for.
- Do research about developing a relevant and effective science curriculum.

- Do research on the role that can be played by NGO's towards the involvement of the parents in academic activities and working hand in hand with schools to improve science performance.

5.6 Concluding remarks

This study explored factors resulting in the poor performance in the science subjects at the Ingwavuma Circuit.

It sought to answer the question "What are the factors that cause poor performance in science subjects at Ingwavuma circuit?"

The factors that were indicated to be the cause of the learners' poor performance in Ingwavuma Circuit were namely: changes in the curriculum, the time allocated for each science topic, the teacher's teaching load, the lack of resources, the lack of specialized subject content in educators, the medium of instruction, parental involvement, poverty and motivation.

However, this does not mean that these are the only factors. There may be many other factors that may cause such poor performances. The recommendations made in this study should be used by all components of the Department of Education in order to improve the learners' performance in the science subjects.

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APPENDIX A: Letter to the KwaZulu-Natal Department of Education

P O BOX 285
Ubombo 3970
14 August 2015

Head of the KwaZulu-Natal Department of Education

Dear: Dr. Sishi

REQUEST TO CONDUCT RESEARCH IN SELECTED SCHOOLS IN INGWAVUMA CIRCUIT FOR M.ED. DEGREE

My name is Mbalenhle Ngema I am doing research with my supervisor Prof AT Motlhabane, an associate professor in the Department of Science and Technology Education towards an MED in Natural Science Education at the University of South Africa.

I hereby wish to request your permission to conduct research in schools in Ingwavuma circuit. The aim of the study is to investigate the factors that cause poor performances in science subjects at Ingwavuma circuit.

The broad question defining the research is:

- What are the factors that cause poor performances in science subjects at Ingwavuma circuit?

If you decide to grant permission for this research to be done in this department, the following information is vital:
The research will take place during formal schooling hours preferably during the extra mural activity time because all identified learners and teachers need to participate for valid results to be obtained. Interviews and questionnaires will be used to collect data. The date will be used solely to compile the dissertation for the Master of Education with specialization in Natural Science Education degree. The dissertation will therefore be read by examiners and the academic community. The findings will also be used for publication in academic journals and for presentation at academic conferences.

I will follow the University of South Africa research ethics regulations and will use the information for the purposes of this study only. Participation is voluntary, teachers and learners may withdraw their participation at any stage during the research process, prior to the reporting of the findings for the project.

Also note that your name, the name of your institution and other participants' names will be withheld in the reporting of the data. No information shared will be disclosed to members of staff at the University in a way that will allow them to identify the name of the institution which participated in the research. As such, confidentiality and anonymity will be guaranteed. If you will agree to participate in this research, please sign this letter as a declaration of your consent.

PARTICIPANT (HEAD OF KWAZULU NATAL DEPARTMENT OF EDUCATION)	…… .....
SIGNATURE:	.....
DATE:	.....
RESEARCHER'S SIGNATURE:	.....
DATE:	.....

Furthermore, to collect research data it is sometimes necessary to use a voice recorder so that no important information is lost before it can be captured and reported. Again, these recordings will only be used for the purpose of this research and not for any other purposes. If you agree to the use of such devices during the research process at your school, please sign the second acknowledgement of your consent to the use of these recorders below:

PARTICIPANT' (HEAD OF KWAZULU-NATAL DEPARTMENT OF EDUCATION)	…… .....
SIGNATURE:	.....
DATE:	.....
RESEARCHER'S SIGNATURE:	.....
DATE:	.....

Should you have any questions about the research and/ or the contents of this letter, please do not hesitate to contact me for further information.

Yours Faithfully,

Mbalenhle Happiness Ngema

0722497399 mbalenhlengema@gmail.com

APPENDIX B Letter to parents

Dear Parent

Your child is invited to participate in a study entitled: Factors that causes poor performance in science subjects at Ingwavuma circuit. I am undertaking this study as part of my masters research at the University of South Africa. The purpose of the study is to identify factors that are the root cause of poor performance in science subjects and the possible benefits of the study are to contribute to policy development, educator development and future research with the aim of improving the performance in the school and also to provide recommendations on how to improve the performance in science subjects. I am asking permission to include your child in this study because he/she is doing science subjects in grade 12. I expect to have all other children in his/ her class to participate in the study.

If you allow your child to participate, I shall request him/her to:

- Take part in a survey
- Take part in an interview

Any information that is obtained in connection with this study and can be identified with your child will remain confidential and will only be disclosed with your permission. His or her response will not be linked to his or her name or your name or the school's name in any written or verbal report based on this study. Such report will be used for research purposes only.

There are no foreseeable risks to your child by participating in the study. Your child will receive no direct benefit from participating in the study; however, the possible benefits to education are to contribute to policy development, educator development and future research with the aim of improving the performance in the school. The study will also provide recommendations on how to improve the performance in science subjects. Neither your child nor you will receive any type of payment for participating in this study.

Your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly you can agree to allow your child to be in the study now and change your mind later without any penalty.

The study will take place during extra mural activity time with the prior approval of the school and your child's teacher. However, if you do not want your child to participate, an alternative activity will be available.

In addition to your permission, your child must agree to participate in the study and you and your child will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the study will be stored securely on a password locked computer in my locked office for five years after the study. Thereafter, records will be erased.

If you have questions about this study please ask me or my study supervisor, Prof Motlhabane, Department of Science and Technology, College of Education, University of South Africa at 012 429 2840. My contact number is 0722497399 and my e-mail is mbalenhlengema@gmail.com.

The e-mail of my supervisor is motlhat@unisa.ac.za.Permission for the study has already been given by the Department of Education KwaZulu-Natal and the Ethics Committee of the College of Education, UNISA.

You are making a decision about allowing your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

Name of child: _____

Sincerely

_____ _____ _____

Parent/guardian's name (print) Parent/guardian's signature: Date:

_____ _____ _____

Researcher's name (print) Researcher's signature Date:

APPENDIX C

LETTER REQUESTING ASSENT FROM LEARNERS IN A SECONDARY SCHOOL TO PARTICIPATE IN AN INTERVIEW FOR A RESEARCH PROJECT

Title of study: Factors that causes poor performance in science subjects at Ingwavuma circuit

Dear: Learner

I am doing a study on factors that cause poor performances in science subjects at Ingwavuma circuit as part of my studies at the University of South Africa. Your principal has given me permission to do this study in your school. I would like to invite you to be a very special part of my study. I am doing this study so that I can find ways that your science teachers can use to produce better results in science subjects. This will help you and many other learners of your age in different schools.

This letter is to explain to you what I would like you to do. There may be some words you do not know in this letter. You may ask me or any other adult to explain any of these words that you do not know or understand. You may take a copy of this letter home to think about my invitation and talk to your parents about this before you decide if you want to be in this study.

I will ask you questions. The purpose of the interview is to investigate the factors that cause poor performance in science subjects (Physical Sciences and Life sciences). You are asked to express your honest opinion while answering question. It will take you approximately 30 minutes to complete the interview.

I will write a report on the study but I will not use your name in the report or say anything that will let other people know who you are. You do not have to be part of this study if you don't want to take part. If you choose to be in the study, you may stop taking part at any time. You may tell me if you do not wish to answer any of my questions. No one will blame or criticise you. When I am finished with my study, I shall return to your school to give a short talk about some of the helpful and interesting things I found out in my study. I shall invite you to come and listen to my talk.

If you decide to be part of my study, you will be asked to sign the form on the next page. If you have any other questions about this study, you can talk to me or you can have your parent or another adult call me at: 0722497399. Do not sign the form until you have all your questions answered and understand what I would like you to do.

Researcher: Ngema M.H Phone number: 0722497399

Do not sign written assent form if you have any questions. Ask your questions first and ensure that someone answers those questions.

ASSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my assent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the interview.

I have received a signed copy of the informed assent agreement.

Participant Name & Surname…… (please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature……..Date……

APPENDIX D

LETTER REQUESTING ASSENT FROM LEARNERS IN A SECONDARY SCHOOL TO PARTICIPATE IN A QUESTIONNNAIRE FOR A RESEARCH PROJECT

Title of study: Factors that causes poor performance in science subjects at Ingwavuma circuit

Dear: Learner

I am doing a study on factors that cause poor performances in science subjects at Ingwavuma circuit as part of my studies at the University of South Africa. Your principal has given me permission to do this study in your school. I would like to invite you to be a very special part of my study. I am doing this study so that I can find ways that your science teachers can use to produce better results in science subjects. This will help you and many other learners of your age in different schools.

This letter is to explain to you what I would like you to do. There may be some words you do not know in this letter. You may ask me or any other adult to explain any of these words that you do not know or understand. You may take a copy of this letter home to think about my invitation and talk to your parents about this before you decide if you want to be in this study.

I will give you a questionnaire which has 47 questions. The purpose of the questionnaire is to investigate the factors that cause poor performance in science subjects (Physical Sciences and Life sciences). You are asked to express your opinion on these statements. You will be required to read the questions carefully and put an X in an appropriate box. Please answer the questions honestly and accurately. It will take you approximately 30 minutes to complete the questionnaire.

I will write a report on the study but I will not use your name in the report or say anything that will let other people know who you are. You do not have to be part of this study if you don't want to take part. If you choose to be in the study, you may stop taking part at any time. You may tell me if you do not wish to answer any of my questions. No one will blame or criticise you. When I am finished with my study, I shall return to your school to give a short talk about some of the helpful and interesting things I found out in my study. I shall invite you to come and listen to my talk.

If you decide to be part of my study, you will be asked to sign the form on the next page. If you have any other questions about this study, you can talk to me or you can have your parent or another adult call me at: 0722497399. Do not sign the form until you have all your questions answered and understand what I would like you to do.

Researcher: Ngema M.H Phone number: 0722497399

Do not sign written assent form if you have any questions. Ask your questions first and ensure that someone answers those questions.

ASSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my assent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the questionnaire.

I have received a signed copy of the informed assent agreement.

Participant Name & Surname……(please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature…….Date……

APPENDIX E

A LETTER REQUESTING AN ADULT TO PARTICIPATE IN AN INTERVIEW

Dear ……

This letter is an invitation to consider participating in a study I, Mbalenhle. H Ngema, am conducting as part of my research as masters student entitled factors that causes poor performance in science subjects at Ingwavuma circuit at the University of South Africa. Permission for the study has been given by the Department of Education and the Ethics Committee of the College of Education, UNISA. I have purposefully identified you as a possible participant because of your valuable experience and expertise related to my research topic.

I would like to provide you with more information about this project and what your involvement would entail if you should agree to take part. The importance of research in education is substantial and well documented. In this interview I would like to have your views and opinions on the topic mentioned above in paragraph one.. This information can be used to contribute to policy development, educator development and future research with the aim of improving the performance in the school and also to provide recommendations on how to improve the performance in science subjects.

Your participation in this study is voluntary. It will involve an interview of approximately *30 minutes* in length to take place in a mutually agreed upon location at a time convenient to you. You may decline to answer any of the interview questions if you so wish. Furthermore, you may decide to withdraw from this study at any time without any negative consequences.

With your kind permission, the interview will be audio-recorded to facilitate collection of accurate information and later transcribed for analysis. Shortly after the transcription has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or to clarify any points. All information you provide is considered completely confidential. Your name will not appear in any publication resulting from this study and any identifying information will be omitted from the report. However, with your permission, anonymous quotations may be used. Data collected during this study will be retained on a

password protected computer for 5 years in my locked office. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 0722497399 or by e-mail at mbalenhlengema@gmail.com.

I look forward to speaking with you very much and thank you in advance for your assistance in this project. If you accept my invitation to participate, I will request you to sign the consent form which follows on the next page.

Yours sincerely

……

Mbalenhle. H Ngema

CONSENT FORM

I have read the information presented in the information letter about the study on factors that causes poor performance in science subjects at Ingwavuma circuit.. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and add any additional details I wanted. I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses. I am also aware that excerpts from the interview may be included in publications to come from this research, with the understanding that the quotations will be anonymous. I was informed that I may withdraw my consent at any time without penalty by advising the researcher. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

Participant's Name (Please print):

Participant Signature:

Researcher Name: (Please print)

Researcher Signature:

Date:

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries:NomangisiNgubane Tel:0333921004 Ref.:2/4/8/566

MissMHNgema
POBox285
UBOMBO
43970

DearMissNgema

PERMISSIONTOCONDUCTRESEARCHINTHEKZNDoEINSTITUTIONS

Yourapplicationtoconductresearchentitled:**"FACTORSTHATCAUSESPOORPERFORMANCEINSCIENCESUBJECTSATINGWAVUMACIRCUIT",**intheKwaZulu-NatalDepartmentofEducationInstitutionshasbeenapproved.Theconditionsoftheapprovalareasfollows:

1.Theresearcherwillmakeallthearrangementsconcerningtheresearchandinterviews.
2.TheresearchermustensurethatEducatorandlearningprogrammesarenotinterrupted.
3.Interviewsarenotconducteddurinthetimeofwritingexaminationsinschools.
4. Learners,Educators,SchoolsandInstitutionsarenotidentifiableinanywayfromtheresultsoftheresearch.
5. AcopyofthisletterissubmittedtoDistrictManagers,PprincipalsandHeadsofInstitutionswheretheintendedresearchandinterviewsaretobeconducted.
6.Theperiodofinvestigationislimitedtotheperiodfrom21October2015to31November2016.
7. Yourresearchandinterviewswillbelimitedtotheschoolsyouhaveproposedandapprovedbytheheadofdepartment.PleasenotethatPrincipals,Educators,DepartmentalOfficialsandLearnersareundernoobligationtoparticipateorassistyouinyourinvestigation.
8.Shouldyouwishtoextendtheperiodofyoursurveyattheschool(s),pleasecontactMissConnie Kehologileatthecontactnumbersbelow.
9. Uponcompletionoftheresearch,abriefsummaryofthefindings,recommendationsorafullreport/dissertation/thesismustbesubmittedtotheresearchofficeoftheDepartment.PleaseaddressittoTheOfficeoftheHOD,PrivateBagX9137,Pietermaritzburg,3200.
10. PleasenotethatyourresearchandinterviewswillbelimitedtoschoolsandinstitutionsinKwaZulu-NatalDepartmentofEducation.

UmkhanyakudeDistrict

NkosinathiS.P.Sishi,PhD
HeadofDepartment:Education
Date:20October2015

UNISA university of south africa

COLLEGE OF EDUCATION RESEARCH ETHICS REVIEW COMMITTEE

16 September 2015

Ref # **2015/09/16/48023302/07/MC**
Student#: Miss MH Ngema
Student Number#:48023302

Dear Miss Ngema

Decision: Ethics Approval

Researcher
Miss MH Ngema
Tel: +2772 249 7399
mbalenhlengema@gmail.com

Supervisor
Prof. AT Motlhabane
College of Education
Department of Science and Technology Education
Tel: +2712 429 2840
motlhat@unisa.ac.za

Proposal: Factors that cause poor performance in science subjects at Ingwavuma circuit.

Qualification: M Ed in Natural Sciences Education

Thank you for the application for research ethics clearance by the College of Education Research Ethics Review Committee for the above mentioned research. Final approval is granted for 2 years.

For full approval: *The application was reviewed in compliance with the Unisa Policy on Research Ethics by the College of Education Research Ethics Review Committee on 16 September 2015.*

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the College of Education Ethics Review Committee.*

2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the College of Education Ethics Review Committee.*

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.

3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

Note:

The reference number **2015/09/15/48023302/07/MC** *should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the College of Education RERC.*

Kind regards,

Dr M Claassens
CHAIRPERSON: CEDU RERC
mcdtc@netactive.co.za

Prof VI McKay
ACTING EXECUTIVE DEAN

APPENDIX H

Educator interview schedule

1. How would you describe the socio economic background of your learners? Do you think it has an impact on their performance?
2. How would you describe the attitude of learners towards science and would you relate it to their performance in science subjects?
3. Would you say your learners are motivated to learn science, how do you help those who are not motivated?
4. What factors would you identify as contributing to poor performance of your learners in science subjects? Explain why.
5. How many learners do you have in your science class? Does the number of learners in your class affect learner's performance in science subjects? Explain why?
6. How would you describe the relationship between you and the parents of learners you teach?
7. Do you think parents play an important role in their child's education? Explain why.
8. What would your comment be about the changes in the Science curriculum? Are you coping with implementing these changes?
9. Are you able to do practicals? If not why? If yes do you see them useful in making learners relate to science?
10. What teaching methods do you use when teaching science? Do you change them according to learners needs?
11. What teaching aids do you use when teaching sciences? Do you believe they assist learners to do better?
12. What would be your comment on the language of instruction in relations to learner performance?
13. Do you know your entire learners abilities? How do you assist learners who struggle with understanding science concepts?
14. Does the amount of content you have to cover matches the time allocated?
15. Are you motivated to teach science in the current conditions of your school, if not what causes you to be demotivated?
16. Which is important to you when it comes to teaching science? Is it the experience one has on teaching the subject or the knowledge of the subject content beyond what is required by the job and syllabus?

APPENDIX I

Learner interview Schedule

1. Is your performance in science good? If not what challenges can you identify as a contributory factor towards your performance in science subjects?
2. How would you describe the character of your science teacher? Does it have an effect on your learning?
3. How would you describe your relationship with your classmates, does it have an impact on your learning?
4. How would you describe your family state? What are the challenges that come with living in such a family in relation to your learning?
5. Do you do any household chores? If you do how do you balance between them and tour school work?
6. Is there a difference between science language and English, do you understand these languages?
7. When you are unable to understand something in Science, are your parents/ brothers or sisters able to assist you at home?
8. Are extra lessons in Science subjects outside school an affordable option for you? If they are not how do you get extra help with science subjects?

9. Do you engage in practical activities at school for Science subjects? If so, does it help to improve your understanding of the subject?

10. What in your opinion as a learner can be done to improve learner performance in Science Subjects?

APPENDIX J

Questionnaire for Grade 12 Science teachers

Dear respondent

This questionnaire forms part of my *masters* research entitled: Factors that causes poor performance in science subjects at Ingwavuma circuit, for the degree of MEd at the University of South Africa. You have been selected by a purposive sampling strategy from the population of all grade 12 science teachers in the school. Hence, I invite you to take part in this survey.

The aim of this study is to investigate factors that are the root cause of poor performance in science subjects. The possible benefits of the study are to contribute to policy development, educator development and future research with the aim of improving the performance in the school and also to provide recommendations on how to improve the performance in science subjects.

You are kindly requested to complete this survey questionnaire, comprising three sections as honestly and frankly as possible and according to your personal views and experience. No foreseeable risks are associated with the completion of the questionnaire which is for research purposes only. The questionnaire will take approximately 30 minutes to complete.

You are not required to indicate your name or organisation and your anonymity will be ensured; however, indication of your age, gender, occupation position etcetera. will contribute to a more comprehensive analysis. All information obtained from this questionnaire will be used for research purposes only and will remain confidential. Your participation in this survey is voluntary and you have the right to omit any question if so desired, or to withdraw from answering this survey without penalty at any stage. After the completion of the study, an electronic summary of the findings of the research will be made available to you on request.

Permission to undertake this survey has been granted by the Department of Education KwaZulu-Natal and the Ethics Committee of the College of Education, UNISA. If you have any research-related enquiries, they can be addressed directly to me or my supervisor. My contact details are: 0722497399, e-mail: mbalenhlengema@gmail.com and my supervisor can be reached at 0124292840 , Department of Science and Technology Education , College of Education, UNISA, e-mail: motlhat@unisa.ac.za .

By completing the questionnaire, you imply that you have agreed to participate in this research.

A. Biographic information

1. Are you a male of a female?
   Male ☐ Female ☐
2. What is your home language?
   Zulu ☐ Swati ☐ Tsonga ☐ Other ☐
3. Science teaching experience in years:
   1-3 ☐ 4-6 ☐ 7-8 ☐ More than 8 ☐
4. Grade 12 science teaching experience in years:
   1-3 ☐ 4-6 ☐ 7-8 ☐ More than 8 ☐
5. Subjects you teach:
   Science only ☐ Science and one other subject ☐ Science and 2 other subjects ☐
6. Your school location :
   Rural ☐ Urban ☐
7. Professional qualification :

Teaching certificate of Education	
Diploma in Education	
Bachelor of Education	
Advanced certificate in education	
Postgraduate Certificate in education	
Honours bachelor of education	
Masters in education	
Doctorate in education	
None	

8. Major subjects in your professional qualification:
   Science only ☐ Science and Maths ☐ Science and other non science subject ☐
9. Academic qualification in science stream :
   Bachelor of Science ☐ Honours in science ☐ Diploma in science ☐ BTech in science ☐
10. Number of days absent at school per year :
    0-10 ☐ 11-20 ☐ 21-30 ☐ 31-40 ☐ 40 and above ☐
11. Reason for absence :
    Study leave ☐ Family responsibility ☐ Sick leave ☐ Union Leave ☐ Other ☐
12. Number of children in each of your science class:
    Less than 25 ☐ 25-35 ☐ 35-45 ☐ 45-55 ☐ 55-65 ☐ 65 and above ☐

B. Resources and infrastructure :

ITEMS	Yes	No
13. Is there electricity at your school?		
14. Is there water at your school?		

15. Is there a science lab at your school?		
16. Is there a library at your school?		
17. Is there access to internet at your school?		
18. Is there adequate science equipment at your school?		
19. Are there adequate classes at your school?		
20. Are there adequate teachers at your school?		
21. Is there adequate desks and furniture at your school?		
22. Are there different kinds of teaching aids at your school?		
23. Does every science learner have an individual science textbook?		

C. Teaching and learning

Next to each statement indicate whether you **Strongly Disagree, Disagree, Neither Disagree nor Agree, Agree, Strongly Agree** indicate by putting an X in the appropriate box to the following meaning of numbers.

Strongly Disagree	1
Disagree	2
Neither Disagree nor Agree	3
Agree	4
Strongly agree	5

ITEMS	1	2	3	4	5
24. I know my subject policy and comply with it when teaching					
25. I know my subject content beyond what is required in the curriculum					
26. I find it easy to teach the CAPS					
27. The school science curriculum is relevant to life					
28. The language used in textbooks is understandable to learners					
29. I am always in class on time					
30. My lessons are always planned					
31. My lessons are driven by objectives and outcomes					
32. My lessons starts with prior knowledge					
33. I am able to relate my lesson to learner's real life situations					
34. I deliver my lessons in diverse styles					
35. I use different learning AIDS WHEN presenting my lessons					
36. I am always confident on my lesson presentation					
37. I create comfortable learning environment for learners					
38. I inspire learners to love science					
39. I teach learners so that they can understand even when I fall behind schedule					

40. I assess learners frequently					
41. I give learners constructive feedback					
42. I use different questioning methods for assessment					
43. I allow learners to research their own information					
44. I am able to discipline my learners					
45. I mediate learning I do not lecture					
46. I involve parents in their child's learning					
47. I am able to capture the attention of learners throughout the lesson					
48. Most of my assessments are practical investigations					
49. I allow learners to make their own notes					
50. I am able to identify learners with problems and assist them individually					
51. I am able to ask for help from colleagues in some topics					
52. I teach all topics as required irrespective of my comfortability with them					
53. Time allocated to cover a topic in the work schedule is realistic					
54. My teaching load is fair					
55. The department supports science educators effectively					
56. The head of science department gives the necessary support					
57. The department gives opportunity of professional growth					
58. I am satisfied with my salary					
59. The unavailability of resources have a negative effect on learning					
60. The number of learners affects learning negatively					

Thank you for participating in this survey!

APPENDIX K

Questionnaire for grade 12 Science learners

Dear respondent

This questionnaire forms part of my *masters* research entitled: Factors that causes poor performance in science subjects at Ingwavuma circuit, for the degree of MEd Natural Science Education at the University of South Africa. You have been selected by a purposive sampling strategy from the population of all grade 12 science learners in the school. Hence, I invite you to take part in this survey.

The aim of this study is to investigate factors that are the root cause of poor performance in science subjects. The possible benefits of the study are to contribute to policy development, educator development and future research with the aim of improving the performance in the school and also to provide recommendations on how to improve the performance in science subjects.

You are kindly requested to complete this survey questionnaire, comprising three sections as honestly and frankly as possible and according to your personal views and experience. No foreseeable risks are associated with the completion of the questionnaire which is for research purposes only. The questionnaire will take approximately 30 minutes to complete.

You are not required to indicate your name or organisation and your anonymity will be ensured; however, indication of your age, gender, occupation position etcetera. will contribute to a more comprehensive analysis. All information obtained from this questionnaire will be used for research purposes only and will remain confidential. Your participation in this survey is voluntary and you have the right to omit any question if so desired, or to withdraw from answering this survey without penalty at any stage. After the completion of the study, an electronic summary of the findings of the research will be made available to you on request.

Permission to undertake this survey has been granted by the Department of Education KwaZulu-Natal and the Ethics Committee of the College of Education, UNISA. If you have any research-related enquiries, they can be addressed directly to me or my supervisor. My contact details are: 0722497399, e-mail: mbalenhlengema@gmail.com and my supervisor can be reached at 0124292840 , Department of Science and Technology Education , College of Education, UNISA, e-mail: motlhat@unisa.ac.za .

By completing the questionnaire, you imply that you have agreed to participate in this research.

A. Biographic background

1. Are you a boy or a girl?
   ☐ Boy ☐ Girl
2. What is your age group?
   ☐ 15-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40
3. Do you have a child?
   ☐ Yes ☐ No
4. Are your parents still alive?
   ☐ Both ☐ Mother ☐ Father ☐ None
5. If your answer to question above is none who do you live with at home?
   ☐ Grandparent/s ☐ Older Sibling/s ☐ Younger sibling/s
   ☐ Extended family ☐ Orphanage
6. How many people live at your home?
   ☐ 3 ☐ 4 ☐ 5 ☐ More than 6
7. Distance from home to school
   ☐ Less than 5km ☐ 5-10km ☐ 11-15km ☐ 16-20km ☐ 21-25km ☐ More than 25km
8. How do you get to school?
   ☐ Walk to school ☐ Bicycle ☐ Hitch hiker ☐ Lift club
   ☐ Dropped off by parents

B. Socio economic background

9. Is you parent employed?
   ☐ Yes ☐ No
10. If your answer in the question above is yes, where is your parent employed?
    ☐ Government department ☐ Private sector ☐ domestic worker
    ☐ Self employed
11. What is the highest level of education of your parent or guardian?
    ☐ Never went to school ☐ Completed some primary school
    ☐ Completed all primary school ☐ Completed some secondary school
    ☐ Completed all secondary school ☐ Completed training after secondary school ☐ Don't know
12. How big is your home?
    ☐ 1 room ☐ 2-3 Rooms ☐ 4-5 rooms ☐ 6-7rooms
    ☐ More than 7 rooms
13. School location
    ☐ Rural ☐ Urban
14. Which of the following can be found at the place you stay during your school period?

ITEMS	Yes	No
WATER		
Electricity		
Radio		

DSTV		
TV only		
Computer with internet		
Study room		
Car		

C.Learning, Teaching and School activities

15. My Science teacher

ITEMS	YES	No
15.1. Is your teacher always in class on time?		
15.2. Does your teacher use all the allocated time for teaching?		
15.3. Would you say your teacher knows his /her learning area well?		
15.4. Does your teacher use different teaching methods?		
15.5. Does your teacher use prior knowledge before every new chapter?		
15.6. Does your teacher explain the same thing in different ways to help you understand?		
15.7. Does your teacher ask you the same question in different ways?		
15.8. Does your teacher give you class tests?		
15.9. Does your teacher use test results to give extra help to learners?		
15.10. Is your teacher approachable?		
15.11. Does your teacher motivate you to learn?		
15.12. Does your teacher organize extra lessons for you?		
15.13. Does your teacher care if you understand the lesson?		
15.14. Does your teacher invite other science teachers from other schools to teach?		

16. About the learner

ITEMS	Yes	No
16.1. Did you go to crèche?		
16.2. Are you always on time?		
16.3. Would you define Science lessons as interesting?		
16.4. Do you understand the teaching language very well?		
16.5. Do you understand the science language?		
16.6. Do you do your homework every day?		
16.7. When you don't understand the teacher do you ask?		
16.8. Do you have access to the library at your home place?		

17. What language does your science teacher use while teaching?

☐ English only ☐Mixture of English and his/her Home language

☐ His/her home language only

18. Which language do you prefer?

☐ English only ☐Mixture of English and my home language
☐ My home language only

19. How often do you get absent from class?
☐ Once a month ☐More than once a month ☐ Never

20. The reason of your absenteeism
☐ Illness ☐ Taking care of siblings at home ☐ Sent by elders to do house chores ☐ Taking care of my sick child

21. How often do you study your work?
☐ Everyday ☐Once a week ☐ Once a month
☐ Never

22. How does your parent involve him/herself in your learning?
☐ Attend parent meetings only
☐ Assist with homework and everything that involves learning ☐ Not involved

23. How many learners are in your class?
☐ Less than 25 ☐26-35 ☐36-45 ☐ 46-55 ☐ 56-65
☐ 66 and above

D. School resources, infrastructure and class size

ITEMS	YES	No
24. Does the number of learners have a negative effect to your learning?		
25. Do you have enough desks?		
26. Do you have enough textbooks?		
27. Is there a library at the school?		
28. Is there a science lab at the school?		
29. Do you have a computer lab?		
30. Does the school have water?		
31. Does the school have electricity?		
32. Does the school have enough classes?		
33. Does the school have toilets?		
34. Does the school have a code of conduct?		
35. Do you know your school governing body?		

E. Attitudes and beliefs

Next to each statement indicate whether you **Strongly Disagree, Disagree, Neither disagree nor agree, Agree, Strongly Agree** indicate by putting an X in the appropriate box to the following meaning of numbers.

Strongly Disagree	1
Disagree	2
Neither Disagree nor Agree	3
Agree	4
Strongly Agree	5

ITEMS	1	2	3	4	5
36. Science is a subject related to everyday life					

37. The science teachers at my school know how to teach their subject very well					
38. My science teacher makes science lessons interesting					
39. Science is a subject related to everyday life					
40. Science is important in life					
41. Science is a manageable subject					
42. Practical work helps me to understand science better					
43. Availability of resources makes learning easier					
44. Discipline during lessons results in good marks					
45. Parental involvement in my school work motivates me					
46. Changes in curriculum affect my learning					
47. My home environment contributes towards my school performance					

Thank you for participating in this survey!

APPENDIX L

Educator interview transcript

1. "How would you describe the socio economic background of your learners? Do you think it has an impact on their performance?"

Teacher 1: *Most of their parents are not working and they depend on social grants. Some are working as domestic workers, some are employed by the government and some are employed on the private sector but only a few.*

Teacher 2: *Most learners in this school are from very poor families where you find that both parents are unemployed, if one is working but his or her income is so little to support the family well sometimes these learners are orphans and they can't even afford basic material such as calculators that assists them in science therefore they end up doing badly at school.*

Teacher 3: *Learners from my school come from poor families, the socio economic background does have an effect on my learners in two ways, some are affected positively and some are affected negatively. A positive effect arises from the desire of the learner to change the situation at home; it drives them to work hard so that they perform well. A negative effect arises because the learners parents are not working this result in non conducive environments for learning at home, the learner does not even afford required resources for the school.*

2. "How would you describe the attitude of learners towards science and would you relate it to their performance in science subjects?"

Teacher 1: *Many learners think that science is for boys or clever learners only*

Teacher 2: *Boys are well motivated and have a positive attitude towards science they perform better, girls have a negative attitude towards science and this results in poor performance.*

Teacher 3: *Most learners look at science as a difficult and abstract subject and this leads to poor performance in class since they become afraid to take chances and make initiative in the subject.*

3. "Would you say your learners are motivated to learn science, how do you help those who are not motivated?"

Teacher 1: *Only few learners are motivated, it is not easy to motivate somebody who is not motivated internally*

Teacher 2: *Some are motivated but some are not. In helping non-motivated learners I used to unpack career opportunities in different sectors offered by science subjects, also making examples on successful people within their location as the result of science subjects they did while at school level.*

Teacher 3: *I would say my learners are motivated because I always tell them that science is like any other subject and with extra dedication good performance is guaranteed.*

4. "What factors would you identify as contributing to poor performance of your learners in science subjects? Explain why?"

Teacher1: *Most of our learners want to complete matric without knowing what they want to be at the end of matric, some do not have money to further up their studies and some don't even get bursaries because they need good marks.*

Teacher 2: *English as the language for teaching is the most contributing factor. Learners fail to analsye the question in trying to feature what is required of them to do and they end up giving irrelevant answers.*

Teacher 3: *They do not study, lack of motivation, absenteeism, lack of parental involvement*

5. "How many learners do you have in your science class? Does the number of learners in your class affect learner's performance in science subjects? Explain why?"

Teacher1: *34 this is a controllable number*

Teacher 2: *There are 34, this is a manageable number. I am able to identify learners experiencing some problems on time to provide individual attention and time.*

Teacher 3: *I have 21 learners and this is a good number because I can give each learner attention*

6. "How would you describe the relationship between you and the parents of learners you teach?"

Teacher 1: *When we call a parents meeting only a few parents come*

Teacher 2: *We have a good relationship as they used to come to school to discuss issues relating to their children's work.*

Teacher 3: *Parents of this area are willing to come when invited however they do not understand their role in their children's learning*

7. "Do you think parents play an important role in their child's education? Explain why."

Teacher1: *No only parents who ensure that learners are at school studying during study time after school*

Teacher2: *No, most of the parents did not have formal education so they cannot help their children in doing their school work and some do not provide time for learner to do work after school.*

Teacher3: *Only a few parents are educated and most do not even know how to read and write and therefore cannot assist their children with schoolwork.*

8. "What would your comment be about the changes in the Science curriculum? Are you coping with implementing these changes?"

Teacher1: *Some changes need time but we are coping*

Teacher2: *These changes are confusing sometimes but as an educator, a life-long learner I have to adapt through research and reading more textbooks and content.*

Teacher3: *I am currently getting used to these changes but need more guidance in order to be able to implement this curriculum in confidence*

9. "Are you able to do practicals? If not, why? If yes why?"

Teacher 1: *Yes they make sense all learners enjoy them because they relate to science and everyday life.*

Teacher 2: *Yes I am able to do practicals and they are so useful as they consolidate the theory learnt in class in making the lesson more meaningful.*

Teacher 3: *Yes but some are new and we cannot do them we need more workshops for some materials so that we can be able to use them in practicals.*

10. "What teaching methods do you use when teaching science? Do you change them according to learner's needs?"

Teacher1: *Narrative, discovery and full engagement method so that my learners can be able to use what I told them to get new knowledge.*

Teacher 2: *Different methods being co-ordinated or being determined by the lesson and learners potential at that time method are changed frequently to cater for the individual differences.*

Teacher 3: *I use narrative and group work my learners do not have resources for self discovery method.*

11. "What teaching aids do you use when teaching sciences? Do you believe they assist learners to do better?"

Teacher 1: *All types and they help learners to pass at the end of the year.*

Teacher 2: *Wall charts and I believe they assist to improve learner performance as they (charts) simulate the real life situation. I cannot even do practicals for my learners because we don't have necessary aids.*

Teacher 3: *I use only wall chart, I would like to use DVDs but because of lack of `resources at school I am unable to. This makes teaching science abstract.*

12. "What would be your comment on the language of instruction in relations to learner performance?"

Teacher 1: *It affects a lot, but it must not be changed because we don't have science words in our home language e.g. acceleration, velocity, voltage and this might confuse learners. Even when I try code switching there are words that I cannot explain in Zulu and I can see that this leaves my learners very confused science language must be taught.*

Teacher 2: *Language (English) is a learning barrier as most learners are struggling to understand it. It prevents them to receive the whole content of the lesson. Let alone the science language.*

Teacher 3: *The language used for teaching is not understandable to most learners and this makes it difficult for them to understand exam questions because we are not expected to explain anything to them during exams.*

13. "Do you know your entire student's abilities? How do you assist learners who struggle with understanding science concepts?"

Teacher1: *Yes I always give them extra time for more explanation I invite other educators and also use DVDs for them to understand*

Teacher 2: *Yes I know their abilities; struggling learners are given more time by the educator. Continuously check whether they are still following the lesson.*

Teacher 3: *Yes I do, I give them extra classes and extra work. I ensure that I check their work every day.*

14. "Does the amount of content you have to cover matches the time allocated?"

Teacher 1: *No. There is a lot of content to be covered and little time. The days we use for workshops and meetings or any other event during learning hours is not considered in this time.*

Teacher 2*: Yes it is in accordance to be covered in each term*

Teacher 3: *No there is a lot of work and little time allocated*

15. "Are you motivated to teach science in the current conditions of your school, if not what causes you to be demotivated?"

Teacher 1: *No, not exactly because everything here needs to be a lot of effort. There is lack of resources and one cannot be innovative enough when teaching science, and we get paid peanuts for such a difficult job.*

Teacher 2: *Yes I am motivated*

Teacher 3: *Partly motivated, availability of resources and a better salary can make me fully motivated.*

16. "Which is important to you when it comes to teaching science? Is it the experience one has on teaching the subject or the knowledge of the subject content beyond what is required by the job and syllabus?"

Teacher1: *Both experience and extensive knowledge is important to me. You cannot separate the one from the other*

Teacher 2: *Combination of both, experience makes me be able to know areas needing more emphasis and how the examiner might ask such content*

Teacher 3: *Both because knowledge enables me to unpack the lesson in a way that students understand and experience enables me to identify where learners lack and be able to assist them.*

APPENDIX M

Transcripts of learner interviews

1. ”Is your performance in science good, what challenges can you identifying as a contributory factor towards your performance in science subjects?”

Learner A: *Yes it is good*

Learner B: *Not good because we didn’t do all science practicals, we also don’t finish chapters. However we try to work hard in order to perform well*

Learner C: *Yes*

Learner D: *My performance is bad but not in all science subjects some of them I am good but in physics I don’t do well.*

Learner E: *I am not good in science because I am far from school, I don’t get time for evening classes. Even though I gather with other learners from other schools but it does not make any difference for me because I am not close to my teacher who can give me a clear picture about what we learn in class.*

Learner F: *Not that bad. I do not manage to spend more time doing my science subject this subject needs time.*

Learner G: *No*, I don’t know but I am just not good at it when it comes to tests.

Learner H: *No it is not good to me but I am trying all my best to improve my results but most science words are hard to understand and that gives me problems during tests.*

3. "How would you define the character of your science teacher, does it have an effect on your learning?"

Learner A: *He is a good teacher and gives himself time for teaching and explaining where we do not understand. He also organizes extra lessons.*

Learner B: *The character of my teacher has a big impact on my learning because he tries by all means to help us and to motivate us to do well in science.*

Learner C: *My teacher has a great character he is humble, he assists me in my education and this gives me time to ask where I don't understand. He makes sure that I understand.*

Learner D: *My teacher is a good teacher he tries his best to make us understand the subject but although it takes a lot to make us understand his subject because he does not have enough experience in teaching science he only has 2 years.*

Learner E: *My teacher is a humble teacher, disciplined and he motivates me, he is friendly to learners and always wants to see us successful so he has a good impact on my learning.*

Learner F: *He is a very good teacher and he makes sure that we understand what he is teaching, he spends time teaching us and making sure that we understand what he is teaching at that particular time.*

Learner G: *He teaches in a way that all learners understand his work.*

Learner H: *My teacher motivates me*

4. "How would you define your relationship with your classmates, does it have an impact on your learning?"

Learner A: *We have a good relationship, it doesn't impact my learning*

Learner B: *My classmates have a positive impact because we try to help one another to solve problems in learning.*

Learner C: *My classmates are lacking cooperation. This results in failure to form study groups which enhances our science knowledge.*

Learner D: *We are friendly, we all know each other very well, and it does have an impact because we help each other when studying.*

Learner E: *My relationship with my classmates is very good because we help each other while studying and we motivate each other so that we can do well. We even have formed a theme which says "Education must be a first priority, let us leave what will damage our future".*

Learner F: *I have a very good relationship with my classmates and I get along with them very well. Yes our relationship does have an impact on my learning because we help each other with our school work.*

Learner G: *The relationship with my classmates is good we work together in ensuring that we do well.*

Learner H: *My relationship with my classmates is good because we always work together.*

5. "How would you define your family state, and what are the challenges that come with living in such a family in relation to your learning?"

Learner A: *My family is normal, I don't experience any challenges.*

Learner B: *My family has a positive impact they try to help if they are able to but others didn't go to school even if it is so but they always make sure I have everything for school.*

Learner C: *We are below middle-class, we are not financially viable. This result in inability to afford some schooling material needed for my education.*

Learner D: *No comment in that, it is complicated.*

Learner E: *In my family most of my siblings are educated even though my parents are not but they are the ones that motivate me to do well.*

Learner F: *We are normal family nit rich not poor, we afford only basic schooling material.*

Learner G: *My family is not rich but they encourage me to study hard even in those circumstances*

Learner H: *My family has educated siblings even though my parents are not educated but they want me to do well at school.*

6. "Do you do any household chore, if you do how do you balance between them and tour school work?"

Learner A: *No I don't.*

Learner B: *Yes, I try to manage time for them and school work.*

Learner C: *Yes. I have to set time frame to do my house chores and time for my school work.*

Learner D: *No I don't do any.*

Learner E: *I do household chores when I come from school before studying.*

Learner F: *Yes I fail to manage time I am not a fast person but I do try to manage time for my school work.*

Learner G: *No*.

Learner H: *No, I don't get time to do household chores most of my time I study*.

7. "Is there a difference between science language and English, do you understand these languages?"

Learner A: *Yes, there is a difference and I understand both of them.*

Learner B: *Yes there is a difference even though it's hard I do understand some of the words, but they are easily forgettable.*

Learner C: *Yes there is with the teacher explaining I do understand but in tests I do get a challenge.*

Learner D: *Yes big difference. Science has difficult words which may be the same word in English but mean different thing in science and this sometimes confuses me.*

Learner E: *Yes. Science has bombastic words you can't even find in a dictionary but I have to try to understand them because we live in a science world.*

Learner F: *Yes, I try to understand even its hard.*

Learner G: *Yes, science language is hard for me but have to study hard to understand it.*

8. "When you are unable to understand something in Physical Science, are your parents/ brothers or sisters able to assist you at home?"

Learner A: *No*

Learner B: *Yes they are able to assist because they make me understand better.*

Learner C: *Yes*

Learner D: *No they can't assist me because they don't understand science.*

Learner E: *No they are not able to because none of them studied science.*

Learner F: *No*.

Learner G: *My grandmother helps me in science.*

Learner H: *No one assists me because they did not study science.*

9. "Are extra lessons in Science subjects outside school an affordable option for you? "

Learner A: *No they are not an affordable option for me; I have best science teachers in my school who give me enough knowledge.*

Learner B: *No I am assisted by other people who studied science.*

Learner C: *No I ask for assistance from my teacher.*

Learner D: *No I haven't done extra lessons in science subjects outside school.*

Learner E: *No they are not an affordable option for me, I use those provided by my teacher.*

Learner F: *No*

Learner G: *My teacher is always there to assist me.*

Learner H: *No, I am assisted by my teacher.*

10. "Do you engage in practical activities at school for Science subjects? If so, does it help to improve your understanding of the subject? "

Learner A: *We do not have a science lab but our teacher tries to do some practicals and when he does, I understand what he teaches better, I wish most science work was done in practicals because it makes it fun and easier.*

Learner B: *Sometimes and it helps to improve my understanding in science.*

Learner C: *Yes, it helps a lot.*

Learner D: *No I don't because we never done practicals at school.*

Learner E: *Yes I think so but we don't do them at school we have no science lab.*

Learner F: *No*.

Learner G: *Yes, it improves my knowledge in science.*

Learner H: *No.*

11. "What in your opinion as a learner can be done to improve learner performance in Science Subjects? "

Learner A: *More work must be given to learners and they should be compulsory extra classes.*

Learner B: *My opinion to improve science is that we must do practicals because in theory we really do not understand some of the things.*

Learner C: *Science students should be disciplined and work hard, they should be dedicated to their work.*

Learner D: *Science teachers should put more effort in ensuring that learners understand lessons and we should be taught in different ways possible.*

Learner E: *There must be extra lessons and practicals and teachers should make science fun. Hey must reduce the amount of thing we learn in one hour it becomes boring and we can't concentrate.*

Learner F: *The teachers must make us love science and they must teach us how to absorb all this work in a short time. They must teach us how to remember all this work because at times I forget some of the things.*

Learner G: *Science have a lot of work if teachers can teach us how to absorb all that work and be able to remember it in exams then we can improve. Otherwise our teachers are putting all effort in making sure that we understand it is just that there is too much work.*

Learner H: *Experiments and extra classes are a way to go. Teachers should find a way of a way of reducing that work for us.*

APPENDIX N: Editor's declaration

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DECLARATION

I herewith declare that the dissertation

FACTORS THAT CAUSE POOR PERFORMANCE IN SCIENCE SUBJECTS AT INGWAVUMA CIRCUIT

by Mbalenhle Happiness Ngema

was edited by me.

However, the correction of all errors/missing information remains the responsibility of the student.

.....

Prof. K. le Roux