

**Factors affecting the academic achievement of learners in Physical Sciences in
selected Limpopo rural secondary schools**

by

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DECLARATION

I declare that **FACTORS AFFECTING THE ACADEMIC ACHIEVEMENT OF LEARNERS IN PHYSICAL SCIENCES IN SELECTED LIMPOPO RURAL SECONDARY SCHOOLS** 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.

SIGNATURE

DATE

STUDENT NUMBER: 31070647

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DEDICATION

I dedicate this thesis to my wife Sekai.

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ABSTRACT

The study explored factors that affect learner academic achievement in Physical Sciences in Limpopo rural secondary schools. The motivation for the research was based on the high failure in Physical Sciences in South African schools. The new Curriculum Assessment Policy Statement (CAPS) has brought changes in the teaching and learning of Physical Sciences such as assessment processes, methodology and new content. It was worth pointing out that the achievement of Physical Sciences learners gives an indication of the effectiveness and efficiency of Physical Sciences teaching and learning. Therefore, identifying the factors entails important issues which are of great relevance to the way Physical Sciences should be taught in schools to improve learner academic achievement. The primary question was “Which factors impact on learners’ academic achievement in Physical Sciences in Limpopo rural secondary schools?” In order to answer this question a qualitative approach and qualitative survey design were used and individual interviews were carried out with Physical Sciences teachers, principals, parents and curriculum advisors. Data was further collected through focus group interviews with Physical Sciences learners. Purposeful sampling was used to identify the participants.

Data analysis in this research was aimed at giving appropriate meaning to the views of the Physical Sciences teachers, Physical Sciences learners, principals, curriculum advisors and parents on factors affecting learner academic achievement in Physical Sciences. The data was audio-recorded, transcribed and printed. The interview transcriptions were organised into themes by coding. The coded data was used to form the true analysis of the activity system by identifying the purpose of the activity in order to get clarifications. This included the context of the Physical Sciences teaching and learning and learner academic achievement.

The results according to the perceptions of Physical Sciences teachers, Physical Sciences learners, principals, curriculum advisors and parents showed that the main issues of high failure rate are lack of adequate resources, teacher effectiveness, lack of motivation, high teacher-learner ratio, workload, discipline of learners, supervision of teachers, parental involvement, management and leadership skills, and appropriate teaching methods.

Recommendations for practice and policy are suggested and the indication was that provision of common tasks to teachers and formation of subject committees decreases the workload. The availability of resources allows learners to do practical work and improve performance. The goal was to engage learners in challenging and stimulating tasks with appropriate help from the teachers to improve achievement. In order for the teacher to provide assistance to the learners there must be maximum teacher-learner ratio. Effective supervision ensures that teachers and learners are punctual, which will ensure maximum use of available teaching time and timely completion of the work schedules or pace setters. A smaller number of learners per class could result in improved performance in Physical Sciences. It is important for principals to instil discipline in learners. The support and value of NGOs to assist in sharing workload by carrying out experiments in secondary schools was acknowledged.

Key terms:

Academic achievement; Assessment of learners; Discipline of learners; Instructional resources; Motivation of learners; Physical Sciences curriculum; Physical Sciences learner, Physical Sciences subject; Socio-economic status; Supervision of teachers; Teacher effectiveness; Teacher-learner ratio; Workload.

CHAPTER 1

INTRODUCTION AND ORIENTATION

1.1 CONTEXTUALISATION

According to the International Institute for Education Training, a branch of the United Nations of Educational, Scientific Cultural Organisation (UNESCO) science report, (2010:9) “Physical Sciences addresses concerns of food, water and energy and security to provide better healthy service and better infrastructure.” There are many schools that offer Physical Sciences to South African children. This prompted the researcher to study the teaching and learning of Physical Sciences to find out what may affect learners’ academic achievement. According to Zumdahl (2008:5), the teaching of Physical Sciences should be managed in such a way that learners are engaged in some practical activities since visual material is especially important for learning. Laboratories, Science kits or mobile laboratories should be available to cater for these activities. The researcher has identified a number of issues such as poor infrastructure, a shortage of laboratories and textbooks and appropriately qualified educators that may be the cause of poor pass rates. It is against this background that the research on the factors affecting the academic achievement of learners in Physical Sciences in selected Limpopo rural secondary schools is undertaken.

Howe, (2003:15) states that high rate of low academic achievement in Physical Sciences is a cause of great concern in South Africa. Furthermore, the Department of Basic Education, (2011:14) reiterated that the central feature emerging from rural secondary schools in Limpopo Province is low academic achievement in Physical Sciences, which continues to be a major challenge. However, Muwanga-Zake, (2008:1) states that, although there are efforts to improve the academic achievement in Physical Sciences, it has however been noted that the results in Limpopo rural secondary schools are still low. Makgato’s, (2007:90) study reports on a number of factors that affect learner performance, such as shortage of resources, shortage of appropriately qualified teachers, lack of preparation, content coverage, lack of supervision, use of traditional teaching methods, non-compliance by teachers in the curriculum and discipline. Bloch, (2009:2) states that the high failure rates in Physical Sciences persist to be a perennial problem and a major concern in Limpopo rural

secondary schools. It may then indicate that the reasons for low learner academic achievement in Physical Sciences, especially in rural secondary schools in South Africa have not been sufficiently researched. Therefore, this research is designed to identify and analyse the rural secondary school related factors that adversely affect learner academic achievement in Physical Sciences in Limpopo Province.

According to Cameron, (2009:10) development in South Africa is affected negatively due to a smaller number of learners who pursue scientific careers. In addition, failure in Physical Sciences has an impact on the number of scientific professionals and development. Moreover, high failure rates in Physical Sciences have resulted in the subject becoming an unpopular choice, resulting in fewer learners selecting the subject at Further Education Training (FET) (Department of Basic Education, 2011:8). This has resulted in shortages of engineers, skilled artisans, technicians, doctors and technologists. Makgato, (2007:257) reiterated that learners are not motivated to enrol for Physical Sciences as a subject because they observe the high failure rates and therefore, fear failure in Grade 12. Cameron, (2009:21) emphasised that Physical Sciences is an instrument for sustainable development, and therefore, Limpopo rural secondary schools face great challenges to enhance the academic achievement of learners in Physical Sciences.

In an attempt to increase and improve the pass rate in Physical Sciences, the Department of Basic Education and private sector are developing a number of initiatives and intervention programmes at national, provincial and district levels and institutions of higher learning. These include the Technology Research Activity Centre (TRAC), Mathematics Science and Technology (MST) learning programmes and sponsored Saturday and holiday lessons in Physical Sciences. As a way of trying to improve the academic achievement of Physical Sciences learners, experienced foreign educators have been recruited in Limpopo Province to fill the gap of skills shortages in order to improve the pass rate (Department of Basic Education, 2011:3). However, despite these efforts, it is disturbing to note that the failure rates in Physical Sciences are increasing at an alarming rate, especially in Limpopo rural secondary schools (Cameron, 2009:16). This shows that besides those factors that are in play that affect the academic achievement of learners in Physical Sciences, there are other factors; hence the need for the study.

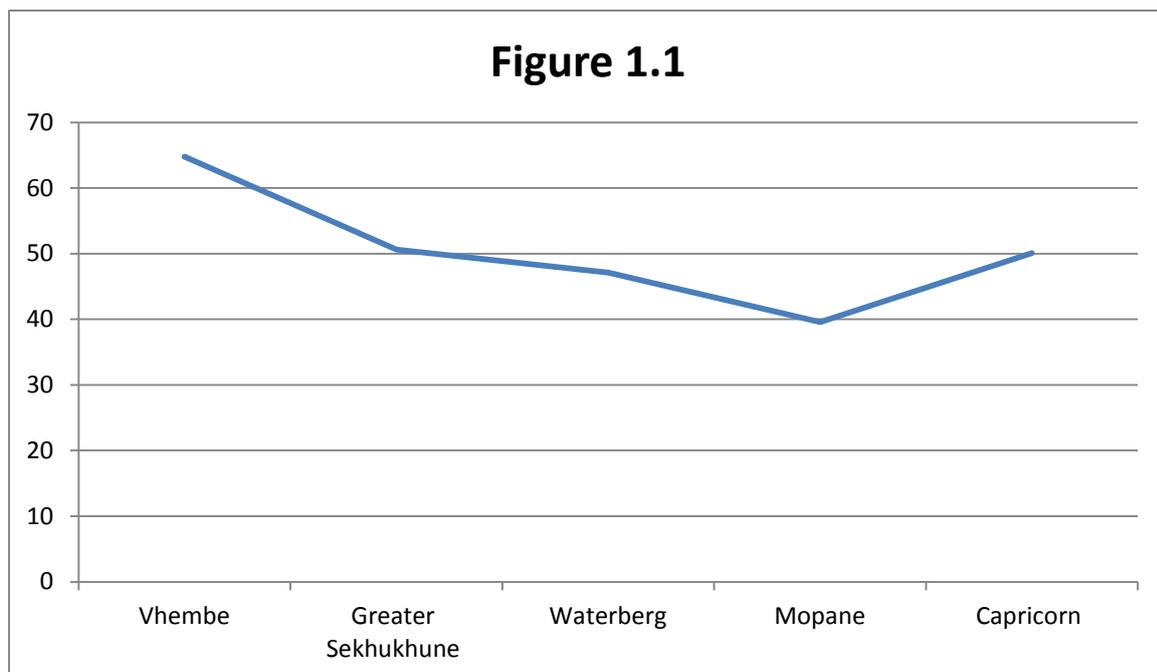
As indicated earlier an analysis of the 2011 matriculation results of Limpopo Province reiterated the poor performance of rural secondary schools, particularly in Physical Sciences (Department of Basic Education, 2011:12). Physical Sciences learners should obtain 30% and above to pass, while 29% and below is considered a fail (Department of Basic Education, 2011:12). A review of these results in Limpopo Province by districts shows that performance of learners in Physical Sciences especially in rural secondary schools is a burning issue that needs further research. The table below shows evidence of the analysis of the results of 2011 in Physical Sciences by district in Limpopo Province.

Table 1.1: Districts' achievements in Limpopo Province 2011 for Grade 12.

| DISTRICT | % AVERAGE PASS |
|--------------------|----------------|
| VHEMBE | 64.8 |
| GREATER SEKHUKHUNE | 50.6 |
| WATERBERG | 47.1 |
| MOPANE | 39.6 |
| CAPRICORN | 50.1 |

(Department of Basic Education, 2012:9)

Figure 1.1 Line Graph showing districts' achievements on the table above.



The evidence shows some deficiencies and gaps in the teaching and learning of Physical Sciences and therefore, necessitates the study of learner academic achievement in Physical Sciences. The data shows that three of the districts were under performing. This indicates that many learners are performing poorly in Physical Sciences. The poor performance could be attributed by the shortage of resources, teaching methods, teacher-learner ratio and workload. According to the Department of Basic Education (2011:7), any district that achieves a pass rate below 50% is underperforming. It is worth pointing out that the achievement of Physical Sciences learners gives an indication of the effectiveness and efficiency of Physical Sciences teaching and learning. This is substantiated in the Report on the 2011 National Senior Certificate Examination, National Diagnostic Report on learner performance in Physical Sciences:

Table 1.2: Overall achievement in Physical Sciences from 2008-2012 (National Matric Results (Grade 12).

| YEAR | Number that wrote | 30% and above (n) | 30% and above (%) | 40% and above (n) | 40% and above (%) |
|------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 2008 | 217 300 | 119 206 | 54.9 | 62 530 | 28.8 |
| 2009 | 220 882 | 81 356 | 36.8 | 45 452 | 20.6 |
| 2010 | 205 364 | 98 260 | 47.8 | 60 917 | 29.7 |
| 2011 | 180 585 | 96 441 | 53.4 | 61 109 | 33.8 |
| 2012 | 178 887 | 109 700 | 61.3 | 69 927 | 39.1 |

(Report of Department of Basic Education 2013:60)

The table shows that from 2009 the number of learners taking Physical Sciences decreased annually. Although the pass rate has increased slightly, the difference is minimal and quality of the results is low. Most of the learners achieved between 30% and 39% (Department of Basic Education, 2013:165). According to the Department of Education, (2013:166) there still appear to be two distinct sets of candidates. Those who are performing well and those who were seriously lacking the knowledge and skills required. The table also indicates a drop in the number of learners taking Physical Sciences as a subject. In 2008 the number was 217 300 and in 2012 it was 178 887. Most of the candidates passed with level 2 (30%-39%).

A comparison of results between urban secondary schools and rural secondary schools in Limpopo Province is given below

Table 1.3: Matriculation achievement in five selected urban secondary schools for 2011 in Limpopo Province (Grade 12).

| Names of schools | Percentage pass rate (%) |
|--------------------------|--------------------------|
| CAPRICORN HIGH | 88.7 |
| HOERSKOOL PIETERSBURG | 98.3 |
| FLORA PARK COMPREHENSIVE | 51.5 |
| TAXILA COMBINED | 94.3 |
| SESHEGO HIGH | 42.0 |

(Department of Basic Education, 2012:1)

The results show that the performance in urban schools is high; only one school from the list got a percentage below 50% and this school is located in a township. This can be attributed to the availability of resources and better infrastructure in urban areas.

Table 1.4: Matriculation results of some rural secondary schools in Limpopo province for 2011 (Grade 12).

| Names of schools | Percentage pass rate (%) |
|---------------------|--------------------------|
| SCHOONGEZICHT HIGH | 29.0 |
| KGEREPI SECONDARY | 18.8 |
| KETUDI HIGH | 13.3 |
| RAPHATLHA SECONDARY | 0.0 |
| MAPHUTHA SECONDARY | 9.1 |

(Department of Basic Education, 2012:2)

The pass percentage is far below 50% in schools situated in rural areas. When compared with some schools in the urban area, performance in rural schools is far below of that in urban secondary schools.

It is hoped that this research could assist in improving learner academic achievement in Physical Sciences and bring back the desire or confidence in learners to take up Physical Sciences as a subject. The research should contribute

to solving national and international problems of shortages of scientific skilled labour. Accurate descriptions of the factors affecting learner academic achievement could play a key role in policy reform (Marsh, 1982:3).

1.2 THEORETICAL FRAMEWORK

This research focuses on various factors that affect learner achievement in Physical Sciences in Limpopo rural secondary schools by mainly considering the theories and models of learning. The discussions aim at identifying, clarifying and establishing factors and related issues that negatively affect learner academic achievement in Physical Sciences in rural secondary schools in Limpopo Province. The discussion is based on theories of learning and the Cultural Historical Activity Theory (CHAT) in relation to factors that contribute to the success of learners in Physical Sciences.

Most theories have great value in organising knowledge, have value in the direction of research for new knowledge, are used in the solution of problems, are of importance in understanding how children learn and facilitate teaching and learning processes in Physical Sciences (Morrison, 2009:170). However, these learning theories differ from each other in terms of how they view learning of Physical Sciences. This study will compare and contrast the theories of learning and provide suggestions on how they can be applied in the teaching and learning of Physical Sciences in Limpopo rural secondary schools.

The study focuses on how the teaching and learning of Physical Sciences can be adapted to the teaching and learning approaches in an integrated manner. According to Mwamwenda (2004:174), these theories interchange and are common to one another. Research studies have revealed that these theories have important influence on Physical Sciences teaching (De Witt, 2009:53).

1.2.1 Cultural-Historical Activity Theory (CHAT)

Engeström and Miettinen, (1999:3) argued that the concept of activity opens up a new way to understand change. The key is “revolutionary practice,” which is not to be understood in narrow terms but as joint “practical-critical activity.” Kuutti, (1996) in Foot, (2001:5) defined activity as “a form of doing directed to a goal.” The goal-orientation of activity is critical. The transformation of the goal into an outcome, by

engaging it through mediating artefacts, motivates the existence of activity. Activity-centred theory is distinctive in three ways, as Engeström, (1999:377-378) observed:

- Activity theory is deeply contextual and oriented at understanding historically specific local practices, their goals, mediating artefacts, and social organisations;
- Activity theory is based on dialectical theory of knowledge and thinking, focused on the creative potential in learner cognition; and
- Activity theory is developmental theory that seeks to explain and influence qualitative changes in learner practices over time.

According to Vygotsky (1978) in Foot (2001:6), action consists of a subject (or actor), an object (either an entity or a goal), and mediational tools. Tools can be either material or conceptual. Scientific methods and models, and other forms of cultural artefacts are tools as are computers. Leont'ev, (1978:65) developed mediated social processes into what is known as activity theory. He distinguished between actions, operations and activity. Actions are conscious tool-mediated, and goal-oriented, whereas operations are routines and therefore unconscious components of actions subject to concrete conditions. Operations are “the methods for accomplishing actions.” An activity is a molar unity that manifests itself in actions while operations and actions are constituent characteristics of an activity. Leont'ev, (1978:65) maintained that they must not be conceptualised as special “units” that are included in the structure of the activity, because “learner activity does not exist except in the form of actions. If the actions that constitute activity are mentally subtracted from it, then absolutely nothing will be left of activity.”

The implication of this theory is that there must be time when Physical Sciences learners sit on a computer and learn how to find scientific information and answer questions. This also entails that learners should be engaged in practical activities in Physical Sciences. With practice, doing experiments becomes an operation comprising actions that had become automatic and thus condensed and unconscious. Leont'ev, in Foot (2001:9), also argued that an activity is identified and distinguished by its goal or purpose. According to this formulation, activities in Physical Sciences would always be specific, each one answering a definite need, extinguished as a result of its satisfaction, and produced again, perhaps in other,

altogether changed conditions. The main thing that distinguishes activity systems from one another is the difference in their purpose. The goal of an activity gives it a determined direction, a horizon toward which it orients, but a goal is not an “end” in the traditional sense.

Engeström, (1999:380:381) explained that an activity constantly generates actions through which the goal of the activity is enacted and reconstructed in specific forms and contents, but being a horizon, the goal is never fully reached or conquered. The creative potential of the activity is closely related to the search actions of goal construction and redefinition. This means that the activity systems are realised through interlinked, tool-mediated actions by which learners collectively engage, enact and pursue an evolving goal. The understanding of the goal stems from the view of learner development as an active social process rather than an individual, cognitive and largely passive one. An activity is a unit of analysis for understanding a larger flow of Physical Sciences learner’s life. In the analysis of milieu of Physical Sciences learner’s life, separate, specific activities can be singled out; actions (the processes that are subordinated to conscious goals) can be isolated and analysed.

Engeström, in Foot (2001:10) explained the definition of activity as a unit of analysis that fulfils the following demands:

- It is representative of the complexity of the whole;
- It is analysable in its contextuality;
- It is specific to learners by being culturally mediated; and
- It is dynamic rather than static.

Engeström, (1999:380) stated that the unit of activity includes three additional components that explicate the social structure of activity, namely:

- Rules that regulate the learner’s actions toward a goal, and relations with other learners in the activity;
- The community of people who share an interest in and involvement with the same goal; and
- The division of labour; what is being done by whom toward the goal, including both the relatively horizontal division of tasks and the vertical division of power, positions, access to resources, and rewards.

Consistent with Vygotsky's, (1978:208) view of learning, Physical Sciences learners do not solely internalise or appropriate the cultural-historical and material resources available to them, but they also externalise or create new social and material forms, patterns of relations, and tools; in expansive cycles of development. The model of the activity system facilitates reflexivity on the part of the Physical Sciences teacher who employs it.

1.2.2 Constructivism

Constructivism is viewed today as the construction of knowledge occurring in the mind of the individual and within his/her perception of the world. The process of learning involves the linking/thinking of newly acquired knowledge with old internalised knowledge. Technology has contributed to the constructivist theory by providing a wide range of technology mediated learning resources such as computers (Dalgamo, 2001:183-194). The constructivist approach can be implemented into the mediated learning framework via the definition of the constructive elements of the learning structures, the social system where learning is taking place and the power dynamics among the actors to create an environment where knowledge is allowed to be created in the minds of the learners via the use of technology (Saade and Huang, 2009:87-99).

Constructivists believe that knowledge is constructed by learners as they make sense of new experiences. Therefore, learners are not empty vessels waiting to be filled but active beings seeking meaning through their experiences (Berk, 2006:220). Learning is a cognitive process that results from the interaction of past experiences (prior knowledge) and new experiences (new knowledge) on the part of the learner. This indicates that learners do not learn things in isolation from what they are already familiar with. As a result, teachers should understand the mental models or constructs that learners bring to the classroom and build on such knowledge when introducing new information. Furthermore, learners should be given opportunities through which they can construct their own knowledge (Harmmil and Bartel, 2004:213). Kramer, (2002:24) states that all learners can succeed if they are allowed to learn in ways and at the pace that is natural since learners learn differently and are different.

According to Piaget 1968 in Mwamwenda, (2004:84) each individual is born with some sort of collection of knowledge, skills, and values called schema. Cognitive development is development of schema on structures which are the means by which a person interprets and organises experience. Morrison, (2009:114) states that using constructivist model, learning may be viewed as an active process in which children and adults construct their own personal meaning of the objects and events through interactions with them by incorporating new information into prior knowledge and experiences. According to Morrison, (2009:113) knowledge is a result of constructive activity and exists in the mind of the cognising being where it is constructed or built and cannot be transferred to passive receiver. Therefore, acquiring knowledge involves personal construction of meanings and informal theories that an individual develop about the natural phenomena (Sternberg, (2003:446).

Piaget's constructivism model of equilibrium show that; learners build or construct new knowledge and skills based on what they already know or can do, learners adjust to what they already know to fit the new knowledge and the old knowledge together in a balanced way, teaching and learning experiences should be designed to give the processes of assimilation, disequilibrium and accommodation to function. According to Piaget (1968) in Mwamwenda, (2004:96) learning takes place as a result of active engagement in the part of the learner. It is important, therefore, for teachers to see that learners take an active role by participating in whatever is being taught and learned. Such learning, as opposed to rote learning, "promotes deeper and more enduring understanding." Teachers should not impose knowledge on children; rather, children should do most of the learning through materials presented by the teacher that they will find interesting and challenging. Children should search for solutions to the problems posed to them. It is argued; therefore that teaching in Physical Sciences in secondary schools should be designed to suit the developmental level of learners.

1.2.3 Behaviourism

The teacher organises teaching to ensure that learners are exposed to specific stimuli rather than provoke particular responses that in turn demonstrate that learning has actually taken place (De Witt, 2009:52). It is acknowledged, that learning reveals itself only through observable behaviour (Sternberg, 2003:444).

According to Trowbridge, Bybee and Powell, (2004:258), Physical Sciences teachers should know the kind of behaviours they expect in the learners from the Physical Sciences learning experience and determine the reinforcers and the stimuli such as the environment. There are clear and predetermined instructions, and immediate and personal feedback. However, the idea of reinforcement has some negative impact in some situations during teaching and learning in Physical Sciences. Some negative comments influence the behaviour of the learner negatively (Harlen, 2000:44). In addition, Bandura in Sternberg, (2003:10) criticises rewarding of learners to some extent, because learning does not appear to result from direct rewards of behaviour since it is also social, resulting from punishments given to others.

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

1.2.4 Social learning theory

The theory views learning as a process whereby, new knowledge is acquired when individuals from different social conflicts interact with one another (De Witt, 2009:21).

In addition, social learning theory asserts that many of the discoveries that learners make occur within a rich social context whereby co-operative or collaborative dialogues between a skilful adult or peer, models the activity and transmits verbal instructions (Berk, 2006:263-264). Kramer, (2002:7) posits that social learning strongly asserts that human cognitive development is influenced by values, resources, and intellectual adaptation passed to learners by parents. According to Morrison (2009:121), learners interact with parents and a variety of development processes occur through these interactions. According to Mwamwenda, (2004:192) social learning theory states that learners construct their own meaning of things that they perceive. Furthermore, De Witt, (2009:239) stresses that social learning theory views learning as a process whereby new knowledge is acquired when Physical Sciences learners from different social conflicts and points of understanding, interact with one another. Social learning theory asserts that human cognitive development is inherently socio-cultural such that it is influenced by beliefs, values and tools of intellectual adaptation passed to individuals by their culture (Kramer, 2002:7).

Social learning theory believes that learner's mental, language and social development is supported by and enhanced through such social interactions. Children seek adults for social interactions beginning from birth and a variety of developmental processes occur through these interactions (Morrison, 2009:121). However, Mwamwenda, (2004:185) emphasised that children learn more by social interactions with parents, peers and educators and therefore develop new ideas, skills, values and attitudes. In social learning theory, children learn a multitude of a variety of new social responses by observing the actions of salient models around such as parents, teachers and peers. This implies that humans are social beings that acquire knowledge and skills through observational learning whereby they consciously observe others and imitate them (De Witt, 2009:30).

1.2.5 Discovery learning

According to Mwamwenda, (2004:192-193) the discovery model of learning emphasises that the learner learns best through discovering the structure of the subject through inductive reasoning and intuitive thinking. The learner is viewed as an active explorer and is capable of discovering new information independently (Kramer, 2002:6-7). Discovery learning calls for active participation of the learner.

Teaching of Physical Sciences through discovery methods provides opportunities for learners to experiment, investigate problems, and to work in groups. Learners are able to discover scientific concepts and principles for themselves rather than through other social groups, such as educators (Department of Basic Education, 2011:9). Discovery learning is a problem-centred approach; it brings about some cognitive conflicts in the learners' minds as they experiment and try to search for scientific solutions. Cognitive conflicts promote in learners, development of problem solving skills and the ability to think and act in ways which are associated with inquiry (Harlen, 2000:17). The Department of Basic Education, (2011:4) emphasises that scientific enquiry provides learners with opportunities to share ideas, develop communication skills and co-operate in effective team work and be confident in handling apparatus.

According to Bruner (1971) in Mwamwenda, (2004:193) discovery learning enables learners to increase their ability to learn related material; it increases their interest in the task in which they are involved, it contributes to lasting retention of information; it makes the transfer of learning more probable, it develops initiative in dealing with similar problems; it trains learners in important thinking operations such as comparing, summarising, interpreting and criticising, and finally, it trains learners how to learn.

To encourage discovery, Bruner (1971) in Mwamwenda, (2004:192) proposes that it is vital to provide learners with opportunities to engage in thinking, insights and problem solving as an integral part of the teaching and learning. Through exposing children to inductive processes that will ultimately lead to the discovery of the principles and concepts underlying whatever they may be studying or investigating. According to Mwamwenda, (2004:192) the teacher should present learners with a problem; play the role of facilitator of an inductive inquiry process, starting with specific information and continuing step-by-step discovery. This allows learners to arrive at concepts, and learn how to reach major concepts, learn the process involved in gathering data and make references from such data.

However, Mwamwenda, (2004:88) argues that deductive reasoning begins with the general and moves to the specific. Thornbury, (1999:81) states that deductive reasoning is essential a top-down approach which moves from the more general

notion or theory, which are narrowed down to specific hypotheses, which are tested. A deductive approach involves the learners being given a general rule which is then applied to specific science examples.

1.2.6 Learning styles

According to Morrison, (2009:435), learning style is described as the way the learners of every age are affected by their immediate environment, own emotionality and sociological needs when concentrating and trying to master and remember new or difficult information or skills. Learners learn best in classroom environments that are compatible with their own learning styles. Learners need to be given the opportunity to use their own learning styles in order to enhance academic achievement. Therefore, teachers should accommodate different learning styles and preferences of learners (Lemmer, 2000:68). However, Kramer, (2002:10) emphasised that each learner should use learning styles in association with the four stages, namely; the concrete experience, reflective observation, abstract conceptualisation and active experimentation stages. According to Komarraju and Karau, (2008:10) learning styles are constituted by heredity, education, experience, environment demands and work preferences. It is crucial for Physical Sciences teachers to realise that real Physical Sciences learning occurs only when the learner is actively engaged in hands-on-activities (Berk, 2006:239).

1.2.7 Input-process-output (System model)

According to Howe, (2003:4), input and process factors are complementary, intimately interrelated and act as important determinants of learner's success in Physical Sciences. The input factors involve school factors such as laboratories, textbooks, Physical Sciences curriculum content, teachers, morale, commitment and parental involvement. Learners' aptitude, ability, commitment and readiness also fall under input factors (Lemmer, 2000:90-91). The process factors include strong leadership and management styles, attitudes, sufficient teaching time, supervision, motivation, active teaching methods, discipline, assessment and feedback, and appropriate teacher-learner ratio (Howe, 2003:4). Improving interaction among these factors results in positive outcomes such as high achievement in Physical Sciences. Kanyango, Schreiber and Brown (2007:38), suggests that learners' academic achievement should be viewed in the context of an input-process-output (system)

model. There is a relationship between the input and the process factors within the school as a system which determines the output or learners' achievement.

Having reviewed the various learning theories and learning styles and acknowledging the relevance and contribution of each in the learning of Physical Sciences, CHAT appears to incorporate all the important stakeholders and strategies to address the research problem and consequently this theory forms the lens through which the problem will be investigated.

1.3 STATEMENT OF THE PROBLEM

Based on the preceding discussion, the problem on which this research focuses is:

- Which factors impact on learners' academic achievement in Physical Sciences in Limpopo rural secondary schools?

1.4 RESEARCH AIMS AND OBJECTIVES OF STUDY

1.4.1 Research aim

The aim of the research is to determine factors which are related to Physical Sciences achievement of learners in Limpopo rural secondary schools and provide recommendations based on findings. Ideally, this would assist Physical Sciences educators, Physical Sciences learners, principals and parents in improving the teaching and learning of Physical Sciences and also help in policy reform.

1.4.2 Research objectives

The purpose of the study is to:

- Determine factors which affect the academic achievement of learners in Physical Sciences in Limpopo rural secondary schools.
- Identify the problems faced by learners, teachers, principals and parents with regard to the teaching and learning of Physical Sciences in Limpopo rural secondary schools.
- Suggest intervention strategies that could be implemented to improve academic achievement of Physical Sciences learners in Limpopo rural secondary schools.

In order to achieve the research objectives that have been identified, the following research questions need to be answered.

- What are the factors that affect the academic achievement of Physical Sciences learners in Limpopo rural secondary schools?
- Which intervention strategies could be implemented to improve the academic achievement of learners in Physical Sciences in Limpopo rural secondary schools?

1.5 RATIONALE AND MOTIVATION

This research intends to evaluate the factors that may affect the academic performance of learners in Physical Sciences in selected rural secondary schools in Limpopo Province. The research could possibly assist in the improvement of academic performance in Physical Sciences in Limpopo rural secondary schools. In addition, the views of principals and curriculum advisors will help to determine possible solutions on how academic performance in Physical Sciences could be improved. The research findings could possibly assist school principals to understand problems faced in implementing Physical Sciences if resources are limited. Principals could find ways of providing adequate learning materials and aids to Physical Sciences educators. In addition, the findings could assist educators to implement Physical Sciences effectively in schools to improve the academic performance of learners. Furthermore, the importance of the study is to come up with strategies to establish self-motivated Physical Sciences educators who have exposure to new teaching methods in Physical Sciences, who stimulate scientific curiosity in learners through direct investigations of the natural phenomena in their own immediate environments. This will also assist educators to seek for new solutions to problems facing the Physical Sciences learners in the classroom. As a result, this may elevate the levels of teaching and learning of Physical Sciences in rural secondary schools in Limpopo Province.

The research findings could contribute to help parents understand the importance of Physical Sciences and the role they as parents can play in promoting the teaching of this subject in selected secondary schools and the learning of learners. The researcher also hopes that the findings could result in the establishment of Physical Sciences in more schools in Limpopo province. Evidence obtained could be used to

rekindle the learners' interest in Physical Sciences as well as improve and increase their pass rate. Lastly, the researcher also intends to determine availability of learning materials, learning aids and how learners are motivated during teaching and learning in Physical Sciences.

1.6 RESEARCH DESIGN

The researcher adopted a qualitative approach/design and qualitative survey design in this research. According to the International Society for Quality in Health Care, (2002:329) the use of the qualitative approach can enhance the development of quality reports as well as quality improvement efforts. However, the qualitative approach and qualitative survey design require skilful interpretation of the data.

In this investigation interview studies will be used. This keeps the researcher close to the data and markedly facilitates understanding of the phenomenon being studied. The interview studies allow the researcher to view participants as collaborators from whom to learn rather than as subjects to be studied. Participants' credibility in these interview studies tends to be high (Schwandl, 2005:120).

Face-to-face in-depth interviews will be used to collect data from principals, teachers, parents and curriculum advisors. The interviews will be carried out in rural secondary schools in Limpopo Province. Open-ended questions will be used in order to allow participants to formulate their own answers (Muijs, 2012:149). The interview schedule will be developed based on the topic and questions generated from the main research questions. Focus group interviews will be held with learners to collectively gather their input. All the interviews will be recorded so that all nuances of the answers can be retained and the richness of individual statements is not lost. The researcher will ensure that the recordings remain secure and handwritten notes will be made in addition to audio-recordings.

The population consists of Physical Sciences teachers, principals of schools offering Physical Sciences, learners doing Physical Sciences, parents of learners doing Physical Sciences and Physical Sciences curriculum advisors. The study will be conducted in Limpopo Province in five rural secondary schools. Purposeful sampling will be used to select five Physical Sciences educators, five principals, five parents and 30 Physical Sciences learners.

Transcription of data collected from interviews will be done using coding that enables the researcher to handle and analyse data from the interviews more systematically, comprehensively and effectively than can be achieved by other methods. Data will be reduced to a manageable form by coding. Coding categorises data into underlying concepts and dimensions and facilitates systematic retrieval (Friese, 2011:30). Explanations induced from the interviews will be made and interpretations and analysis of data done relating them to the data.

1.7 FOCUS AREAS

The research addresses the following focus areas:

- Principals who supervise Physical Sciences teachers;
- Motivation of learners to work harder in Physical Sciences;
- Teacher effectiveness and learner performance in Physical Sciences;
- Learner socio-economic status and performance in Physical Sciences;
- Practical work and experiments in Physical Sciences;
- Schools' resources for Physical Sciences;
- Willingness of learners to do Physical Sciences;
- Parents and subject choices of learners;
- The influence of teaching Physical Sciences through the medium of English on learner performance;
- The degree of difficulty of some topics in Physical Sciences and the problem of teaching these topics;
- Availability of Physical Sciences textbooks;
- Teachers' work load and learner performance in Physical Sciences;
- Effective teaching methods and learner academic achievement in Physical Sciences;
- Availability of laboratories;
- Class size and performance in Physical Sciences;
- Discipline and learner performance in Physical Sciences;
- Learner assessment and learner academic achievement; and
- The role of management and leadership skills of principals and learner performance in Physical Sciences.

1.8 DELIMITATION OF STUDY

The study is concerned with responses from secondary school teachers, principals, learners, parents and curriculum advisors in one district of Limpopo Province. There are five districts in Limpopo Province. The researcher will study one circuit from a particular district. A sample of five rural secondary schools that offer Physical Sciences will be studied. Five teachers teaching Physical Sciences (one per school) will be interviewed. In addition, five principals (one per school) from the schools will be interviewed. Parents of learners doing Physical Sciences will also be interviewed. Lastly, two curriculum advisors for Physical Sciences and six learners (per school) from five schools offering Physical Sciences are to participate in a focus group interview. The study is restricted to factors affecting academic achievement in Physical Sciences.

1.9 ETHICAL ISSUES

The National Institute of Health Office of Extramural Research Website, (2003:3) states that research ethics provides guidelines for the responsible conduct of research. In addition, research ethics educate and monitor scientists conducting research to ensure a high ethical standard. Based on this the researcher did not indulge in plagiarism by passing off somebody else's ideas, thoughts, pictures, theories and words. The researcher did not copy from modules or textbooks this research.

Belmont's report, (1989:35) states that informed consent should exist to ensure that all research involving human subjects allows for voluntary participation by subjects who understand what participation entails. Informed consent means that people approached and asked to participate in research study must:

- know what they are getting involved with before they commit.
- not be coerced or manipulated in any way to participate.
- must consent to participate in the project as a participant.

The researcher exercised privacy and confidentiality on participants during collecting of information. The researcher considers fairness, honesty, respect for the integrity

and dignity of the participants and confidentiality of information as essential. The researcher ensured that the participants sign a consent form for participation. The researcher discloses of the objectives and methods of research to the participants. Lastly, the researcher applied for authorisation to carry out the research in secondary schools from the Department of Basic Education and subsequently obtained the necessary clearance from the Ethics Committee of the College of Education of the University of South Africa.

1.10 DEFINITION OF TERMS

Academic achievement: According to the Oxford Dictionary, (2010:8), achievement means “bringing about or accomplish by effort, skill or courage.” In this study, it means being able to attain 30% and above in Physical Sciences.

Assessment of learners: According to the Department of Basic Education, (2011:143), assessment is a continuous planned process identifying, gathering and interpreting information about the performance of learners. In this study, assessment is monitoring learners’ progress in Physical Sciences through homework, class-work, tests, experiments and projects.

Discipline of learners: Rosen, (2005:12) indicates that the term could mean:

- training that develops self-control, character, orderliness or efficiency;
- strict control to enforce obedience;
- treatment that controls or punishes; and
- a system of rules.

In this study, discipline is a system of rules that enhances an environment conducive to teaching and learning of Physical Sciences.

Head of Department (HoD): According to the Guidelines for Capacity Building of School Governing Body Members (2012:21), a HoD is Head of a subject. According to this study, the HoD is a teacher leading the Physical Sciences department in a school.

Instructional resources: Multicultural Advisory Council (2003) views instructional resources as tools used in educational lessons, which includes active learning and assessment. Any resources a teacher uses to teach his/her students. According to this study, these are laboratories, chemicals, apparatus, computers and textbooks used to facilitate effective teaching and learning in Physical Sciences.

Motivation of learners: Dubrin, (2008:2) defines motivation as the “act or process of motivating, the condition of being motivating, a motivating force, stimulus, or influence, incentive, drive or something that causes a person or learner to act and the expenditure of effort to accomplish results.” In this study, motivation is a drive that compels the learner to act positively during teaching and learning of Physical Sciences that result in a will to learn.

Parent body (School Governing Body): According to the South African Schools Act (SASA) (Act No. 84 of 1996b as amended) the body has the responsibility to govern a school. In this study, parents are the biological mother or father or guardian of the Physical Sciences learner.

Physical Sciences Curriculum: Kelly, (1999:12) defines curriculum as “all the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside the school” In this study, the “Physical Sciences curriculum” refers to the guidelines given by the Department of Basic Education in the CAPS document for Physical Sciences, which is implemented by the schools.

Physical Sciences Learner: In section 1 of the South Africa School Act (No. 84 of 1996), a learner is: “any person receiving education or obliged to receive education in terms of this Act.” In terms of the study, a learner is a person learning Physical Sciences in the Further Education Training Band (FET) in a rural secondary school.

Physical Sciences subject: For this study, “Physical Sciences” refers to the subject that focuses on investigating physical and chemical phenomena through scientific inquiry by applying scientific models, theories and laws in order to explain and predict events in our physical environment (Department of Basic Education, 2011:8). It is offered as an elective in the Further Education Training (FET) band, and consists of chemistry and physics.

Rural schools: In terms of section 239 of the Constitution, a rural school is regarded as an “organ of state” because it exercises public power and performs public functions in terms of legislation. According to this study, a rural school is a school situated in a communal area and is under-resourced. According to the National Centre for Education Statistics (2006:3) education in a rural school is poorly resourced and has a poor infrastructure.

Socio-economic status: According to the American Heritage, New Dictionary of Cultural Literacy (2005), socio-economic status is an economic and sociological combined total measure of a person’s work experience and of an individual’s or family’s economic and social position in relation to others, based on income, education and occupation. For this study, it refers to the economic and social status of the families of the Physical Sciences learners.

Supervision of teachers: Glathorn, (1984:126) defines supervision as a process of facilitating the professional growth of teachers. In this study, it is referred to as the development of teachers by principals or Heads of Department (HoDs) for Physical Sciences through observations in order to improve teaching and learning.

Teacher effectiveness: Mwamwenda, (2004:497) views an effective teacher as one who leads to increased learning on the part of the learners. In this study, teacher effectiveness is the extent to which teachers achieve goals in Physical Sciences.

Teacher-learner ratio: Blatchford, Bassett, Brown, (2011) defines it as the number of students who attend a school divided by the number of teachers in the institution, for example, teacher-student ratio of 1:10 indicates there are 10 students for every one teacher. According to the study, it means the number of Physical Sciences learners the educator teaches in a school.

Workload: Is the amount of work or of working time expected or assigned (Cambridge English Dictionary, 2016:142). According to the study, it is the amount of work that leaves teachers with very little time for actual teaching to cover the content in the Physical Sciences curriculum.

1.11 OUTLINE OF THE STUDY

The thesis contains six chapters. The content of each of the chapters of the research study are as follows:

Chapter 1: Introduction of study: The first chapter discusses the identification of the problem, which in this study is based on, “Factors affecting the academic achievement of learners in Physical Sciences in selected rural secondary schools in Limpopo province.” In the chapter, the researcher provides an introduction in which the importance of the study is highlighted. The general performance of Physical Sciences learners is discussed from a South African perspective, followed by the general performance of learners in Limpopo Province and narrowed to rural secondary schools as the area of focus of this study. This research could contribute to the improvement of academic achievement of learners in Physical Sciences. The researcher identified the participants in this study, namely; Physical Sciences educators, parents, principals and curriculum advisors. The theoretical framework, research design and ethical considerations are given as well.

Chapter 2: Theoretical framework: Cultural-Historical Activity theory is the framework that is discussed and its aspects linked to the research. CHAT links the teachers, principals, parents, learners and curriculum advisors as the communities of practice to other factors that affect learner academic performance in Physical Sciences.

Chapter 3: Literature review: The literature review sets a broader conceptual framework of relevant theory and research. The purpose of this chapter is to demonstrate how the research question fits into a larger field of study. Factors that may affect learner academic achievement in Physical Sciences such as, management and leadership skills, teacher-learner ratio, and teacher effectiveness, availability of resources, discipline of learners, motivation of learners, assessment, and parental involvement, teaching methods, and socio-economic status of learners are discussed. Relevant books, government publications, journals, websites were consulted to support and explain the research question. The Cultural-Historical Activity theory (CHAT) is the lens to review the literature.

Chapter 4: Research design and methodology: The research methods are interview studies. The qualitative approach and qualitative survey design are used. Bryman (1989:29) has observed that choice of the methodology to be used is influenced by the nature of research question, resources and time available. However, in-depth interviews are used. The population consists of teachers teaching Physical Sciences, principals of schools offering Physical Sciences, learners learning Physical Sciences, parents of learners doing Physical Sciences and Physical Sciences curriculum advisors. Purposeful sampling method is used to select five schools from which the teachers are selected. Five principals from the five schools automatically comprised the sample. Focus groups of six learners were selected from five secondary schools based on their performance. Five parents were interviewed from five schools. Two curriculum advisors are automatically drawn into the study.

Chapter 5: Results and discussion of results: There will be analysis of data collected through the interviews. The results are presented and discussed logically. The researcher identified particular phenomena or themes in data and re-group concepts around such phenomena. The researcher analyses interview responses in order to isolate such themes, which, in turn facilitate coding. Comparative methods are used by using interviews to cross-validate the findings.

Chapter 6: Conclusions and Recommendations: The chapter contains the conclusions of the research based on the results. Answers to the research aim, objectives and research questions are given. Recommendations are drawn from the conclusions and therefore map the way forward. Based on the conclusions, the researcher recommends a shift in existing practices. Focus could also be on the need for further explanation on the research questions.

1.12 SUMMARY

In this chapter, the researcher discussed the problem, the importance of study, research objectives, research questions and delimitation. Definitions of terms, which are related to the study, have been given. An overview of the low academic achievement in Physical Sciences in Limpopo Province in rural secondary schools led to the development of the research questions, aim, and statement of the problem. Ethical issues and theoretical framework are discussed as well. In the next chapter, the researcher focuses on possible factors that may affect learner academic

achievement in Physical Sciences in Limpopo rural secondary schools. The Cultural-Historical-Activity Theory (CHAT) will be discussed and linked to the study.

CHAPTER 2

LITERATURE REVIEW: THE THEORETICAL FRAMEWORK

2.1 INTRODUCTION

In order to extend upon the context and background of this study and also facilitate further insight into the problem, attention was focused on literature related to this research work. It is the role of this chapter to explore the different causes for poor academic achievement in Physical Sciences in selected rural secondary schools in Limpopo Province. This poor academic achievement is a cause of great concern. It is disturbing to note that corresponding trends of low achievements in Physical Sciences have been recorded in other South African secondary schools too. The literature review aims at identifying, clarifying and establishing factors and related issues that negatively affect teaching and learning of Physical Sciences that contribute to low academic achievements in Limpopo rural secondary schools. The framework used to guide the research is the Cultural-Historical Activity Theory (CHAT). CHAT has an interest in the process of social transformation and includes the structure of the social world in analysis, taking into account the conflictual nature of social practice. Learning is seen as a social function. CHAT links the Physical Sciences learners, teachers, principals, curriculum advisors and parents as communities of practice to other factors that affect learner academic achievement in Physical Sciences. These factors provide a social environment in which learning takes place. The factors to be discussed provide a way in which learning can take place in the classroom resulting in the possible improvement of learner performance.

2.2 CULTURAL-HISTORICAL ACTIVITY THEORY (CHAT)

According to Edwards (2010:1) the Cultural-Historical Activity Theory (CHAT) offers a broad approach to analysing learning and the contexts of learning. CHAT is employed in analyses of activities in schools, for example, to uncover how learners use both materials and conceptual tools and what aspects of tasks they prioritise. It is a useful approach to studying how classrooms, schools or teacher teams operate as cultural systems, which afford particular ways of, for example, being a learner. Analysis typically focuses simultaneously on individuals as thinkers and actors, their relationships with others and the habit. These elements (individual, interactional and

systemic) are not seen as separate; rather they are in a constant mutually shaping dialectic. The first generation is based on Vygotsky's activity system which focuses on individuals. According to Vygotsky, (1978:296), a CHAT analysis usually calls for primary attention to the system as the historical carrier of culture because of the importance placed on culture, while recognising the need to capture the multi-voiced engagement of actors in the system as they work on it and change it. Vygotsky came out with a basic mediated triangle (Cole and Engeström, 1993:84).

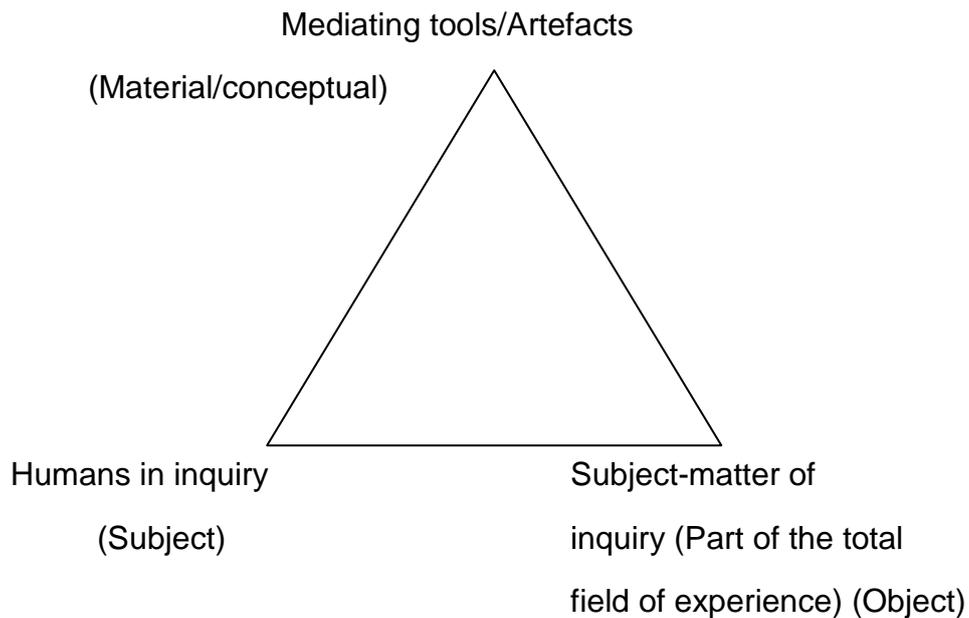


Figure 2.1: Vygotsky's basic mediated action triangle (adapted from Cole & Engeström, 1993:181).

According to Cole and Engeström, (1993:181) the subject in the figure is the learner or learners engaged in the activity. The mediating artefact/tool can include artefacts, social others, and prior knowledge that contribute to the subject mediated action experiences within the activity. The object is the goal of the activity. The triangular representation of the mediated action was an attempt by Vygotsky, (1978:278) to explain learner consciousness development in a manner that did not rely on dualistic stimulus-response associations.

Mediated action is viewed as a means of interpersonal communication through the interactions among learners (subjects), using tools and signs; while the subject (learner) develops new signs that help them make meaning of the world (Kozulini

and Gindis, 2007:18). Once a sign materialises, the subject (learner) can transform the sign into an artefact or a cultural tool through which the learner can continue to use and share the sign. However, there is not a clear moment when an artefact transforms into a cultural tool, but a cultural tool is an artefact that has gained value within learners' activities rather than as a temporary tool for engaging in an immediate activity.

The word "object" has brought about debate regarding its uses. It has been used interchangeably to refer to the goal of an activity, the motives for participating in an activity, and material products that learners try to gain through activity. This has created confusion regarding what object-oriented activity means (Nardi, 2005:19). However, Kaptelinin, (2005:7) explains that "object" is the reason why individuals and groups of individuals choose to participate in an activity, and it is what holds together the elements in an activity. In addition, Yamagata-Lynch, (2010:18) states that object-oriented activity refers to meditational processes in which individuals and groups of learners participate driven by their goals and motives, which may lead them to create or gain new artefacts or cultural tools. Contributing to the development of activity theory, Leont'ev, (1978:83) identified object-oriented activity as the unit of analysis. Object-oriented activity involves interaction between subject, object, motivation, action, goals, socio-historical context and consequences and activity (Davydov, 2000; Lazarev, 2004:5). The fact that Vygotsky focused more on individuals became a limitation to his first generation principle leading to the emerging of the second generation. The second generation emphasises on collective activities rather than individuals. It focuses mainly on tools and artefacts. The major setback of the second generation is that it ignored cultural diversity and external components outside the main system. One of the principles of Physical Sciences curriculum is to address human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the South Africa (Republic Constitution), (1996a:67). The Physical Sciences curriculum is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability, and other factors, which have not been addressed by the two generations (Department of Basic Education, 2011:5). Although the second generation is not linked to the study, it gives way to the activity theory model.

Artefacts that function as tools are not conveniently handed to the subject. They are invented, purchased, discarded, and replaced in the activity. Therefore, learners may discover new tools as they engage in new activities. The rules, community, and division of labour components add the socio-historical aspects of mediated action (Engeström, 1999:87). Rules refer to formal or informal regulations that can, in varying degrees, constrain or liberate the activity and provide to the learner guidance on correct procedures and acceptable interactions to take with other community members. The community is a social group with which the learner identifies while participating in the activity. The division of labour refers to how the tasks are shared among the community. The activity system acts as a work team. It allows a focus on the inter-relationships, the rules in the system, the division of labour and changing interpretations of the object of activity (Engeström, 1999:245). In addition, the activity system is dynamic and open to arise when new tools are introduced and old rules inhibit their use. The analytic resources of activity theory are given to the inhabitants of an activity system as a stimulus for the analysis of the system and recognise the emergent contradictions that will lead to change (Engeström, 1999:246). Engeström represented the activity system in a triangle below.

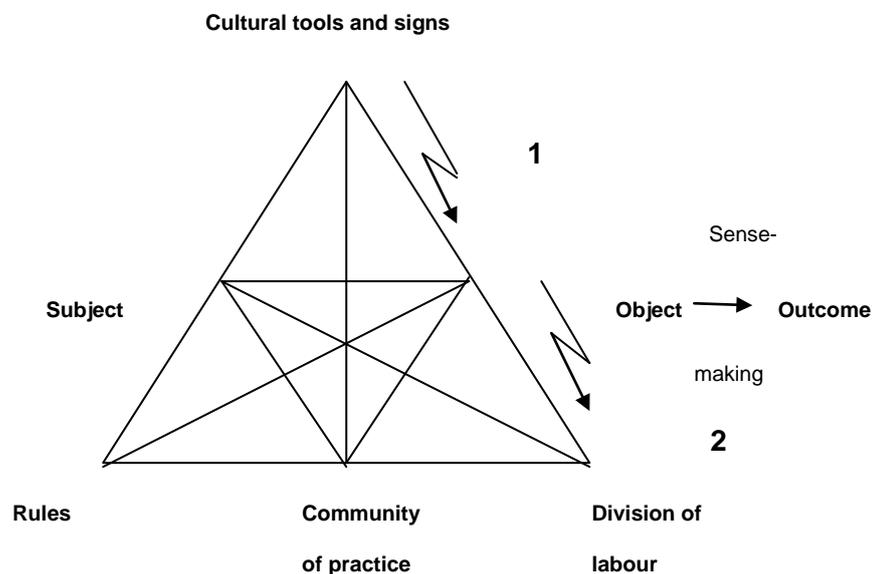


Figure 2.2: The Activity system (Engeström, 1987:128)

From the triangle, Engeström advocates the study of artefacts as integral and inseparable components of human functioning. Engeström, (1999:29) argues that the focus of the study of mediation should be on its relationship with the other components of an activity system. In addition, Engeström expanded Vygotsky

triangle to enable an examination of systems of activity at the macro level of the collective and the community in preference to micro level concentration on the individual actor or agent operating with tools. This expansion aims to represent the social/collective elements in an activity system, through the addition of the elements of community, rules and division of labour while emphasising the importance of analysing their interaction with each other. The object-oriented actions are always, explicitly or implicitly, characterised by ambiguity, surprise, interpretation, sense making, and potential for change (Engeström, 1999:9)

Engeström, (1999: 9) sees joint activity or practice as the unity of analysis for activity theory, but not individual activity. There is interest in the process of social transformation and includes the structure of the social world in analysis, taking into account the conflictual nature of social practice. Instability, (internal tensions) and contradiction are seen as the, “motive force of change and development and the transitions and reorganisations within and between activity systems as part of evolution. It is not only the subject, but the environment, that is modified through mediated activity.” Engeström views the “reflective appropriation of advanced models and tools” as “ways out of internal contradictions” that result in new activity systems (Cole and Engeström, 1993:40).

Engeström, (1999:9) developed conceptual tools to understand dialogues, multiple perspectives, and networks of interacting activity systems. The idea of networks of the activity within which contradictions and struggles take place in the definition of motives and object of the activity calls for an analysis of power and control within developing activity system.

Accordingly, Engeström considers subjects, tools, object and outcome, rules, community and division of labour as a collective activity system. Therefore, the study was based on Engeström’s third generation that will be used as a lens to determine factors that affect learner academic performance in Physical Sciences. In this study, CHAT’s relevance to Physical Sciences teaching and learning is the notion that teaching and learning takes place effectively when learners see themselves as members of a team. Effective learning in Physical Sciences can take place through group activities (Department of Basic Education, 2011:5).

CHAT emphasises the central role of contradictions as sources of change and development. Contradictions are not the same as problems or conflicts but are historically accumulating structural tensions within and between activity systems. Activities are open systems and when an activity system adopts a new element from the outside (for example, a new technology or a new object); it often leads to an aggravated secondary contradiction where some old element (for example, the rules or the division of labour) collides with the new one. Such contradictions generate disturbances and conflicts, but also attempt to change the activity. The relevance of this principle to the study is that learning needs to be structured and technology should be integrated into guided learning opportunities (Engeström, 1999:10).

CHAT proclaims the possibility of expansive transformations in activity systems. Activity systems move through relatively long cycles of qualitative transformations. As the contradictions of an activity system are aggravated, some individual participants begin to question and deviate from its established norms. This escalates into collaborative envisioning and a deliberate collective change effort. An expansive transformation is accomplished when the object and motive of the activity are reconceptualised to embrace a radically wider horizon of possibilities than in the previous mode of the activity (Engeström, 1999:10).

Vygotsky, (1978:296) states that the initial premise of the cultural-historical school was that human psychological processes are bound up with a form of behaviour in which material objects (for example, pictures, gestures, and vocal sounds) and corresponding ideal objects (for example, meanings and values) are incorporated into actions and modified over generations as a means of regulating learners' interactions with the world and each other. Lazarev, (2004:5) expressed that artefacts incorporated into learner action not only "...radically change his or her conditions of existence, they even react on him/her resulting in change taking place." Such artefacts are both symbolic and material mediators. Vygotsky referred to this kind of mediated action as the "cultural habit of behaviour" that enables learners to begin to regulate themselves "from outside."

The analysis of learner psychological functions must be situated in relation to historically accumulated forms of human activity, which are the proximal loci of human experience. CHAT demonstrates that at least in schools and classroom

activities, it is possible to make mediated-actions-in-activity or context a genuine object of study (Greenfield, 2004; Hedegaard, Chaiklin and Jensen, 1999:213).

The aspects of CHAT that will be linked to the study are:

- the subject, which refers to the Physical Sciences learners in the Further Education and Training (FET) phase;
- the object entails the results to be achieved in terms of learner performance. The goal is set in order to have an intended outcome, which is learner achievement through actions and operations.
- the instruments or artefacts or tools refer to resources, teaching methods, motivation, supervision of teachers and Physical Sciences policy documents that serve to guide teachers in the subject;
- the community consists of the Physical Sciences teachers, principals, parents and curriculum advisors. The community is a social group with which the learner identifies while participating in the activity;
- a number of rules set by the Department of Basic Education facilitate the teaching and learning of Physical Sciences, including code of conduct, language policy, assessment guidelines and policy on teacher-learner ratio;
- division of labour refers to the collective effort of the community members. Roles and workload are shared within the community members; and
- the outcome are the goals of the South African Curriculum that include, equipping learners, irrespective of their socio-economic background, and intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society.

These components of the CHAT will be discussed below.

2.2.1 Theoretical context of the activity system and conceptual framework

According to Vygotsky, (1978:296) the elements (learner, interactional and systemic) in CHAT are not seen as separate; rather they are in constant mutually shaping dialectic. There is a strong relationship between the subject and object, linked through mediational tools. Kaptelinin, (2005:7) explains that “object” and “outcome” is the reason why individuals and groups of individuals choose to participate in an activity, and it is what holds together the elements of an activity. According to

Engeström, (1999:87), rules refer to formal or informal regulations that can, in varying degrees, constrain or liberate the activity and provide the learner guidance on correct procedures and acceptable interactions to take with other community members. In this research, the object is the improvement of learner academic achievement in Physical Sciences. The subject is the Physical Sciences learner. The Physical Sciences educators, principals and curriculum advisors make up the community and rules are prescribed rules from the Department of Basic Education and the involvement of parents during teaching and learning in Physical Sciences. The cultural tools or artefacts such as language, resources and teaching methods, supervision and motivation assist in presenting the content.

The subject, goals, community, division of labour, rules and artefacts will be outlined briefly in line with the activity system and linked to the study. Each will be discussed in more detail in the next chapter.

2.2.1.1 The subject

According to Cole and Engeström, (1993:181) the subject in this study is the Physical Sciences learner or learners engaged in the activity. Kozulin and Gindis, (2007:17) states that the subject develops new signs that help them make meaning of the world. The subject forms part of the social structures of the community. The interaction between the subject and object bring about changes in the activity system and results in learning taking place.

2.2.1.2 The Object

As alluded to earlier, the word “object” has brought about debate regarding its uses. It has been used to refer to the goal of an activity, the motives for participating in an activity, and material products that learners try to gain through activity. In this study, the object is to improve learner achievement in Physical Sciences.

2.2.1.3 Rules

In order for the system to have a positive teaching and learning environment, there is a need to establish behavioural rules that give direction in the activity system. Norms and regulations within Physical Sciences are seen as rules. Rules in Physical Sciences are important in that they facilitate teaching and learning of learners. Under

this heading, Physical Sciences curriculum, assessment of learners, teacher-learner ratio and discipline (code of conduct) will be linked.

2.2.1.4 The community

According to Engeström (1999:245), the community is a social group with which the learner identifies while participating in the activity. The community aims to represent the social/collective elements in an activity system. The community which forms part of the activity system consists of the Physical Sciences learners, Physical Sciences teachers, principals and curriculum advisors in the FET phase. There are a number of role players that contribute to the improvement of results, such as teachers, principals, parents, and other stakeholders who are bound together by a common goal, which is to improve learner academic achievement. Leadership and management skills, teacher effectiveness, parental involvement and learner socio-economic background will be discussed under these headings.

2.2.1.5 Artefacts/Tools/Instruments

According to Vygotsky, (1978:210) the relationship between artefacts, tools, and social others are not constant and they change over time. Vygotsky proposed that signs were impressions that assisted individual development as well as consciousness. Signs do not have concrete physical existence in the environment, but they serve as by-product of the interaction between learners and artefacts/tools to mediate thought processes. Vygotsky, (1978:297) reiterated that mediated action involves an interaction between the learner and mediating artefacts/tools and signs. The interactions in which learners engage allow opportunities for mediated action that contributes to the social formation of learners' consciousness (Wertsch, 1998:16). In this interaction, learners are not passive participants waiting for the environment to instigate meaning-making processes for them but, through learner interactions, learners make meanings of the world (Scribner, 1997:84). Most of the factors that are being investigated can be classified as artefacts or tools or instruments of mediation in an effort to improve learner academic achievement in Physical Sciences. The interaction between the community members within Physical Sciences is assisted by cultural tools and artefacts such as language, ways of presenting content (teaching methods) and instructional materials and learning aids (resources). Supervision is a tool that can be used in order to improve learner

academic achievement in Physical Sciences and can be used to mediate action in an attempt to improve learner performance. The following will be discussed in this regard:

- Availability of Instructional Materials and Learning Aids;
- Teaching methods; and
- Supervision of teachers.

2.2.1.6 Division of labour and workload

The division of labour emphasises the need for sharing a common purpose by working together and interacting in order to bring about change in Physical Sciences. Through the division of tasks between the community members, the workload of teachers should decrease. Division of labour entails bringing in different skills and competencies that can result in working towards specific goals. There is professional sharing of experiences during mutual engagement of participants. Greater emphasis is on collaboration of the community members to facilitate receiving of new ideas and assisting each other in order to transform the world. Forming cluster teams will result in sharing knowledge, peer teaching of difficult topics and setting tests during assessment.

2.2.1.7 Outcome

CHAT considers subjects, tools, object and outcome, rules, community and division of labour as a collective activity system. The outcome entails meeting the needs of the society as a result of achievement in Physical Sciences. Bell, (2012:26) states that in educational institutions, success is measured by academic achievement, or how well a learner meets standards set out by local government and the institution itself. As career competition grows evermore fiercely in the working world, the importance of learners doing well in schools has caught attention of parents, legislators and government education department alike. Deming, (1986:182) explained that the quality of school performance lies in placing the needs of the customer (learners) foremost and should strive to meet them. Schools should be sensitive to the needs of learners. However, one of the common criticisms of schools is that they virtually ignore the real needs and expectations of learners and persist in tailoring their efforts in harmony with tradition customs and demands of various

audiences rather than the needs of their customers (learners). The needs drive the entire school. According to the Department of Basic Education (2011:151), the various achievement levels and their corresponding percentage bands are represented in a table below:

Table 2.5 Achievement levels

| Rating scale | Descriptive of competence | Percentage |
|--------------|---------------------------|------------|
| 7 | Outstanding performance | 80-100 |
| 6 | Meritorious achievement | 70-79 |
| 5 | Substantial achievement | 60-69 |
| 4 | Adequate achievement | 50-59 |
| 3 | Moderate achievement | 40-49 |
| 2 | Elementary achievement | 30-39 |
| 1 | Not achieved | 0-29 |

Adapted from CAPS document (2011:151)

Based on the table, in Physical Sciences 30% is the minimum pass mark, but learners are still not meeting the requirement or standard (outcome) that will enable them to participate in contributing to the improvement of quality of life and participation in science-related careers..

2.3 SUMMARY

The CHAT framework suggests that improving social interactions result in positive outcomes such as improved learner participation and pass rate in Physical Sciences. The theory is viewed as appropriate and will guide the study to explore the factors that affect learner academic achievement in Physical Sciences in rural secondary schools in Limpopo Province. This chapter focused on the link between various factors that can affect performance in Physical Sciences. Issues concerning methodology, teacher-learner ratio, socio-economic status of learners, assessment, parental involvement, motivation, Physical Sciences curriculum and availability of

instructional materials and learning aids have been referred. It is not possible within the scope of this chapter to include every significant study in the field of Physical Sciences teaching that addresses all school-related factors that cause high failure rates. The improvement of learner performance in Physical Sciences can be achieved through a community-centred on the involvement of Physical Sciences teachers, principals, curriculum advisors, learners and parents. The following chapter will discuss in detail the factors that affect learner academic achievement.

CHAPTER 3

LITERATURE REVIEW: CONCEPTUAL FRAMEWORK

3.1 INTRODUCTION

According to Howe (2003:1-20) and Shumba, (1999:55-72) the lack of material resources, poor teaching methods and inefficient supportive systems and environments within the school are major contributory factors that affect learner academic achievement in science subjects. There is a continuous debate in South Africa to identify the causes of low academic achievement in Physical Sciences. Research by Lemmer, (2000:81) and Taylor, (2009:12-15) have shown that a wide range of factors affect learner academic achievement in various subjects; factors such as the number of learners per class, absenteeism rates among educators and learners, poor teaching methods and a lack of motivation. Further factors such as the Physical Sciences curriculum, teacher-learner ratio, and discipline of learners, leadership and management skills, parental involvement, learner socio-economic background, teacher effectiveness, workload, and lack of resources, assessment and supervision of teachers will be discussed in this chapter. These factors will be viewed in the context of Cultural-Historical Activity Theory (CHAT) framework, particularly in terms of the interaction between the subject, rules, community and division of labour to affect the object. The framework has shown that learning is a social endeavour and therefore takes place within a social setting.

3.1.1 Subject

3.1.1.1 Motivation of learners

According to CHAT, object-oriented activity involves interaction between subject, object, motivation, action, goals, socio-historical context, and consequences and activity (Davydov, 2000, Lazarev, 2004:5). Dubrin, (2008:2) defines motivation as the “act or process of motivating, the condition of being motivating; a motivating force, stimulus, or influence, incentive, drive, something that causes a person or a learner to act and the expenditure of effort to accomplish results.” Palmer, (2007:38-42) states that motivation is an essential element that is necessary for quality education.

Learners show that they are motivated when they pay attention, begin working on tasks immediately, ask questions and volunteer answers, and they appear to be happy and eager. Basically, very little if any learning can occur unless learners are motivated on a consistent basis. The five key ingredients impacting on learner motivation are the learner, the teacher, the content, the teaching method and the environment. Olson, (1997:34) states that almost everything teachers do in the classroom has a motivational influence on the learners either positive or negative. Furthermore, Olson, (1997:107) notes that learners' motivation depends on the extent to which the teacher is able to satisfy the learners' need to feel in control of their learning; feel competent and feel connected to others in order to improve performance.

Senge, Kleiner, Roberts, Ross and Smith, (2000:489) suggest that teachers should be, "producers of environments that allow learners to learn as much as possible." Research has found motivation to be one of the key drivers of behavioural intention during teaching and learning. According to Petty, (2004:43), teachers regard motivation as a means to make learners want to learn. If learners do not want to learn, their learning efficiency will be so low that they may learn virtually nothing. Therefore, there is a need to motivate learners during teaching and learning in order to improve performance.

Maslow, (1970:75) propounds that motivation comes from a hierarchy of needs. This implies that when the needs are met or satisfied, an individual is motivated. In addition, Herzberg, (2003:232) describes motivation as being composed of two separate, independent factors namely motivational factors that can lead to learner achievement and maintained factors that must be sufficiently present in order for motivating factors to come into play and when not sufficiently present can block motivation and can lead to learning dissatisfaction. Herzberg, (2003:234) suggests that the opposite of dissatisfaction is not satisfaction. By eliminating sources of dissatisfaction one may reduce the dissatisfaction of a learner but this does not mean that such reduction either motivates the learner or leads to the learning satisfaction. According to Herzberg, (2003), motivation appears to rise from a separate set of conditions different to those related to the source of dissatisfaction. These factors are motivating factors.

Learners must have access, ability, interest, and should value learning. The teacher should be focused and monitor the educational process, be dedicated and responsive to his or her learners, and be inspirational. The content must be accurate, timely, stimulating, and pertinent to the learner's current and future needs. The method or process must be inventive, encouraging, interesting, and beneficial and provide tools that can be applied in real life. The environment needs to be accessible, safe, positive, personalised as much as possible, and empowering. Motivation is optimised when learners are exposed to a large number of these motivating experiences and variables on a regular basis. That is, ideally learners should have many sources of motivation in their learning experiences in the classroom (Debnath, 2005; De'Souza and Maheshwari, 2010; Palmer, 2007).

According to Hamachek (1990:476), the teacher should prepare and assign tasks that have various levels of difficulty built in them. Teachers should look for behaviours to praise, but this should be honest praise. Giving constructive criticism where, and when necessary when dealing with high-achievement-motivation learners, providing them with tasks and problems that offer opportunities for a mix of failure and success, is mostly likely to sustain their high motivation. Learners need to be challenged, and will work hard when success is achievable, but not easily won. There is a need to provide learners with tasks and problems that mainly provide success, particularly during the early phases of learning, as this is more likely to keep them interested.

Woolfolk, (2010:439-442) points out that learners are likely to work towards goals that are clear and attainable. Setting clear goals have been related to higher achievement. The types of goals teachers set influence the amount of motivation they have to reach them. There is a need for teachers to set specific, elaborated, moderately difficult goals that are likely to be reached in the near future as these tend to enhance motivation and persistence. Specific, elaborated goals provide clear standards for judging performance (Schunk, Pintrich, and Meece, 2008; Stipek, 2002:439).

Reeve, (2006:69) sums up by arguing that motivation is something that energizes, directs and sustains behaviour; it gets learners moving and points them in a particular direction and keeps them going. Motivated learners are self-driven and

need minimum supervision. Paris and Turner, (1994:118) deduce that motivation is not necessarily something that learners bring to school; it can also arise from environmental conditions at school as pointed before. In order for the learners to possess the relevant knowledge and skills, they must be actively involved during the teaching and learning and this is also relevant to Physical Sciences. Teachers should be concerned with motivating and cultivating the learners' desire and capacity to create, discover and learn for themselves.

Motivation also has an effect on achievement. Schofield, (1981:72), points out that relevant literature shows that learner achievement is influenced by motivation. Learners who enjoy learning are likely to spend more time and energy gaining mastery of the subject. As a result they are reinforced by the success they achieve, which in turn continues to reinforce them to perform well during teaching and learning. On the other hand, teachers who like their subject and are good at it are well-endowed to stimulate their learners during teaching and learning, whereas teachers who dislike the subject or are not competent in it are likely to infect their learners with similar feelings of dislike and similar cognitive competence. Ryan and Stiller, (1991:115-149) elaborate that for learners to be actively engaged in teaching and learning they must value learning, achievement, and accomplishment even with respect to topics and activities they do not find interesting. The preceding shows that motivation can have an impact on teaching and learning in Physical Sciences.

3.1.2 Artefacts/Instruments/tools

3.1.2.1 Availability of instructional materials and learning aids (Resources)

The World Bank, (2001:4) states that learning and teaching materials are critical ingredients in learning and the intended curriculum cannot be easily implemented without them. CHAT introduced mediated action as a concept to explain the semiotic process that enables human consciousness development through interaction with artefacts, tools, and social others in an environment and results in individuals finding new meanings in their world. Relationships between artefacts, tools, and social others are not constant; they change over time (Vygotsky, 1978:296). The importance of the provision of adequate learning and teaching materials (including textbooks, teachers' guides and supplementary materials) to support educational development and quality upgrading has been recognised by governments throughout

the developing world and by most development partners. There is new substantial research evidence that shows that textbooks are one of the most important inputs that have a demonstrable impact on learning as will subsequently be discussed.

According to Jerkins and Whitefields (1974:233), whatever a teacher achieves with his/her learners, would be influenced by the teaching and learning resources available to him or her. Teachers should provide an environment full of opportunities and materials from which learners may choose to engage (Wilhem, Baker and Dube, 2001:7). Schiefelbeen and Simmons, (1981:92) support this indicating that the availability of textbooks and learner achievement demonstrated a positive relationship. However, the United Nations Scientific and Cultural Organisation (UNESCO, 2007:21) deduces that the influence of a specific input or process factor on results is never direct or linear, and an increase in the number of textbooks per learner, for example, may not directly lead to an improvement of examination results. According to UNESCO (2007:21), it was found that individual schools that have similar material and teaching-learning conditions had very different results. In spite of deplorable conditions in some schools, learners do relatively well, while in other schools the results are not good even though the required resources are available.

Mji and Makgato, (2006:254) and Howe, (2003:2) have shown that a lack of resources is a common problem in most South African public schools. These studies revealed that besides textbooks, South African public schools have a serious shortage of physical facilities such as classrooms, computers, laboratories, libraries, chairs and science equipment. In addition, Legotlo et al, (2002:115) states that learners' textbook ratio of 10:1 was recorded in most schools. However, Muwanga-Zake's, (2008:13) findings show that some educators make false claims that they do not teach Physical Sciences practically due to shortage of apparatus. He discovered that the inability to teach Physical Sciences practically was because some educators could not operate certain apparatus available in the schools, and as a result, they avoided them and left them in the storeroom. Therefore, there is a need to provide training for teachers to increase their skills in using apparatus during experiments in order to improve learner performance.

According to CHAT, tools (namely, conceptual and physical artefacts) play an important role in human thinking and learning yet technology is frequently missing, or

insufficiently used in Physical Sciences (Bernhard, 2003:313-321). Although not a guarantee, Bubenzer, (2008:3) mentions that an increase in resource availability could be an answer to improving results in Physical Sciences. This possibility is also supported by Lewin and Stuart, (2003:44) who maintain that the impact of textbooks is greatest in the poorest countries where teacher quality may be low and where facilities and resources are scarce and generally of poor quality. In conclusion, availability of instructional materials and aids could have an impact on learner performance in Physical Sciences.

3.1.2.2 Teaching Methods

CHAT states that the instruments also referred to as tools or artefacts are anything used in the transformation process including both material tools and tools for thinking (Kuutti, 1996:14). There are two kinds of instruments, those that aid in the transformation of behaviour (psychological tools) and those that aid in the transformation of the environment (material tools). Drawing from CHAT, the teaching methods are placed on psychological tools. According to Palmer (2007:42), teaching methods must be inventive, encouraging, interesting, beneficial, and provide tools that can be applied to the learners' real life. Some techniques for assuring success is to state the goal for the lesson, provide simple and clear explanations, request the learners to express their comments and ask questions and provide hands-on activities as often as possible, and assessment tasks that are flexible to improve learner performance. Lindgren and Suter, (1976:107) state that learners should acquire knowledge, think about it, remember it and apply it when solving problems and in so doing, could possibly improve results. Just as recommended in Physical Sciences CAPS, knowledge emanates from experience (Department of Basic Education, 2011:5).

Johnson and Johnson, (2009:365) explain that teaching methods can be useful during the teaching and learning of Physical Sciences. A learner's new capacities can only be developed in the zone of proximal development through using appropriate teaching methods, in actual, concrete, situated activities with an adult or more capable peer. With enough assisted practice, the child internalises the strategy and completes the task (Greenfield, 2004:246). Appropriate teaching methods contribute to learning through generating and refining ideas, organising and

integrating work, sustaining group spirit, and managing learning (Lieberman, 2004:83).

As a teaching method, collaboration allows learners to actively participate in learning by talking to each other and listening to other points of view. Group discussions establish a personal connection between learners and the topic of study and it helps learners to think in a less personally biased way (Lieberman, 2004:83). Lieberman (2004:89), states that learning by teaching is also a teaching method. Therefore, there is a need to create opportunity to learners with skills and knowledge to teach their peers. Learners who teach others must study and understand the topic well enough to teach it to their peers. By having learners participate in the teaching process, they gain confidence and strengthen their speaking and communication skills in Physical Sciences. Therefore, effective group discussions can result in the improvement of learner performance in Physical Sciences.

3.1.2.3 Supervision of teachers by principals, heads of departments (HoDs) and external agents.

According to CHAT, change occurs in the relation between subject and cultural tool. This means that supervision is a quest for better artefacts-tools and signs, objects and language. During supervision activities that can be developed through expansion of artefacts and objects emerge (Kaptelinin, 2005:4-8). For example, several studies have forcefully demonstrated that regardless of the actions being taken at systems level, real quality improvement depends on what is actually happening in the classroom. Schools are the delivery points at which all the inputs of the system come together for interaction and determine the quality of the teaching-learning process. It is in the classroom that most of the basic problems with quality (teacher-learner absenteeism, use of human and material resources, poor teaching practices et cetera) can be monitored properly. When teachers feel that control and support efforts all converge on the improvement of their professional development, they are more pliable and readily accept assistance (UNESCO, 2007:7-8). Any school supervision system should, inter alia, monitor quality of education, schools and teachers. The main objective is to improve quality of delivery and of results (UNESCO, 2007:7-8).

Supervision is expected to have a positive impact on learning and teaching including Physical Sciences. Supervision as a practice or activity forms part of an overall quality monitoring and improvement system, which includes other devices such as examinations, achievement tests, and self-assessment practices by school teachers. Supervision is always an indirect and relational activity. In schools, it has increasingly relied on internal mechanisms of supervision entailing devolution of responsibility of control support to actors at school site level (principals, HoDs, teachers and community members). Proper supervision and appropriate support impacts positively on teachers and learners.

Sergiovanni and Starrat, (1971:98) consider supervision as one of the most effective ways that can be used to improve teachers' morale and learner performance. It also implies cordial interaction and interpersonal relationships with management. Innovation and change are more readily accepted by all parties concerned. Consequently, an effective institution will assure assistance is provided to all its teachers and experts, whatever their level of expertise (Tharp and Gallimore, 1988:53). According to Sergiovanni and Starrat, (1971:98) supervision implies co-operation and directing and influencing teaching and learning activities of willing teachers and supervisors. Supervision encourages teachers to be committed to their work and will ultimately contribute to learner achievement as it has an actual and potential object and purpose. Supervision aims for better practice in another activity (Kaptelinin, 2005:4-8). The purpose of supervision is to enable the teacher to understand and act better. The teacher is not simply an isolated individual professionally but is participant in a rational, historical, and collective activity (Afdal, 2010:254). Frequency of supervisory visits should be determined by the need of supervisee as a relatively new teacher would need more supervisory visits (Nyagura and Reece, 1989:77).

According to UNESCO (2007:6), supervision finds justification in the present trend towards school autonomy. Teachers, once in the classroom, have always had a significant level of autonomy. Also, schools have been receiving more freedom in making decisions in fields as crucial as the curriculum, staff management and budget. This greater degree of freedom left to schools has provoked an equally greater demand for accountability at school level and for monitoring procedures that should allow governments to guarantee standards of quality and equity across the

system. According to UNESCO, (2006:6), supervision should be considered as a twofold process, namely; to inspect, control, evaluate and to advise, assist and support teachers in order to improve learner performance during teaching and learning process.

Cogan, (1973:102) and Goldhammer, (1969:53) reiterate that supervision is a very important factor in determining teacher and learner performance and not only improves teachers' instructions but is also seen as an attempt to dialogically re-describe practices in such a way that it opens up possibilities for actions, understanding and emotions and improve learner performance. Therefore, in conclusion, supervision could have an impact on learner achievement.

3.1.3 Rules

3.1.3.1 Physical Sciences curriculum

The Physical Sciences curriculum is part of the activity system since it is goal-oriented. The goal is set in order to have an intended outcome. According to the Department of Basic Education (2011:8), Physical Sciences investigate physical and chemical phenomena. This is done through scientific inquiry, application of scientific models, theories and laws in order to explain and predict events in the physical environment. Furthermore, the Department of Basic Education, (2011:8) states that this subject also deals with society's needs to understand how the physical environment works in order to benefit from it and responsibly care for it (outcome). All scientific and technological knowledge, including indigenous knowledge systems, are used to address challenges facing society. Teaching and learning should be play that does "WORK" meaning that the learning will have an immediate application, function, and real-world use (Wilhem, Baker and Dube, 2001:8).

Zumdahl, (2008:4) refers to Physical Sciences as a subject that is about wondering. Questions are asked about why things are the way they are, how they are related to one another, and what processes happen to cause the changes that people see around them. Good scientists are not the people who have answers but people who keep asking questions. Scientists make ideas that must pass a strict test. Physical Sciences' knowledge helps scientists to predict things that are going to happen. In Physical Sciences, the learner should develop curiosity about natural phenomena,

and be able to solve problems in scientific, technological and environmental contexts. In addition, Physical Sciences' knowledge must be linked to plans to test predictions or hypotheses where learners should contribute to systemic data collection, with regard to accuracy, reliability and controlling variables. Learners need to evaluate data and communicate findings, to find patterns and trends in the data collected and to generalise in the terms of simple principles.

The Department of Basic Education, (2011:8) reiterates the preceding stating that “the purpose of Physical Sciences is to make learners aware of their environment and to equip the learners with investigating skills relating to physical and chemical phenomena, for example, lightning and solubility.” Examples of some of the skills that are relevant to Physical Sciences are classifying, communicating, measuring, designing an investigation, drawing and evaluating conclusions, formulating models, hypothesising, identifying and controlling variables, and inferring, observing and comparing, interpreting, predicting, problem-solving and reflective skills. The learners work with the problem as they undertake systematic enquiry and the group is guided by the teacher. The problem-solving approach allows learners to develop relevant content knowledge and the meta-cognitive skills that will enable them to become good learners and problem-solvers (Harland, 2002:263-272). Physical Sciences promote knowledge and skills in scientific inquiry and problem-solving, the construction and application of scientific and technological knowledge. According to Department of Basic Education (2011:8), Physical Sciences should prepare learners for future learning, specialist learning, employment, socio-economic development and environmental management. Learners choosing Physical Sciences as a subject in grades 10-12, including those with barriers to learning, can have improved access to academic courses in higher education, and professional career paths. Physical Sciences play an increasingly important role in the lives of South Africans owing to its influence on scientific and technological development, which are necessary for the country's economic growth and the social wellbeing of its people. Teachers are guided by the CAPS document which stipulates the aims and topics to be taught each term and the time frame to complete each topic.

3.1.3.2 Teacher-learner ratio

CHAT states that the activity system takes shape and get transformed over lengthy periods of time. Rules refer to formal or informal regulations that can in varying degrees, constrain or liberate the activity and provide to the learner guidance on correct procedures and acceptable interactions to take with other community members (Engeström, 1999:245). Teacher-learner ratio is a policy or regulation that comes from the Department of Education and schools are required to implement the policy. The policy can constrain or hinder learner achievement. The teacher-learner ratio is guided by set rules in schools and contradictions and conflicts arise that can affect learners' academic performance. The achievement of learners in Physical Sciences needs to be analysed against the history of the teacher-learner ratio and how it affects learner academic achievement. The Organisation of Early Childhood Development (OECD), (2009:372) explains that "smaller classes are often perceived as allowing teachers to focus more on the needs of individual learners and reducing the amount of class time they spend dealing with disruptions. Class size may be viewed as an indicator of the quality of the school system." Mwamwenda, (2004:222-229) argues that if classes are large and crowded, it is difficult for the teachers to maintain control. Undesirable behaviour on the part of the learners in such classes may well be the result of them being uncomfortable and therefore unable to concentrate. Misbehaviour in this context may actually be a way of releasing tension. Learners may also experience discomfort as a result of poor ventilation or extremes of temperature in classrooms. Furthermore, OECD, (2009:372) indicates that the ratio of learners to teaching staff is also an important indicator of the resources devoted to education.

The National Council of Teachers of English, (2012:1) recommends that schools, districts, and states adopt plans and implement activities resulting in class size that allow effective teaching and learning to take place. This Council maintains that "effective learning demands opportunities for learners to become actively involved in their education, and demands many roles of their teachers; teacher as facilitator, as enabler, as empowered, not only as lecturer and transmitter of knowledge" (National Council of Teachers of English, 2012:1). Furthermore, the National Council of Teachers adds that these opportunities and roles cannot be achieved when teachers are faced with large classes and heavy workloads. A teacher who faces more than

25 learners in a class period of 50 minutes has no more than 2 minutes, at best, per learner for one-to-one interaction during any period. The greater the number of learners in a class the fewer the opportunities for learners to participate orally: and the larger the number of learners in a class, the greater the amount of time devoted to classroom management and instruction. The larger the class size, the less likely teachers are to develop lessons encouraging higher level thinking. Teachers of larger classes are more likely to spend less time with each learner. However, statistical analysis of results in some parts of South Africa has shown that the teacher-learner ratio has been decreased to an average class size of 39:1, but this is not the case in many rural schools (Department of Basic Education, 2009:9).

Kirylyuk, (1980:122) carried out a study on 644 pupils in a sample from five comprehensive schools in Oxfordshire. The children were asked to complete a questionnaire containing open-ended questions and were asked why they performed badly in their schoolwork. They were further asked to suggest what they thought would help them improve their performance. The majority of the children complained that they could not get enough attention from the teacher. They further stated that they could do better if they (learners) were fewer in number in that class. In addition, the children said that a good teacher was one who wanted to help every learner and not only the ones who are more intelligent. The preceding discussion reflects the need for individualised teaching. Even though Kirylyuk's study (1980:122) pertained to children in the United Kingdom, the same situation may be encountered in South Africa.

Lemmer, (2000:83) and Phurutse, (2005:5) argue that literature fails to stipulate the optimal class size. The belief though is that the quality of the Physical Sciences educator's teaching, his or her interaction with learners, the learning process, satisfaction and active learners' participation will decline with an increase in the size of the class. According to a report of Department of Basic Education (2009:17), teaching large classes of 50 or more learners in public schools is one of the many long-standing concerns facing the education system in South Africa. Howe's, (2003:3) study shows that large classes are common in South African schools and negatively affect teaching and learning. However, Physical Sciences educators, who teach smaller classes, display more positive attitudes to learners and their work and consequently improve learner academic achievement compared to those who teach

larger Physical Sciences classes (Phurutse, 2005:5; Department of Basic Education, 2009:8-9). Learners in smaller classes show more appreciation for one another and a greater desire to participate in classroom activities. In smaller classes, more learning activities can take place fostering greater interaction among learners. This increases their desire to assist each other. Smaller classes allow for potential disciplinary problems to be identified and resolved more quickly and improve teacher morale and reduce stress. Class size reduction will result in fewer learner dropouts (Howe, 2003:3; Phurutse, 2005:6; Department of Basic Education, 2009:8-9).

According to Gopal and Stears, (2007:16), large classes are characterised by insufficient learner interaction and rapport, lack of individual attention from the teacher and inability to ensure adequate provision of learning experiences such as handling of apparatus, observations and recording of results by each learner during experiments. Phurutse (2005:5), states that large classes negatively influence what the educator does with learners and what learners do during teaching and learning of Physical Sciences. Therefore, there is a need for a smaller ratio of teacher to learners to improve performance in Physical Sciences.

3.1.3.3 Assessment of learners

According to the Department of Basic Education, (2011:143), assessment is a process that measures an individual learner's attainment of knowledge (content, concepts and skills) in Physical Sciences by collecting, analysing and interpreting the data and information obtained to enable the teacher to make reliable judgements about a learner's progress, inform learners about their strengths, weaknesses and progress and assist teachers, parents and other stakeholders in making decisions about the learning process and the progress of learners. The assessment guidelines or programme stipulates the number of activities to be given to learners in Physical Sciences in order to improve learner performance and is part of the rules.

According to CHAT, rules are explicit and implicit norms, conventions and social relations within a community. They refer to informal and formal regulations that can, in varying degrees, constrain or liberate the assessment of learners and provide the learner guidance on improving academic achievement (Engeström, 1999:87). CHAT's relevance to Physical Sciences teaching and learning is the view that effective assessment takes place through collective activities (Gibbs, 1988:355).

Assessment is viewed as a vehicle for driving Physical Sciences teaching and learning since successful implementation of the curriculum mostly depends on it (Beets and Le Grange, 2005:190). The rules that direct how the assessment should be conducted are received from the Department of Basic Education in the form of policy in Physical Sciences CAPS document.

The Department of Basic Education-QAPF (2003:21) views assessment as a critical element of teaching and learning in Physical Sciences. The Department of Basic Education, (2011:143) states that assessment is a continuous planned process of identifying, gathering and interpreting information about the performance of learners using various forms of assessment. Lubisi (1999:17), states that assessment entails making sense of a learner's knowledge and skills. Some purposes for which assessment can be used are monitoring learner's progress, grading, certification, selection, evaluation, guidance and prediction.

However, assessment should be both informal or formative (assessment for learning) and formal or summative (assessment of learning). Informal assessment is a daily monitoring of learners' progress (Department of Basic Education, 2011:143). This is done through homework, class-work, tests and experiments. Informal assessments should be used to structure the acquisition of knowledge and skills and should be precursor to formal tasks in the Programme of Assessment. The Department of Basic Education emphasises that informal assessments should be used to provide feedback to the learners and to inform teacher planning. Teachers and learners can mark these informal assessment tasks. Both self-assessment and peer assessment are important as they actively involve learners to learn from and reflect on their own performance. Self-assessment in itself is a crucial skill for work and for learning. It encourages learners to take responsibility for their own improvement, and is the route to excellence in Physical Sciences. Learners should be motivated by a desire to succeed, to explore, to develop and to improve, not by fear of failure (Department of Basic Education, 2011:142).

Formative assessment tasks are marked and formally recorded by the teacher. All formal tasks are subject to moderation for the purpose of quality assurance and to ensure that appropriate standards are maintained. Formative assessments provide teachers with a systematic way of evaluating how well learners are progressing in

Physical Sciences. It is important to ensure that in the course of a school year, all content for Physical Sciences is covered, the full range of skills is included and a variety of different forms of assessment are used (Department of Basic Education, 2011:143).

Lockwood, (1994:138) elaborates stating that assessment may be formative, enabling a learner or teacher to check the response against criteria: it may be diagnostic enabling at least an initial identification of strengths and potential areas of learning difficulty; it may be used to provide guidance and feedback. Assessment may be summative to provide a grade which contributes to the final award. Assessment can also motivate learners through the feedback from the educator that can help learners to develop self-esteem and confidence in their development (Dunphy and Dunphy, 2003:48-58). In both cases, regular feedback should be provided to learners to enhance the learning experience in Physical Sciences (Department of Basic Education, 2011:143).

The Department of Basic Education, (2011:9) also stipulates that application exercises including problem-solving exercises should be done on all cognitive levels in all knowledge areas and on all scientific concepts. If efficient organisation of the teaching and learning process is to be maintained, there is a need to apply Physical Sciences assessment taxonomy, which shows the pace of progression from unit to unit. Teachers should apply Bloom's taxonomy during assessment of learners in the classroom to have valid tests and exercises. In practice teachers should give learners at least two problem-solving exercises on a frequent basis, learners should do at least one practical activity per term, and learners should be given at least one informal test per term (Department of Basic Education, 2011:142). However, Physical Sciences educators should go beyond this minimum stipulation by giving more assessments in order to improve performance.

The Norms and Standards for Teacher Education (Department of Basic Education, 2000:9) emphasise the need for teachers to effectively and efficiently perform the role of assessor. In terms of this role, competent teachers understand that assessment is an essential feature of the teaching and learning process and demonstrate this understanding by integrating assessment into teaching and learning on a matter of course. By implication, teachers know what the purposes,

methods and effects of assessment are and are able to explain these in the feedback given to learners. Informed by their knowledge and understanding of assessment, teachers are able to design and manage both informal and formal assessments in ways that are appropriate to the level and purpose of the learning. Research has provided a clear indication that using assessment properly does indeed improve learning and raises standards of learners' achievement (Harlen, 2000:3).

3.1.3.4 Discipline of learners

The code of conduct in schools is also a rule that needs to be followed and is necessary for learning to take place. Such a code has as its primary aim the establishment of a disciplined and purposeful school environment that contributes to the quality of the learning process (Education Laws Amendment Act, No 50 of 2002). Learners have to comply with specific rules within the system. With the abolition of corporal punishment (South Africa Republic, 1996b:48), teachers have needed to find alternative ways of managing discipline during teaching and learning of Physical Sciences. One of the biggest challenges in schools today is maintaining a sufficiently disciplined environment in which to foster effective teaching and learning. According to Joubert and Prinsloo (2009:106), discipline is essential for effective teaching and learning. It is impossible to teach or learn in an environment that is disorderly, disruptive and unsafe. However, many principals and educators are finding it increasingly difficult to maintain discipline in schools in the wake of the new education legislation and regulations that govern discipline and punishment in schools. The Bill of Rights as well as national and provincial education legislation has created a new rights culture in schools and has changed ways of discipline management in schools today.

Olivia (1994:208), states that in order to maintain discipline, teachers need to control the learners' behaviour in the classroom and the school environment. In order to enhance effective teaching and learning in Physical Sciences, there is a need for acceptable behaviour of the learners. The learners' conduct and behaviour should facilitate effective teaching and learning. Teachers need to create order that results in a peaceful and harmonious state of affairs in the school and the classroom. Mussaazi (1982:181), states that through discipline, learners are provided with an

opportunity to exercise self-control, to solve school problems, to learn and promote the welfare of the school. Orderliness in schools is important for effective learning in Physical Sciences to take place. A well-disciplined learner is orderly, responsible, diligent, sympathetic, co-operative, honest, and considerate and always true to do what is right and good.

According to the South African Council for Teacher Education (2001:35-41), teachers need to exercise authority in the interest of and to the benefit of the learner so that the learner can attain full potential, becoming a self-disciplined and independent adult. Teachers need to provide positive aspects of discipline such as guidance, giving assistance and support, encouragement, recognition and reward and instruction during teaching and learning of Physical Sciences. Teachers need to be aware of the negative aspects of discipline such as control, restriction, suppression, disapproval, warning, or punishment with respect to undesirable behaviour. However, teachers should not equate discipline with force or punishment; the former is illegal and the latter is the last resort measure when all other more positive interventions have failed.

Discipline is not simply conformity to the enforcement of the rules but a process in which teachers help learners to internalise those values and norms that facilitate a free and orderly society (Hampton and Lauer, 1981:224). Rosen, (2005:1) states that teachers need to provide training to learners to develop self-control, character, orderliness and efficacy. Teachers need to exercise strict control to enforce obedience in learners and instil discipline in learners since it results in rule enforcement against disruptive behaviour. Disruptive behaviour such as noise, bullying, lateness to classes and walking out of the class without permission, are bad for good discipline. However, according to Rogers, (1998:11), teachers need to lead, guide, direct, manage or confront learners about behaviour that disrupts the right of others during teaching and learning of Physical Sciences. Therefore, discipline aims to bring in order to a disorderly environment and could lead to the improvement of learner performance in Physical Sciences.

3.1.4 Community of practice

3.1.4.1 Parental involvement

According to the Department of Basic Education circular, (2012:1), the performance of learners is in terms of law the responsibility of all in education; including parents, teachers, principals and learners. Barber and Kelly, (2004:95) states that it is necessary to create the virtuous circle where public education delivers results, the public gains confidence and therefore, willing to invest, and, as a consequence, the system is able to improve further. Parents together with teachers and learners, form a formidable team tasked with promoting the best interests of the school and enabling it to strive towards the provision of quality education for all learners. The parents have a significant role to play in ensuring that schools meet the country's goal of improved learning and teaching. Parent effectiveness impacts greatly on the successful operation and performance of the school (Department of Basic Education, 2009:18). According to CHAT analysis the importance placed on culture usually calls for primary attention to the system as the historical carrier of culture, while recognising the need to capture the multi-voiced engagement of actors as they work on it and change it (Vygotsky, 1978:296). The interaction of parents as community members can give rise to contradictions and conflicts that may affect learner academic achievement. CHAT emphasises the need to improve social interactions through including parents' involvement, which can result in positive learner academic performance.

Parents play a role in reviewing and contributing to homework given to their children and have capacity to meet learning expectations of the learners. Parents' involvement encourages and improves basic learning and teaching, resulting in excellent outcomes. Furthermore, parents nurture learners' talents and guide them to reach their potential and encourage and ensure that learners study at home and assist them with their school work. The parent plays a key role in dealing with problems such as learner's discipline in order to facilitate effective teaching and learning at school and in classrooms. When parents participate in the school work of their children, they develop and improve the learning of their children. Parents have a major responsibility for their children from birth (Department of Basic Education, 2010:5).

Communication between teachers and the parent is very important, as it can influence parental involvement in the teaching and learning process (Sax, Harper and Wolf, 2012:138). Sax, et al (2012:138), report that all parents have influence on their children's learning. This is supported by Goldring, (1991:90) who elaborates further by saying that what happens with regard to parental involvement in a particular school is determined by the philosophies and priorities of the principal. All teachers should realise the need for parental support, just like parents realise the role of the school in their community. When parents and teachers are not clear on each other's role, the encouragement and activation of parents' involvement may create a strain between them, resulting in division and conflicting interests. However, Mwamwenda, (2004:222) has another view when he states that parents themselves may foster misbehaviour of their children. Often they interfere in what the teacher is doing and refuse to allow their children to be punished, irrespective of what they have done. Some parents criticise the teacher in front of their children, telling him or her, what may and may not be done to them. Obviously, parents must have a say in the way their children are taught and treated. However, it would be beneficial to acknowledge that most teachers do know what they are doing, and parents should refrain from interfering in their work unless teachers do something really outrageous.

Zeldin, (1984:194) states that parental involvement is about ways in which parents can participate in the determination of their children's education. Parents are part of the learning community. Therefore, they have a role to create a functional school through developing structures within which the school operates such as School Governing Bodies (SGB). Through attending school meetings, open days and prize giving ceremonies, parents have the opportunity to view their children's work and discuss progress with teachers. The Department of Basic Education, (2013:2) states that parents should be well informed about what happens in the school, and receive regular reports about how well their children perform against clear standards that are shared by all schools. Parents know that if something is not happening as it should in the school, they are obliged to take steps to deal with the problems.

According to UNESCO, (2007:15), parents' involvement in teaching and learning enhances teacher accountability. The accountability relationship between parents and teachers involves three components, namely: consensus on objectives; exchange concerning methods, and discussion about the results obtained. The

implication being that, parents should work together with teachers to create learning and teaching environment that is conducive to the achievement of quality learning at school. Parents should work collaboratively with teachers and learners to turn schools into thriving centres of excellence. The influence of the parent determines that kind of product that arises from the teacher, instructional materials and school environment (Department of Basic Education, 2012:7).

In conclusion, parents should provide input with the purpose of improving the quality of teaching and learning. There is a need for parents to provide basic resources such as electricity at home to facilitate studying and subsequently improve learner performance. Parents monitor curriculum coverage, written work (formal and informal assessment), and attendance (including lesson attendance) by both teachers and learners. Parents should engage, comment and make recommendations based on the performance of learners and provide a meaningful contribution towards performance (Department of Basic Education, 2012:13). The discussion above leads to the conclusion that parental involvement could have an impact on learner performance in Physical Sciences.

3.1.4.2 Teacher effectiveness

According to CHAT, the community is a social group with which the teacher identifies while participating in the activity. The teacher whom according to CHAT is the expert community member needs to be effective in order to improve performance of learners particularly in Physical Sciences. Teachers guide learners at critical stages of the learning process (Engeström, 1999:245). Teachers in CHAT are the participants who are involved in the community where the activity takes place. Joubert and Prinsloo, (2009:174) argue that the right of learners to education applies to the teaching process in schools and the involvement of the educators. Therefore, all educators have an obligation to protect the rights of learners for effective education (section 29 of the Constitution) through their professional conduct. Teachers should facilitate interaction between the learners and use a range of strategies and resources in order to enable diverse learners to understand and learn (Rogoff, Matusov and White, 2001:33). Education is a critical process to enable learners to transform and grow into responsible adults. All teachers are important community members because they carry a huge responsibility in terms of

transmitting knowledge, values and promoting ethical behaviour in learners. The power of their influence or lack of it could facilitate or hinder learner academic achievement (Department of Basic Education, 2010:8).

Creemers, (1994:190) suggests that effective educators have a positive attitude; develop a pleasant climate in the classroom; have high expectations of what learners can achieve; manage time effectively; use a variety of teaching methods; and use and incorporate learner ideas in order to improve learner performance. Furthermore, Creemers, (2012:51) deduced that effective teachers provide a variety of activities in the lesson and engage in careful planning and preparation of lessons, simplify the subject matter, have knowledge of the learner background (such as age, ability, sex, socio-economic status and ethnicity), understand the learner's personal characteristics (such as personality, learning style, motivation and self-esteem) and create a positive culture of the school. Effective teachers should be a daily source of inspiration for the learners. These attributes could result in improving learner performance.

Reynolds (2007:14), state that teacher effectiveness has been found to strongly influence learner progress. The United Nations Educational Scientific and Cultural Organisation (UNESCO), (2007:15) describes an effective teacher as one where the average achievement of the learners is higher than the expected, given the background of the learners and the context in which they are living. Educators need to guide learners at critical stages of the learning process. Through fulfilling the function of a facilitator, a teacher engages in frequent interactions with the learner. Such interactions, though designed to recognise and nurture learner's potential, may indirectly serve to model positive social conduct. According to the Department of Basic Education (2012:3), effective teachers carry out supervision of learners during group and individual activities. Educators provide counselling and career path guidance to learners and expose learners to the environment outside the school through attending expos and career exhibitions in science as a means to motivate learners to engage in science activities.

Effective educators set realistic, achievable and measurable goals and provide opportunities for learner success that may otherwise have resulted in consistent failure in Physical Sciences. This is achieved by restructuring the learning

experiences in order to draw on a wide range of ability dimensions (Cohen, 1994; Rosenholtz, 1986 in Natriello, McDill and Pallas, 1990:102). The educators have a variety of duties that include on-going assessment of learners to ensure that they meet the required standards, formulating teaching outcomes, understanding disciplinary codes of conduct and maintaining discipline and order in the school and classrooms to protect the learners and regular consultations with learner's parents. Effective teachers encourage learners and provide quick and constructive feedback during teaching and learning process (Joubert and Prinsloo, 2009:174).

Lemmer and Ronald, (2006:52) emphasises that Physical Sciences learners are placed in a difficult situation as they are exposed to three different subjects simultaneously: Physical Sciences, Mathematics and English. Therefore, Physical Sciences educators should create educational environments that allow learners to develop and understand the language that is used as medium of instruction in the most effective and beneficial ways possible. According to Department of Basic Education (2011:14), it is important to provide learners with opportunities to develop and improve their language skills in the context of learning Physical Sciences. Therefore it will be critical to afford learners opportunities to read scientific texts, to write reports, paragraphs and short essays as part of assessment. Morrison, (2009:122) states that effective teachers need to guide and support learners in understanding how to solve problems that involve calculations through integration of Physical Sciences and Mathematics. It is therefore critical to expose learners to a wide variety of basic mathematical skills such as scientific notation, conversion of calculating and substitution in formulae. Learners are provided with the opportunity to explore scientific facts, concepts and principles and often specialised scientific skills to collect and analyse scientific information during teaching and learning of Physical Sciences (Department of Basic Education, 2011:142).

Motshana, (2004:21) carried out a survey of teachers in the Mpumalanga Province, and concluded that teacher effectiveness depends on a positive school climate. Lindgren and Suter, (1976:290) state that teachers who are really effective are those who are empathic, maintain rapport with learners, respect punctuality, and feel personally involved in their work. Therefore, Physical Sciences educators should plan carefully with each learner in mind and provide activities that capture learner's diverse interests as well as create a multi-sensory classroom environment to

accommodate all learning modalities including experiments (Trowbridge et al, 2004:343-344).

Creemers, (1999:51-65) states that teachers should understand and apply knowledge of child development to motivate and engage learners. While content knowledge is important and necessary, it alone cannot determine whether the teacher is able to teach so that learners learn effectively. The teacher is the expert, in turn, makes advances in the ability to structure content as well as increase the skills and strategies that make up pedagogical content knowledge. Content and context of each grade should show progression from simple to complex (Department of Basic Education, 2011:4-5).

Lastly, effective educators are punctual for the lessons and are able to manage time in the classroom (Lemmer, 2000:13-14). According to Windschittl (2002:137), effective teachers elicit learners' ideas and experiences in relation to topics through providing learners frequent opportunities to engage in complex, meaningful, problem-based activities. Lindgren and Suter, (1976:290) state that effective teachers implement the curriculum with enthusiasm, have high and positive expectations, and use a variety of instructional strategies in combination with clearly designated rewards for achievement and consider individual needs of learners through employing combinations of co-operative activity and group involvement. Effective teachers focus on learner performance, high grades, and competition and encourage learners to set performance goals (Woolfolk, 2010:442). Consequently, effective teachers implement the Physical Sciences curriculum on a daily basis by including class-work, homework, tests and experiments given to learners and content coverage. Failure to do so could have a negative impact on the teaching and learning of Physical Sciences.

3.1.4.3 Leadership and management skills

According to Bush and Heystek, (2003:1-2) the process of deciding on the aims of schools is at the heart of management. In most schools, aims are directed by the principal often working in association with the School Management Team (SMT) and School Governing Body (SGB). However, these aims are also strongly influenced by external environment pressures; particularly expectations of government, expressed through legislation or formal policy documents. Usually, schools are left with the

residual task of interpreting external imperatives rather than determining aims based on their assessment of learner needs. Legotlo, Maaga and Sebege's, (2002:116-117) study revealed that low academic achievement in Physical Sciences is also associated with poor management and leadership skills. He recorded higher pass rates in schools that managed their resources effectively and created a learning environment that maximised learning by monitoring curriculum coverage, provided opportunities for in-service development of teachers, supervision of teachers and planning. According to Leithwood, (2008:17), successful leaders have strong positive influences on staff motivation, commitment and working conditions, leading to enhanced classroom practices. Principals need to develop staff capacity and capability; for example, through professional development and working in teams to identify and address challenges. Leithwood, Jantzi and Steinbach, (1999:2) emphasises the need for management and leadership skills that allow participation in decision making, planning and provision of resources.

As alluded to earlier, CHAT allows a focus on the inter-relationships between the community members involved in the teaching and learning of Physical Sciences. There is need for sharing of tasks among the community members during teaching and learning of Physical Sciences (Yamagata-Lynch, 2010:22). Therefore, there is need for management and leadership skills that allow the establishment of effective subject teams. In this study, the principals, Physical Sciences teachers, Heads of Departments (HoDs), Physical Sciences learners, parents and curriculum advisors are a community that provides support to improve performance in Physical Sciences. Sergiovanni, (2002:13) points to the importance of community members participating in decision making as one that bonds the staff together. McLennan and Thurlow, (2003:6) argue that a participative model results in the establishment of SMTs, SGBs for schools and Student Representative Councils (SRCs) in an attempt to enhance teacher accountability during the teaching and learning process.

According to Bush and Heystek, (2006:87), principals need to create an environment conducive for learning in schools. The Ministerial Review Committee's (2004:7), review of school governance, notes that 20% of schools experienced conflict between members of the SGB and principals. There is a need for effective management and leadership skills that facilitate co-operation between parents and the school staff in order to improve learner performance particularly in Physical

Sciences. Southworth, (2002:78-79) also points out that principals need to manage teaching and learning in the schools. The instructional leadership of principals is strongly concerned with teaching and learning of teachers as well as learner growth. The implication is that principals should provide staff development programmes for teachers particularly Physical Sciences educators in order to improve learner performance. The South African Task Team report, (1996:27) stresses that management is important because it provides a supportive framework for teaching and learning.

Leithwood et al, (1999:52) makes the important point that in practice, principals in their day-to-day work are rarely aware whether they are leading or managing, they are simply carrying out their work on behalf of the school and learners. For example, according to the Ministerial Review Committee, (2004:3) and Pandor (2006:2), South Africa's underperforming schools require a greater emphasis on basic management and making the organisation functional. This may involve ensuring regular and timely attendance by learners and educators; maintaining order and discipline in the classroom and providing adequate resources to enable learning to take place. Once schools are functional, leaders can progress to developing vision, and outlining clear aims and policies, with the confidence that systems are in place to secure their implementation in Physical Sciences. However, research by Prince and Nelson (2007:4-5), and Trowbridge et al, (2004:341-342) show that effective leadership and management skills are characterised by setting clear and specific goals; shaping a dynamic subject team characterised by a positive climate of openness and co-operation; prioritisation of team-building; group work and group morale among educators; initiating staff development programmes; in-service training, workshops and supervision of educators; ensuring that the facilities and teaching and learning materials are adequate; and promoting the teaching of the subject by leading and advising educators to improve effectiveness. Management and leadership skills provide the means for curriculum implementation, through time tabling, subject allocation, textbook allocation, use of period registers and provision of all instructional materials and competent educators, as well as creating a conducive teaching and learning atmosphere (Bush and Glover, 2002:20). Management also entails timeous provision of work schedules to teachers to improve learner performance. Basically, principals guide and monitor curriculum implementation and

assessment of learners and that recording of marks is in accordance with regulations.

In sum, “the principal maintains a school tone and culture that creates the climate for the development of social responsibility” (Starrat, 2001:333). The principals, HoDs, SMTs, and curriculum advisors are expected to monitor the implementation of Physical Sciences subject curriculum on a daily basis, including the tests, class-work, homework, projects, practical investigations given to learners within a certain period and content coverage using pace setters. All the preceding factors discussed above leads to the conclusion that management and leadership skills could have an impact on learner performance in Physical Sciences.

3.1.4.4 Learner socio-economic background

According to CHAT the learners carry their own diverse history and this includes socio-economic background, which may affect learner academic performance. CHAT refers socio-economic status to the position of the subject (learner) in the social system based on economic resources, education, prestige and lifestyle (Lauer and Lauer, 2006:22). The learner (subject) is a person (subgroup) who is working towards an object and does not exist outside the social structures of the community. The roles of the learners differ according to the different contextual factors and according to the various activity systems forming part of the community (Ogawa, Crain, Loomis and Ball, 2008:77). Socio-economic status is an economic and sociologically combined total measure of an individual’s or family’s economic and social position in relation to others, based on income and education. Socio-economic background has been identified as a key predictor of learner success. Recent data show that there is a significant correlation to the socio-economic background of the learner and learner achievement (Wolfe and Nevills, 2004:327). Nyokong, (2009:4) states that there are millions of gifted and talented young people from poor socio-economic backgrounds who are yearning for opportunities to study and who are capable of becoming our future cohort of engineers, technologist, scientists and researchers. It is critical during teaching and learning to consider the socio-economic background of learners to improve performance.

Ezewu, (1983:24) asserts that the family is the back-bone for a child’s success in education. The family sets the life style and influences the life chances for the child’s

educational performance. The assertion dictates that families with better socio-economic status are able to prepare for education in advance. These families send their children to schools with better facilities. As a result, such learners stood a chance of succeeding in their academic performance. However, Wolfe and Nevills, (2004:170) argue that the data based on the research work conducted indicated that families within each socio-economic status group differed widely in the kinds of and amounts of stimulation they provided to learners. Middle class parents take an active role in their children's education and development. Families with lower income do not participate in this movement, causing their children to have a sense of constraint. An interesting observation that studies have noted is that parents from low socio-economic status households are more likely to give orders to their children in their interactions while parents with a higher socio-economic status are more likely to interact and play with their children. A division of education is thus born out of these differences in child rearing (Kraus and Keltner, 2008:411).

Ezewu (1983:25), states that the status of a family affects a learner's attitude and values in life. Learners from high socio-economic families are more motivated because of the value of education given by their parents. However, Ezewu accepted that there were children from the lower socio-economic families who performed brilliantly and could surpass those from high socio-economic families. Research has shown how children who are born in lower socio-economic status households have weaker language skills compared to children raised in higher socio-economic status household (Wolfe and Nevills, 2004:189). It is important to provide learners with the opportunities to develop and improve their language skills in the context of learning Physical Sciences (Department of Basic Education, 2011:14).

Parelius and Parelius, (1978:132) reiterate the point that individuals from more socio-economically advantaged backgrounds have higher levels of measured abilities than the disadvantaged family background. The implication is that the family sets the basic environment on which academic performance rests. Therefore, learners whose parents are concerned with regular school attendance and homework do well in education performance. Ezewu (1983:26), states that high socio-economic families tend to show more concern over their children's poor performance at school. Most parents either teach their children those challenging subjects in which they perform poorly or they appoint part-time tutors. High socio-economic status families are in a

position to give parental help and better motivation to their children than those of a lower socio-economic status.

In conclusion, Lindgren and Suter, (1976:113) argue that teachers should plan instructional methods and curricula in such a way that makes sense to learners. This implies that learner backgrounds must be taken into account. Teachers who encounter a variety of patterns of behaviour in their classrooms should have some understanding of the impact of social class because much of the behaviour they encounter is the result of socio-economic status differences. The attitudes of learners toward Physical Sciences will be affected by the attitudes of their parents and their peer group (Shapiro, 2004:278). Physical Sciences stresses the need to equip learners, irrespective of their socio-economic background (Department of Basic Education, 2011:4) yet socio-economic background could have an impact on learner performance in Physical Sciences.

3.1.5 Division of labour and workload

Much of the problems and criticism lies in the fact that the curriculum leaves educators overloaded with administrative paper work and very little time for actual teaching to cover the content in the curriculum (Grayson, 2010:10). Teachers like sharing ideas and skills with other teachers, especially when solving problems, such as presenting a lesson. Teachers share question papers and memoranda they have developed and thereby manage and even decrease the workload of fellow teachers. Greater emphasis is on collaboration of the community members to facilitate receiving of new ideas and assisting each other in order to transform the world. Forming cluster teams will result in sharing knowledge, peer teaching of difficult topics and setting tests during assessment.

Through reduction of workload, teachers will be left with activities that will engage the learners in the actual teaching and learning of Physical Sciences tasks. The Physical Sciences teacher will put his/her effort in helping learners understand instructions and take more time to clear up problems experienced with some tasks. Teachers need more time for the actual teaching to cover the content in the curriculum and improve learner academic performance (Grayson, 2010:11). The goal of the community is the development of learning on the part of all its members. The norms established in the community are mutual support, trust, respect and

collaboration. These perspectives will go a long way in improving learner academic performance, as various members of the activity work collectively through actions, and proceed in engaging their shared goal (Grayson, 2010:11).

3.2 SUMMARY

This chapter focused on what authorities say about factors that can affect performance in Physical Sciences viewed through the lens of CHAT. Issues concerning teaching methods, teacher-learner ratio, socio-economic status of learners, assessment, parental involvement, motivation of learners, curriculum, supervision, parental involvement and availability of instructional materials and learning aids have been discussed. The chapter has cited research studies that best illustrated an overview of key school-related factors through sampling relevant research. Collaboration between the teachers, principals, learners, curriculum advisors and parents shape the thinking processes of each. The conceptual framework emphasised learning in a social context. The following chapter will outline the research design based on factors that affect learner academic achievement. In the research design, sampling procedures, research method and data collection procedures and mechanisms to ensure dependability and trustworthiness, will be discussed. The research questions in Chapter 1 formed the basis for the gathering of data to determine factors that affect learner academic achievement in Physical Sciences.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter explains how the research will be carried out. It also gives an overview of the composition of the population from which the sample of respondents is to be drawn. The research design to be used to collect data is also described. It examines the qualitative approach, qualitative survey design and methods that can be employed to carry out the research. The chapter includes details of the methods, the description of the population, and information about the data analysis procedures and triangulation issues that will be implemented. The aim of the research is to determine which factors are related to learners' achievement in Physical Sciences. The question dominating the research is: "Which factors impact on learners' academic achievement in Physical Sciences? The Cultural Historical Activity Theory (CHAT) provides the theoretical lens through which interpretation of results will be made.

4.2 RESEARCH DESIGN

Research design refers to a plan that forms the research study. It focuses on the strategies chosen by the researcher that fit with ontological and epistemological frameworks, the methods, approaches and technologies used by the researcher to collect and analyse data (Briggs, Coleman and Morrison, 2012:107). The research design refers to the overall strategy that the researcher chooses to integrate the different components of the study in a coherent and logical way, thereby ensuring the researcher to effectively address the research problem (De Vaus, 2001:62). According to McMillan and Schumacher, (2001:166) a research design describes the plan for selecting the subjects, research sites, data collection methods, data analysis methods and how the data is to be presented to answer research question(s). In regard to the purpose of this study which was to investigate factors which affect the academic achievement of learners in Physical Sciences in Limpopo rural secondary schools, a qualitative design and qualitative survey design were followed. Qualitative design and qualitative survey design facilitated data gathering from Physical Sciences educators, principals, parents, Physical Sciences learners and curriculum

advisors who experience the effect of the teaching and learning processes in Physical Sciences so that valid results to the problems could be found (Gay, Mills and Airasian, 2006:11).

4.2.1 QUALITATIVE DESIGN

The basic research approach that was used by the researcher was qualitative. Qualitative design is concerned with phenomena relating to or involving quality or kind of results in the teaching and learning process. Qualitative design aims to discover the underlying motives and desires, using in-depth interviews for the purpose. Through qualitative design, researchers can analyse various factors that motivate people to behave in a particular manner or why people like or dislike a particular thing. Tuckman, (1994:19) states that qualitative design also involves interviews. However, qualitative methods require skilful interpretation of the data. Miles and Huberman, (1994:6), state that “qualitative design is conducted through an intense and prolonged contact with a “field” or life situation. These situations are typical or normal ones, reflective of the everyday life of individuals, groups, societies and organisations.” Morse, (2001:123), states that qualitative design is concerned with the subjective assessment of attitudes, opinions and behaviour. Research in such a situation is a function of a researcher’s insights and impressions. The data are accounts of interviews, including detailed descriptions of context and nearly verbatim records of conversation.

McMillan and Schumacher, (2001:479) define the qualitative approach as “primarily an inductive process in organising data into categories and identify patterns (relationships) among categories.” This definition implies that data and meaning emerge “organically” from the research context. Morse, (2001:77) explains qualitative research as a system of inquiry that seeks to build a holistic, largely narrative description to inform the researcher’s understanding of a social or cultural phenomenon. It takes place in a natural setting employing interviews. According to Schwandl (2005:120), the qualitative design keeps the researcher close to the data and markedly facilitates understanding of the phenomenon being studied. The design allows the researcher to view participants as collaborators from whom to learn rather than as subjects to be studied. Morse, (2001:76) reiterates that the

qualitative research aims to create understanding from data as analysis proceeds and pre-empts other ways of looking at the research question.

The indications of form, quantity, and scope must be obtained from the research question, from the chosen method, from the selected topic and goals, and also, in an ongoing process, from the data. The design seeks to understand phenomena from the viewpoints of those being studied, is holistic and relies on flexible research strategy (World Health Organisation, 2001:76). Furthermore, Patton, (2001:6) states that qualitative design can be used to help planners and providers move from the relatively general information about what can be done to improve performance.

The approach is therefore, relevant to this study, which seeks to investigate the present state of affairs with regard to learner academic achievement in Physical Sciences in selected secondary schools in Limpopo Province. The qualitative design has been selected for this research as it was deemed appropriate to the exploration and interpretation of the perceptions of principals, teachers, curriculum advisors, parents and learners. In order to explore the social worldviews of these community members, an interpretivist approach will be followed, which according to Merriam, (1998:76) attempts to understand and sense what other people say of their experiences of their particular worlds. According to Cohen, Manion and Morrison, (2000:22) there is a need to examine situations through the eyes of participants rather than the researcher. The research will reflect on the meaning that teachers, principals, curriculum advisors, parents and learners assign to their own experiences in the teaching and learning of Physical Sciences and learner academic performance.

The researcher is a Physical Sciences teacher in one of the schools in the circuit and therefore has in-depth knowledge of the structures and contexts in which the research is to be conducted. The researcher will interpret the perceptions of the teachers, principals, curriculum advisors, parents and learners. Furthermore, the research will not only be inductive in nature. Elements of deductive reasoning will also be included as the CHAT provides the lens through which the results will be interpreted. The research will take place in a natural setting, with analysis, categorisation and interpretation of the perceptions of teachers, principals, curriculum advisors, parents and learners forming the community in Physical

Sciences. The researcher will collect the data making use of information provided by the interviews. Inductive data analysis will be used to enable coding and organising data according to themes. The meanings attached to the perceptions by the participants will be important and the researcher will verify these interpretations by triangulation techniques in order to ensure that they are correctly analysed, interpreted and described within this research.

4.2.2 QUALITATIVE SURVEY DESIGN

Qualitative survey design analyses the diversity of member characteristics with the population. The diversity of member characteristics may either be redefined or developed in open coding. In the inductive survey, relevant topics, dimensions and categories are identified through interpretation of raw data (for example, interview transcripts (Creswell, 1998:60). The participants are selected because of their experience with the topic of study. According to Guba and Lincoln, (1998:58) qualitative survey may include ontological realism and epistemological objectivism. A survey involves taking specific views of scanning and examining opinions, beliefs, attitudes, values, characters, demographic, habits, desires, ideas and other types of information (McMillan and Schumacher, 2001:304). Therefore, the qualitative survey design was found to be appropriate because it provided information that allowed the researcher to gain insight into the factors that affect academic achievement of learners in Physical Sciences directly from the ideas and opinions of Physical Sciences educators, principals, parents, Physical Sciences learners and curriculum advisors who experience the teaching and learning of Physical Sciences in Limpopo rural secondary schools.

4.3 SELECTION OF PARTICIPANTS

The population comprised of Physical Sciences teachers, principals managing schools, Physical Sciences learners, parents and curriculum advisors. The study took place in Limpopo rural secondary schools. The population was limited to Bochum circuit. The circuit consisted of 10 secondary schools offering Physical Sciences. There was a total of fifteen Physical Sciences educators and a total of 148 Physical Sciences learners in the circuit. The population of principals was ten, tallying with the number of secondary schools.

The purpose with the selection of participants is to solicit information regarding factors affecting learner academic performance in Physical Sciences. Purposeful sampling will be used for the collection of data. According to Patton, (2001:169) purposeful sampling is done to increase the utility of information obtained from small samples. Purposeful sampling requires that information be obtained about variations among the subunits before the sample is obtained. According to Creswell, (2007) and Merriam, (1998:61), purposeful sampling is based on the assumption that the researcher wants to discover, understand and gain insight and therefore must select a sample from which relevant data will be obtained. In other words, the sample was chosen because it was knowledgeable and informative about the phenomena the researcher was investigating.

The selection was first limited to a specific provincial education department and then to one of its education districts from which the researcher selected a cluster. From the cluster the researcher selected one circuit. There are nine provinces in South Africa and Limpopo province was chosen using simple random selection method. The province is divided into five districts. The districts are divided into clusters and clusters divided into circuits. Capricorn district was chosen and has seven clusters. Bochum cluster was chosen and there are five circuits in Bochum cluster. Bochum West circuit was chosen for the study and has ten secondary schools. A total of five schools in this circuit that offer Physical Sciences are selected purposefully. The circuit consists of 10 schools from which five schools are selected. Two schools were selected that produced the best performers and two of the underachieving schools were selected from the circuit. A school in the middle in terms of performance were selected from the circuit to make a total of five schools. The grade 12 final year examination results of 2013 were used as criteria to select the five schools. Physical Sciences teachers in the five schools automatically comprise members of the sample. Five principals responsible for managing and leading the five schools automatically comprise members of the sample. Focus groups of six Physical Sciences learners per group are selected from Grades 10, 11 and 12 in the five schools. The selection of this particular sample was based on performance of the schools in Physical Sciences. Physical Sciences learners to be interviewed comprised of learners performing poorly and learners performing well in Physical Sciences. The sample of learners consisted of thirty learners. The sample comprised

of the best learners and the least performing learners from grades 10, 11 and 12 (two learners per grade). There are only two curriculum advisors in the circuit office therefore they will be automatically drawn into the study. Critical case sampling was used to select the parents. The parents of two learners in the two best performing schools were selected as participants as well as three parents from the three underachieving schools. Consequently, five parents of learners doing Physical Sciences were selected.

The criteria used for the selection of teachers, principals, learners and parents in the selected circuit will be that schools need to offer Physical Sciences and need to be in close geographical proximity to one another in order for the researcher to reach them easily from his school. Performance differences of the schools are important as the researcher should get varied information from participants. Therefore, performance of the schools is also used as criterion to select the schools. These are rural secondary public schools. Most of the schools sampled had one teacher or two teachers teaching Physical Sciences. In some schools one teacher was responsible of teaching grades 10, 11 and 12 alone. In some bigger schools two or three Physical Sciences educators were involved in teaching Physical Sciences.

The sample consisted of secondary schools teaching Physical Sciences. Therefore, the sample can be described as “convenient.” The schools sampled will differ in various ways from one another. Some schools are well-resourced and others poorly-resourced. The contextual factors that were linked to the teaching and learning of Physical Sciences (environment) in which the teachers, principals, learners, parents and curriculum advisors operate differ with variation in the qualifications of teachers, principals and curriculum advisors and performance of the learners. These differences between the participants enabled the researcher to gather more important information.

4.4 DATA COLLECTION AND DATA COLLECTION INSTRUMENTS

The data collection method entailed in-depth interviews with Physical Sciences teachers, principals, parents and curriculum advisors and focus group interviews with Physical Sciences learners. As teaching and learning Physical Sciences takes place within this circuit, data collection is in a natural setting for participants. A discussion of the reasons for using interviews and their advantages and disadvantages follows:

4.4.1 The interview

According to Patton, (2001:129), the interview has the following advantages:

- usually yields richest data, details, and new insights;
- permits face-to-face contact with participants;
- provides the opportunity to explore topics in depth;
- allows the interviewer to explain or help clarify questions, increasing the likelihood of useful responses; and
- allows the interviewer to be flexible in administering the interview to particular individuals or circumstances.

In an interview the researcher is able to discover information that he may not be aware of in the beginning. Scott and Morrison, (2006:153) explain that interviews provide a “more informed” way of claiming knowledge than a questionnaire could provide in order to address one or more specific research questions. Cohen, Manion, and Morrison, (2000:268) suggests that “the interview may be used as the principal means of gathering information having direct bearing on the research objectives.” However, Patton, (2001:130) identifies the disadvantages of interviews regarding them as expensive and time-consuming. Flexibility can result in inconsistencies across interviews. Interviews may distort perceptions and desire to please the interviewer. Therefore, the researcher needs to be aware of these problems during the interviews in order to have effective interviews.

Slavin, (2006:52) stipulates that the researcher creates a schedule that consists of a set of questions in an interview study. Five different schedules are used in this study: One for the principals, one for Physical Sciences teachers, one for Physical Sciences learners, one for parents and one for curriculum advisors. According to Lofland and Lofland, (1995:17), interviews provide very different data from observations and questionnaires. Gillham, (2005:7), points out that the interview is “still one human being interacting with another and using their resources of interpersonal sensitivity to do so.” Furthermore, Lofland and Lofland, (1995:18), state that an in-depth interview is a dialogue between an interviewer and an interviewee. Its goal is to elicit rich, detailed material that can be used in analysis. In-depth interviews are characterised by extensive probing and semi-structured questions. The researcher prepared different interview schedules or guides that include a list of

questions or issues that are to be explored. Questions are semi-structured to allow teachers, principals, learners, parents and curriculum advisors to express their own views on factors affecting learner academic achievement in Physical Sciences respectively. The interview questions were developed from the literature review exploring factors that affect learner academic performance in Physical Sciences.

The purpose of the interviews will be to explore what is in the minds of the interviewees and to gather information and explore the perceptions of principals, teachers, learners, parents and curriculum advisors on factors affecting learner academic achievement in Physical Sciences. All interviews will be conducted on a face-to-face basis. Therefore, the interview technique is considered appropriate to the study since it can be used to solicit more information from the participants' minds concerning factors affecting learner academic performance in Physical Sciences.

4.4.2 Data collection instruments

4.4.2.1 Interview of principals

Interviews were conducted with each of the five principals. An interview guide was prepared by the researcher. It includes a list of questions or issues that are to be explored, such as availability of resources; motivation of learners; language of instruction; pass-rates; discipline of learners; assessment; work load; learner socio-economic background, parental involvement, teaching methods, supervision of teachers, teacher effectiveness, leadership and management skills and teacher-learner ratio. The questions were linked to the literature review. The interview guide consists of semi-structured questions. Questions are phrased to allow for individual responses. These questions are open-ended but fairly specific in intent. Questions provide a high degree of objectivity and uniformity, yet allows for probing and clarification (McMillan and Schumacher, 1993:251) (See Appendix 10).

4.4.2.2 Interview for teachers

In-depth interviews were conducted with each Physical Sciences teacher. The aim of the interview was to collect data on factors affecting learner academic performance in Physical Sciences. The interviews were conducted in English, audio-recorded and transcribed. The formulation of the schedule was based on the literature review discussed on factors affecting learner academic performance in Physical Sciences.

Questions ranging from availability of resources, leadership and management skills, teaching methods, motivation of learners, teacher effectiveness, teacher-learner ratio, assessment, discipline of learners, supervision of teachers, parental involvement, learner socio-economic background, instructional language and work load will be asked. The interview schedule consisted of semi-structured questions (See Appendix 11).

4.4.2.3 Focus group Interviews for learners

Focus group interviews were conducted with groups of six learners from the selected secondary schools. During the focus group interviews groups of 6 Physical Sciences learners were interviewed. The total number of learners interviewed was thirty. The learners were selected based on their performance in Physical Sciences using second term results of 2013 of grades 10, 11 and 12. One best learner from each grade and one learner performing poorly were selected. This brings the number to six learners per school. That is two learners from grade 10, two from grade 11 and two learners from grade 12. The focus groups involved learners of mixed achievement in Physical Sciences. Questions were semi-structured to allow learners to express their own views. The interviews were conducted in English, audio-recorded and transcribed. The interview schedule was based on factors discussed in literature review such as home background, pass rate, availability of resources, teaching methods, discipline of learners, assessment, learner socio-economic status, language of instruction, teacher-learner ratio, parental involvement, teacher effectiveness and motivation of learners (See Appendix 12).

The researcher interviewed six Physical Sciences learners from grades 10, 11 and 12. As indicated, selection was based on performance of learners during mid-year examinations. Two learners were selected from each grade; the best and poorest achiever in each grade. Learners were informed well in advance regarding the date of the focus group interviews. A common set of questions were asked and each learner was given a chance to answer each question. Learners were free to answer any question and were not forced to do so. Learners sat as a group in a room facing the interviewer.

4.4.2.4 Interview for curriculum advisors

Both curriculum advisors of the circuit were interviewed individually. The interviews took place at the circuit office. The questions were based on the literature review and ranged from availability of resources, motivation of learners, teaching methods, supervision of teachers, teacher-learner ratio, assessment, leadership and management skills, discipline of learners, parental involvement, learner socio-economic background, teacher effectiveness, workload, language of instruction and pass rate in schools (See Appendix 9).

4.4.2.5 Interview for parents

Parents of children doing Physical Sciences were interviewed. Again the questions are based on the literature review and ranged from problems learners face at home and at school, discipline of learners, motivation of learners, support by parents, resources, homework, assessment, teacher-learner ratio, teacher effectiveness, management and leadership skills and learner socio-economic background (See Appendix 13).

4.4.3 Data collection procedure

The researcher used focus group interviews for learners and individual interviews for teachers, parents, principals and curriculum advisors. The researcher travelled to the five selected rural secondary schools to carry out interviews with teachers, principals, parents, learners and curriculum advisors respectively. Arrangements were made with the school principals to interview the participants in a vacant room and to audio-record all interviews. When responses were unclear, the researcher probed with further questions for further clarity. Teachers, principals, learners, parents and curriculum advisors were informed in advance of the dates and time during which the interviews were to be conducted. The researcher audio recorded all the interviews. Audio recordings reduce the tendency of the interviewer to make a subconscious selection of data favouring his biases. Kvale, (2007:81-82) explains that semi-structured interviews can be recorded so that all nuances of the answers can be retained and the richness of individual statements is not lost. In addition, audio-recorded data can be played back more than once and can be studied much more thoroughly than would be the case if data were limited to notes taken during

interviews. However, the researcher can take handwritten notes in addition to recordings as these might not only act as insurance against technical mishaps, but can also form the basis of transcription which can then be augmented from the recording. The other purpose of handwritten notes is to report that which cannot be recorded such as non-verbal cues that can be seen, by writing in the notes to supplement the recorded data.

4.4.4 Data Analysis

According to Patton, (2001:12), data analysis in qualitative work is to generate impressions based on initial digital recordings and to move quickly to written summaries that blur the distinction between what was heard (the raw data) and the patterns and themes that an investigator has discerned (which can often best be termed an interpretation of the data). In order to achieve this, the researcher needs explicit processes for tracking and managing raw qualitative data for coding the data (using phrases) in ways that permit data to be looked at both in its textual context and outside of it for checking on the dependability of coding by using multiple coders for recognising and articulating emergent ideas about patterns, themes and explanations. Watling and James, (2007:48) describe data analysis in the qualitative paradigm as a search for understanding, interpretations and meaning rather than conveying facts and measuring information. Data analysis in this research aims at giving appropriate meaning to the views of the Physical Sciences teachers, learners, parents, principals and curriculum advisors on factors affecting learner academic performance in Physical Sciences. The data which were audio-recorded was transcribed and printed.

The interview transcriptions were organised into themes by coding. Open coding was used to condense the data by assigning codes to it. There was identification of categories and themes emerging from the data. Data of the five interview schedules were analysed separately at first to compare the responses of teachers, principals, learners, parents and curriculum advisors respectively. After the coding process, the coded data were used to form a true analysis of the activity system. The analysis was done by identifying the purpose of the activity in order to get clarification. This included the context of Physical Sciences teaching and learning and learner academic performance. The subject, the community and the object were defined.

The subject included a description of how learners are motivated during teaching and learning in Physical Sciences. The community included the structure and social interactions within the teaching and learning of Physical Sciences. The expected outcome of the activity was used to define the object. The analysis of the activity system included an identification of the activities in which the community and subject will participate and the rules within the activity system.

Lastly, there was description and analysis of the tools (artefacts) used in the activity system, the rules that will guide the activity system and the roles of the community members involved in the teaching and learning of Physical Sciences to enhance learner academic performance. There will be analysis of the social structures, the tools (artefacts) and division of labour among the community members. Analysis of the perceptions of participants on learner academic performance in Physical Sciences as well as problems they encounter with the teaching and learning of Physical Sciences will be done. According to Merriam, (1998) the researcher is the primary instrument for data collection and data analysis has certain biases and limitations when collecting and interpreting data. The researcher encoded and interpreted all the data.

4.4.5 Issues of dependability, member-checking and trustworthiness.

4.4.5.1 Dependability

According to Merriam, (1998) reliability in qualitative studies may be problematic, since human behaviour differs over time and therefore replication of a study will not necessarily produce the same results. There is a need for the researcher to establish consistency when reporting on the results. In order to maintain consistency, triangulation methods are used and the different semi-structured questions were asked to teachers, principals, learners and curriculum advisors respectively. Examination of raw data and process notes was used by the researcher to verify the steps of the research. According to Lincoln and Guba, (1985:300-317), inquiry audit can be used to examine both the process and the product for the research for consistency. The researcher established standard conditions of data collection by giving participants the same directions and have the same time frame in which to answer questions. The interview instruments were appropriate in reading level and

language. The researcher ensured that questions mean the same to all participants, check that all the questions are concise and clear and check ambiguity in sentences. The researcher motivated participants to answer questions by ensuring confidentiality of participation and explaining the importance of the research. The researcher compared data found from teachers, learners, principals, parents and curriculum advisors and time periods in order to find regularities in the data and see if the same patterns keep recurring. Learners were asked about their grades and of their experiences in learning Physical Sciences. Teachers also stated the grades and subjects they were teaching.

4.4.5.2 Member checking

Findings of teachers, principals, learners and curriculum advisors were cross-checked against the information obtained during the interviews. Findings that emerge from the interviews were used to identify factors affecting learner academic achievement in Physical Sciences. In addition to audio recordings, the researcher also wrote notes that will help during transcription. Member checking took place immediately after the initial interpretation of the results to ensure that the perspectives of the participants were captured correctly. This was done with teachers, principals, parents and curriculum advisors. The researcher verified the consistency of the data through process notes of the focus group interviews. Member-checking was used in order to control bias and establish valid research. The researcher should engage in research that probes for deeper understanding rather than examining surface features (Johnson and Christensen, 2008:4). Probing questions were used by the researcher to prevent bias. The researcher checked problems that were experienced and ensured that participants do not experience difficulties in answering interview questions.

4.4.5.3 Trustworthiness of data

Research is a public trust that must be conducted ethically, is trustworthy and socially responsible if the results are to be valuable. During the interviews the researcher used both the audio recordings and written notes in triangulation to establish the trustworthiness of the interviews. The participants involved in the research had knowledge about Physical Sciences. The questions on the interview

instruments were based on the factors affecting learner performance in Physical Sciences. The researcher tried to minimise bias by examining each participant in great depth. The researcher sought patterns by assessing the accuracy of the sources of data (participants). The researcher needs to be aware of the pre-dispositions and influence on the social situation and minimise bias. Several data sources were used to collect data including teachers, principals, learners, curriculum advisors and parents. The researcher evaluated the data for information adequacy, usefulness, and centrality. This helped the researcher to illuminate the research problem and which data are central to the research about the factors affecting learner academic performance in Physical Sciences. The researcher needs to be aware and identify participants who were biased during the interviews through using probing questions.

4.4.6 Ethical issues

Before the interviews verbal consent was obtained from the participants. The purpose of the research was explained to the participants. In addition, assurance was given of the confidentiality of their responses in the research report. In order to ensure confidentiality, no names of participating teachers, principals, parents, learners and curriculum advisors are used in the research. The interviews were transcribed and transcriptions analysed to identify codes, categories and emerging themes (Neumann, 2006:18). Participation in the focus groups and individual interviews were voluntary. Participants had the right to withdraw without penalty. The researcher applied for permission to carry out the research in schools from the Department of Basic Education. This application was successful (Appendix 2). Consent was also obtained from principals, teachers, learners, parents and curriculum advisors. The researcher has to apply for clearance from the Research Ethical Clearance Committee of the College of Education at UNISA. The certificate is attached as Appendix 1.

4.5 SUMMARY

This chapter examined the research design, taking the qualitative approach as the most appropriate. The qualitative approach enabled the researcher to explore and interpret the views of teachers, principals, parents, learners and curriculum advisors on factors that affect learner academic performance in Physical Sciences. The researcher described the data collection instruments that were used to collect the data. The next chapter presents the analysis and description of the data gathered. In the analysis, teachers, parents, principals, learners and curriculum advisors will be discussed separately as communities of practice. The factors affecting learner academic performance in Physical Sciences will be determined and will be linked to the teaching and learning within Physical Sciences in order to improve performance.

CHAPTER 5

FINDINGS AND DISCUSSION

5.1 INTRODUCTION

This chapter focuses on the analysis and presentation of qualitative data. It represents the factors that may affect learner academic performance in Physical Sciences in selected rural secondary schools in Limpopo Province. The data were collected through interviewing individual Physical Sciences teachers, principals, curriculum advisors and parents. The input of Physical Sciences learners was gained through focus group interviews.

The findings of the research will be given and linked to the literature. The description and analysis of the activity system will include the Physical Sciences curriculum, resources, assessment, discipline of learners, parental involvement, sharing the workload, management and leadership skills, the teacher-learner ratio, teacher effectiveness, socio-economic background of learners, teaching methods and motivation of learners. The discussions in this chapter are guided by the research question, namely: "Which factors impact on learners' academic achievement in Physical Sciences in Limpopo rural secondary schools?"

5.2 PURPOSE

As mentioned, the research intends to determine which factors affect learner performance in Physical Sciences in rural secondary schools in Limpopo Province. The aim is to address these factors and thus improve the performance of Physical Sciences learners.

5.3 CODING OF PARTICIPANTS

Interviews were used to collect the data from five Physical Sciences teachers, five principals, five parents, two curriculum advisors and 30 Physical Sciences learners. Focus group interviews were carried out with Physical Sciences learners. The researcher travelled to schools to interview all the participants. All interviews were audio-recorded with permission from the participants. The researcher also took notes

during data collection. The five principals who were interviewed are referred to as Principal 1, Principal 2, Principal 3, Principal 4 and Principal 5 in the reporting of the findings. The five teachers that were interviewed are referred to as Teacher 1, Teacher 2, Teacher 3, Teacher 4 and Teacher 5. Curriculum advisors are referred to as Curriculum advisor 1 and Curriculum advisor 2. Parents who were interviewed are referred to as Parent 1, Parent 2, Parent 3, Parent 4 and Parent 5. Lastly, the findings from the learners interviewed in focus groups are referred to as learner 1 in group 2, learner 6 in group 4 and so on during reporting of the findings. This is done to ensure confidentiality and anonymity. The numbers assigned to the principals, educators, parents and learners is also the number of the school.

5.4 THE ACTIVITY SYSTEM AND FINDINGS OF THE RESEARCH

Engeström, (1999) sees joint activity or practice as the unit of analysis for activity theory, but not individual activity. There is interest in the process of social transformation and this includes the structure of the social world in analysis, taking into account the conflictual nature of social practice. Leont'ev in Foot, (2001:9) also argues that an activity is identified and distinguished by its goal or purpose. The activity system, as described in Chapter 2 consists of different components. The subject as indicated in the discussion of the theoretical framework in this research comprises Physical Sciences learners in secondary schools and the findings related to this appear in 5.4.1. The artefacts and tools refer to resources, teaching methods and supervision of teachers used in the activity system. These findings are discussed in 5.4.2.

The rules that control the system are guidelines from the Department of Education such as assessment guidelines, the Physical Sciences curriculum, discipline of learners and policy on the teacher-learner ratio and appear in 5.4.3. The Physical Sciences teachers, principals, parents and curriculum advisors form part of the community in the activity system (5.4.4). The division of labour explains the sharing of tasks to reduce workload among members of the community. The members play different roles to enhance performance in Physical Sciences (5.4.5). Finally, the object of the activity system is to improve learner performance in Physical Sciences. Kaptelinin, (2005:7) explains that "object" is the reason why individuals and groups of individuals choose to participate in an activity, and it is what holds together the

elements in an activity. Success in Physical Sciences is measured by academic achievement on how well a learner meets the standards set by the Department of Education and the schools themselves. In order to improve learner performance in Physical Sciences, different objectives need to be established. The findings related to the activity system are subsequently discussed.

5.4.1 The subject

In this study, the subject is the Physical Sciences learner or learners engaged in the activity. Kozulini and Gindis, (2007:17) states that the subject develops new signs that help them make meaning of the world. The subject in this research comprises of the Grade 10, 11 and 12 Physical Sciences learners. Learners who participated in the focus group interviews were from the rural secondary public schools. Focus group interviews were carried out with six Physical Sciences learners from five secondary schools respectively. At least two learners were selected from each grade and their academic performance was used as criterion. Questions were asked using English. These learners are taught using English as a medium of instruction. In an attempt to identify possible ways of motivating learners, questions were asked to teachers, principals and curriculum advisors on how learners are motivated to improve performance in Physical Sciences.

Teachers indicated that there is need to show enthusiasm by coming to work on time and even to assist on Saturdays. There is need for more time to help learners to practice reading and developing Physical Sciences skills. This is substantiated by Teacher 4 who mentioned that *“the way I have tried is at least showing them my enthusiasm by coming to work even when I am not being paid on Saturdays. I think that has paid in trying to make them read the subject well, giving them time to read to develop those skills. Basically, giving more quality time, explaining things to them and giving them practice to read.”* Teachers talk to learners about the careers that are rewarding such as engineering, medicine and chemistry. This was the view of Teacher 1 who stated *“I encourage learners in many ways by talking to them about some careers which are rewarding like engineering, medicine and chemistry-related careers and Life Sciences related careers. I try to explain to them as much as I can how rewarding these careers are. I encourage them to come to school at half past six and to come in the afternoon at 5 o’clock and most of them are enjoying it.”*

Learners are encouraged to attend morning, afternoon, Saturdays and holiday lessons.

Teachers should link teaching and learning with real life situations. Topics taught should have a direct bearing on learners' future lives or careers. This is substantiated by Teacher 3 who indicated "*learners should learn a topic which has a direct bearing on their lives and when teaching teachers need to start with the basics. In most cases topics like Pythagoras are associated with professionals and topics with probability are associated with actuarial science.*" When learners write exams and their marks are displayed on notice board. It acts as motivation because when other learners see the marks they will work harder. These were the views of Teacher 2 who also stated: "*I encourage them to work harder in Physical Sciences, first of all we do not talk about Physical Sciences but we talk to them about possible careers. We encourage them to work hard when they write examinations and their marks are displayed on the notice board and when they see the marks it acts like motivation because they want to perform like their top counterparts.*" Furthermore, Teacher 2 indicated: "*I think it is expected that not all learners will perform the way you expect them to perform, like lack of interest, others may have their issues such as family background and others have attitudes. So some learners will not perform the way you like them to do.*"

Teacher 5 stated: "*There is a group that help other learners so that there is learner to learner assistance or peer-teaching. I encourage the learners to practice previous exam question papers so that they can help peers. I also help them to answer questions they are not able to do well and tell them that there is no one who will struggle after finishing Grade 12 and passing Physical Sciences and Mathematics. Apart from that I use the opportunities that arise after passing Mathematics and Physical Sciences and it acts as a motivator.*" In addition, Teacher 5 stated: "*I give them questions which they go and solve to see if they are still above the rest. We are using peer teaching, giving learners previous examination papers to go and answer and that needs thorough monitoring of learners' work and is a way of motivating these learners.*"

Principals indicated that motivation is the key to Physical Sciences' achievement because if learners are motivated achievement is pushed to its highest level. This is

substantiated by Principal 4 who stated: *“I think this one is key in Physical Sciences because if learners are motivated that in itself pushes achievement to a very highest level. Sometimes learners fail because they are not motivated because they do not know what they are going to do after passing Grade 12. For Grade 10 they should know what career paths they can follow and can improve performance.”* Learners should also develop a love for the subject. Principal 2 mentioned *“...by the term motivation it means that we talk to the learners to instil love of the subject, knowing very well that if they have love for the subject learners will do better.”* Principals emphasised the need to source Physical Sciences specialists from other institutions or to form partnerships with other institutions as this will result in the sharing of resources so that learners can benefit and become motivated. This was substantiated by Principal 5 who said: *“Motivation is always needed to learners particularly to encourage them to perform well so in Physical Sciences motivation is needed. You can at times outsource specialists for Physical Sciences from other institutions or you can form partnership with other institutions whereby you know that they are well-resourced so that learners will be able to face this subject.”* In addition Principal 5 pointed out *“learners feel self-motivated knowing very well that the career path that they want to follow needs them to pass Physical Sciences at a particular level as a result they get motivated in trying to work hard in order to achieve.”* Principal 1 stated *“...if they are well motivated and given the examples of people who have done Physical Sciences these learners will be interested in doing Physical Sciences and then for those people who are working they need to be given examples of such learners.”*

Principal 3 mentioned: *“We motivate learners by giving them more work and allowing them to attend career exhibitions. We announce top 10 in the subject and provide the necessary resources for them. It is the responsibility of the educator to identify weak learners and assist them.”* When probed Principal 3 indicated that he assists educators to be patient with learners. *“To be patient is another way of motivating the learners so that you must not treat them with harsh words. You must also motivate them to like the subject.”* Principal 1 pointed out that three years ago their results were unsatisfactory but that the results improved. He said: *“We achieved 75% last year (2013).”* When probed he explained *“For the poor results I can say it was because of the teacher there and the attitude of the learners towards that teacher*

and by now and the past two years for the results to improve, I can say the teacher concerned gives them more work, learners are given a lot of work. If you visit the class you see learners doing Physical Sciences. Learners do not have a negative attitude towards the teacher, they enjoy the subject.”

Curriculum advisors mentioned that Physical Sciences educators need to implement extra classes and practical activities so that learners are motivated. This is substantiated by curriculum advisor 1 who stated *“I will request teachers to work more not to focus on the time provided to them as the educators just to follow the time table and the periods for Physical Sciences they need to have extra classes. The subject needs more practice. If you teach only and not ask learners to do some practical work they won’t be motivated. Learners need to be motivated all the time. They need to act as role models and do some presentations to learners so that they are motivated.”* Curriculum advisors encourage learners and teachers to work hard. This is substantiated by curriculum advisor 2 who stated: *“We visit the schools and assist the teachers in class were possible. We also encourage teachers or schools to outsource to work together with neighbouring schools to assist one another. If it is in terms of content, we try to help the teachers individually.”* Curriculum advisor 1 stated: *“Learners are motivated because they are assessed and are given speedy feedback and there is need to do some projects or some fun where learners are motivated by seeing role models demonstrating and assisting the learners.”*

In summary the findings suggest that motivation is of key importance in Physical Sciences because if learners are motivated their achievement is pushed to the highest level. Palmer, (2007:38-42) states that motivation is an essential element that is necessary for quality education. Firstly, it is important to keep learners motivated. Educators need to be patient with learners and not to treat them harshly as a way of motivating them. Secondly, teachers should show their enthusiasm by coming to work on time and should be willing to go the extra mile by assisting learners after hours. There is a need for extra classes and practical activities to keep learners motivated. Thirdly, there is a need for teachers to talk to learners about possible careers that are rewarding such as engineering, medicine and chemistry-related careers.

Learners will be self-motivated if they acknowledge the importance of Physical Sciences for their future careers. Learners doing Physical Sciences need to be confident, patient and committed. They persevere despite setbacks and challenges and can only succeed through the support and motivation from the Physical Sciences teachers. Physical Sciences teachers should assist average learners to improve their performance by stimulating their thought processes during teaching and learning. Through inspiring and stimulating learners, teachers can assist learners to improve performance.

5.4.2 Artefacts/tools/instruments

Vygotsky, (1978:297) reiterated that mediated action involves an interaction between the learner, mediating artefacts/tools and signs. The analytic resources of activity theory are given to the inhabitants of an activity system as a stimulus for the analysis of the system and recognise the emergent contradictions that will lead to change (Engeström, 1999). The artefacts or instruments in CHAT refer to the resources such as textbooks, laboratories, teaching methods, and language as a barrier to achievement, supervision of teachers and attendance to career exhibitions or expos. The interaction between the community members within the activity is assisted by the cultural tools and artefacts such as language, ways of presenting content and instructional materials and learning aids and will be discussed in the following paragraphs.

5.4.2.1 Availability of instructional resources

This section reports on data related to the availability of teaching and learning resources. Teacher 3 indicated *"...if I have an overhead projector for example, it is easier to teach with an overhead projector with our big classes. Also textbooks, like now I do not have CAPS aligned textbooks until now even in Grade 12."* When probed, Teacher 3 mentioned *"...if each learner has got a textbook that can supplement teaching and learning in the absence of the educator plus when the classroom activities have got to be written there is point of reference that is let us go to page 111 or 84. If they do not have textbooks, it becomes laborious and there are some diagrams you cannot draw without using a projector or textbook."* Teacher 2 was the only teacher who stated *"We have the new laboratory; it has all the apparatus and chemicals and other resources. Maybe internet which can be*

accessible to the learners and where they have problems may check and find answers. Other apparatus maybe the internet but most of the resources we have access to them.” When probed, Teacher 2 pointed out that resources such as laboratories help to expose learners to real things, they all use their senses. Teacher 4 responded that they need a number of items, *“...like first textbooks, secondly the learning spaces, accommodation where they sit, then we need a laboratory for experiments.”* Teacher 4 also pointed out that if a laboratory is available, abstract concepts can be easily explained while learners do experiments in class.

Teacher 5 stated *“We are facing a lot of challenges in terms of apparatus and chemicals. Also textbooks we use do not have a lot of questions for learners to practice and worked examples for learners to do on their own. As an educator I will be very happy to have these. More importantly Physical Sciences is a subject where the learner has to discover on his own, so we need apparatus and chemicals to do experiments. I am teaching Physical Sciences as if I am teaching History. If a teacher wants to teach about double bond in organic compounds, teachers need bromine solution to test the presence of ethane but it is not available in our schools.”* It was also pointed out that when learners only hear something, they easily forget, but if they see and do work practically, they should remember. Consequently, it is important that teachers do experiments to facilitate learning. Textbooks assist learners to work on their own yet some teachers mentioned that the textbooks they have are not ideal.

Teacher 1 stated *“I don’t have textbooks for a start, and then resources for practical activities are not there at all, even the basic kit is not available and this is affecting learners’ performance seriously because some of the activities need hands-on approach and then in the absence of the resources is a setback.”* The teachers also indicated that there are no internet facilities which learners can access. The main concern is that most teachers do not have CAPS aligned textbooks in Grade 12. Textbooks are important because they supplement teaching and learning in the absence of the educator and they serve as a point of reference during classroom activities.

The school principals are aware of the resource problems. Principal 1 indicated *“...if learners have suitable textbooks then they can achieve...if they have laboratories it*

will be easy for the teacher or learner to do experiments or if they have computer technology they can have exemplar questions and even use of lessons which are taught through television and radio programmes." Principal 4 indicated that the advantage of technology is that it allows teachers to do simulations, or they can show videos of aspects that are impossible to do in class. Ideally, teachers can make video-recordings of information and these can be used during teaching and learning. For example, demonstrations on how generators work can be explained through video-recordings. Most principals indicated that computer technology is essential for learners to access exemplar question papers. In addition principals pointed out that television and radio programmes that are broadcast during the holidays play an important role in improving learner performance. However, principals mentioned that many learners in rural areas do not have access to these facilities. Principal 3 pointed out that resources can only affect learner performance if they have the relevant information and are properly used.

The principals acknowledge that the shortage of textbooks places immense strain on the school and educators as they have to photo-copy materials that learners may need and that the absence of equipped laboratories in the schools leads to the memorisation of theory rather than through practical activities. This will adversely affect learners when they attend tertiary institutions. This was substantiated by Principal 5 who said: *"As one of the practical subjects, Physical Sciences needs to be taught in a laboratory; hence in most cases if there are no laboratories in schools learners will resort to theory than practice. If learners complete grade 12 they may experience problems when they use the resources for the first time at tertiary level hence the laboratory can facilitate teaching and learning in the classroom."* This principal proposed that computer technology could solve the problem. *"Most of the things can be done through the use of computers. If learners are taught using computers, some of the things which are not accessible to them like chemicals...they see them and it will be more like they are doing those things."* In addition, Principal 5 pointed out that *"Our school is presently using sponsorship partnership with African Bank which is sponsoring TRAC which come to our school once a week to do experiments with the learners. They make use of computer technology in teaching experiments; as a result our results are improving bit by bit."*

The parents who were interviewed had the same opinions. They indicated that there is a shortage of textbooks and that the schools are not well-equipped to do practical work. The parents emphasised the importance of collaboration between them and the principals in solving the problem of textbook shortages. Parent 1 pointed out that the school, the community and principal should try to guide parents on how to get the necessary resources and where possible parents could assist financially and buy some resources. In addition, parents pointed out that they accept that it is their responsibility to supplement different resources in schools. Parent 5 mentioned that a possible levy for Physical Sciences can assist in buying equipment and chemicals for experiments but Parent 3 argued that the best way to get the resources is for the principal to ask the Department of Education to provide them. However, this parent indicated *"...it is my responsibility to buy the resources not depending solely on the school because it is my child and the future is his."*

Parents unanimously indicated that they buy books and study guides for their children where needed. They do so to help their children to perform well in school. Parent 4 goes further, saying the following: *"As a parent I afford my child the chance of attending extra lessons and I can also make a contribution financially so that the school is able to buy missing things that are not readily available at school such as equipment for experiments and chemicals."* Parent 5 mentioned: *"I think as a parent one has to pay a certain fee for the school specifically just for Physical Sciences resources. As parents we have an obligation to fulfil for our children."*

Both curriculum advisors that were interviewed indicated that the lack of resources contributes to poor performance of learners. Learners need to work on their own to perform well in Physical Sciences and there is a need to carry out practical work especially in terms of laboratory work and ideally learners should be given the opportunity to access computers. Curriculum Advisor 1 mentioned that the lack of resources is a major concern especially when it comes to practical work in a laboratory. Technology could help to solve this problem. Through computer access, learners can go onto the internet and view experiments that they cannot do due to a lack of equipment. However, the curriculum advisors pointed out that learners are not able to search for information on the internet because they are not able to handle computers. Learners without computers are encouraged to use their cell phones. This is substantiated by curriculum advisor 2 who stated *"that sometimes they are*

not able to search information from the internet. Our learners are not able to handle computers. Therefore, we encourage them to use their cell phones.”

The curriculum advisors consider textbook selection a concern. “*Our teachers choose textbooks without knowing its content*” (CA2). Curriculum Advisor 1 indicated that teachers in schools just choose textbooks because they may not be aware of good textbooks during textbook requisition. Curriculum Advisor 1 also added that there is a problem with the preparedness of teachers. “*Recently, we have CAPS that needs to be implemented so we have new entrance of educators who are not used to policies, because there are other sections which need to be examined at the end of the year, usually because they are not used to the new syllabus they just teach everything even those things in the old syllabus.*” Consequently curriculum dissemination is not as effective in preparing teachers to teach Physical Sciences.

The findings indicate that the lack of quality textbooks is a serious issue. Textbooks that are used lack examination-related questions and examples for learners to practice. The World Bank (2001) suggests that learning and teaching materials such as textbooks form critical ingredients in learning and the intended curriculum cannot be easily implemented without them. The shortage of Physical Sciences resources is reiterated and the textbooks that are provided by the Department of Education are inadequate especially as far as textbooks for CAPS are concerned. The availability of quality textbooks and learner achievement demonstrate a positive relationship (Schiefelbeen and Simmons, 1981:92). If textbooks are not available learners cannot benefit by doing homework or assist learners to work on their own. Textbooks should provide exercises and learners should be able to write notes using the textbooks. The shortage of textbooks has cost implications for schools because educators have to photo-copy materials for the learners.

The analysis further suggests that most schools in the district do not have well-equipped laboratories and this results in a lack of practical activities. Learners need to do practical work on their own to perform well in Physical Sciences. This is not unique as Mji and Makgato, (2006) and Howe, (2003:2) have shown that there is a serious shortage of physical facilities such as laboratories and science equipment in South African public schools; hence poor learner achievement. As a matter of urgency, apparatus and chemicals are needed to do experiments. Bubenzer,

(2008:3) mentions that an increase in laboratory availability could be an answer to improving results in Physical Sciences and as schools are not well-equipped teachers do resort to teaching theory rather than practice. This adversely affects learner results. Laboratory work is important because in Physical Sciences there is a need to do experiments as part of assessment and to help learners understand. Resources such as laboratories help to expose learners to the real world and they can use all their senses. If resources for practical activities are not available, (even the basic science kits) learners' performance will be affected. Physical Sciences is a subject where learners have to discover on his or her own. Therefore, resources to do experiments are essential.

Computers are considered an important resource in Physical Sciences because this offers a new medium of creative expression and communication for teachers and learners. Tools play an important role in human thinking and learning; yet technology is frequently absent in schools, or insufficiently used in Physical Sciences (Bernhard, 2003:313). The internet is not accessible to the schools in this study and if computers were available teachers could become facilitators and co-ordinators of learning rather than having to be the centre of knowledge. However, the findings indicate that most learners lack computers skills and this will have to be addressed. Learners are not able to search for information from the internet because they are not able to use computers. If computer technology was available learners could access not only exemplar question papers but also enable teachers to do simulations; meaning that they can show videos of things that are impossible to do in class.

Generally, the schools in this study are under-resourced contributing to poor learner achievement in Physical Sciences. According to Jerkin's and Whitefields, (1974:223), whatever a teacher achieves with his or her learners would be influenced by the teaching and learning resources available to him or her. Any lack of resources contributes to poor performance of learners. Television and radio programmes that are broadcast during the school holidays play an important role in improving learner performance. However, learners in rural areas (where the study was undertaken) do not have access to these. Schools could possibly acquire these resources to assist learners to improve performance.

5.4.2.2 Teaching methods

Appropriate teaching methods contribute to learning through generating and refining ideas, organising and integrating work, sustaining group spirit, and managing learning (Lieberman, 2004:83). This section reports on interviews and data related to teaching methods in view of their role as tools, instruments or artefacts in the CHAT theory.

Teachers indicated that they use the lecture method given the large numbers of learners in classes. In addition, peer teaching (where a learner takes the role of an educator) is perceived to be useful too. This is substantiated by Teacher 5 who stated that given the large numbers of learners *“I have mostly used the lecture method when introducing the topic and I also use peer learning where some learners take the role of an educator. When discussing the questions, I give learners the chance to help others but because of the large classes mostly we rely on the lecture method.”* When probed Teacher 5 stated: *“With a class of more than 55 learners and the time Physical Sciences is allocated and also the problem with the language...if you employ other methods you won’t be able to finish the syllabus, so the lecture method will help us to push faster.”* Teacher 2 was of the opinion that better teaching methods would be carrying out experiments where learners have hands-on activities. Most of the things being taught will be appreciated by the learners if learners see them physically. However, there is a lack of time for demonstrations and covering the topics: *“If Physical Sciences educators were many in the schools it will help in improving learner performance”* (T2). When probed further, Teacher 2 pointed out that during experiments learners share ideas and as they are physically involved, they learn better.

Teacher 3 stated the following: *“Ideally, experiments, pragmatic approach, practical activities...but there is a limitation to the number of resources, for example, I was saying one pendulum with a class of 80 learners! Although it is effective, it cannot be desirable - first choice should be the available resources.”* When probed, Teacher 3 pointed out that he uses other teaching methods besides experiments because of the shortage of resources and the large numbers of learners. The teachers unanimously pointed out that better teaching methods would entail carrying out experiments where learners participate in hands-on activities. Teaching and learning

will be appreciated by the learners when they are involved in practical activities. However, some teachers identified time and the lack of resources as a hindrance because limited time reduces the number of demonstrations they can do as they then cannot complete the syllabus leading to poor results.

Teacher 1 stated that grouping learners into small groups and giving them some content to work on and later presenting those items show that they perform better than when using the lecture method. *“Since we do not have facilities to do practical activities this method of research and presentation is more effective. Learners are motivated and performance improves”* (T1). Teacher 4 mentioned that there is no single method that can be used to cover all the topics that we have in Physics and Chemistry. Practical activities and projects can be used in order to provide learners with the chance to work on their own and allowing them to express themselves if given enough time. So the method chosen depends on the topic and content that needs to be covered. *“Specifically, I use multiple representations, why because we have a mixed class and this can be appealing to other learners and not good to others”* (T4). Most Physical Sciences educators mentioned that hands-on activities and projects play a major role in allowing learners to have a chance of doing those activities on their own with the help of the teacher. One can conclude that teachers are aware of the need for different teaching strategies and methodologies because the classes have learners of mixed abilities and that one teaching method will not appeal all learners.

The principals who were interviewed had the same opinion concerning the use of a variety of teaching methods such as the discovery method, question-and-answer method and the textbook method. Principal 1 indicated *“I cannot say which method can improve the results, teachers can ask the learners questions, and questions asked must be examination related, meaning that he or she must use past examination papers.”* Principal 1 further suggested that teaching methods motivate learners to work harder in class and they allow learners to share through group activities. The textbook method was found to be effective because in Physical Sciences there are many problems that can be solved by learners at school and at home. The discovery method, whereby the educator can come up with a situation where learners can make use of chemicals and apparatus while being supervised by the teacher, is considered the best. Consequently, it is important to expose learners

to several experiments individually and in groups in order to facilitate effective teaching and learning. This was substantiated by Principal 5 who stated: *“Physical Sciences is a practical subject and textbook method can be one of those methods that can be used whereby the teacher can frequently ask the learners questions.”*

Principal 3 also emphasised the need to use the question-and-answer method by stating: *“Physical Sciences is a practical subject, therefore learners need to be provided with many questions to answer and teachers need to show the learners how to answer those questions.”* Principal 4 supported this opinion by stating that *“...it has to be a combination of teaching methods, sometimes a teacher has to do lecturing where he or she just tell learners a concept but also need to apply methods which are learner-centred. You need to do activity-based-approach in Physical Sciences regularly; you need to integrate this thing of experiments.”* When probed, Principal 4 indicated that teaching methods help to improve performance in quite a number of ways; for example, if a teacher knows how to use the learner-centred approach, learners can attempt research issues on their own and teachers can provide assistance especially when learners answer past examination question papers. Principal 2 pointed out that a teaching method such as working in groups assist in improving learner achievement. Learners are able to share ideas and help one another with difficult topics. *“Linking theory and practical work in the classroom assists learners to answer questions correctly. In order to improve the results small groups are necessary because they can be managed easily and teachers are able to control learners’ work and provide feedback on time. However, this may not be possible given the large numbers of learners. Therefore, principals need to encourage teachers to use a variety of methods during teaching and learning of Physical Sciences”* (P2).

Curriculum Advisor 1 has the same sentiments as the principals stating that teaching methods contribute more to teaching and learning because *“teaching Physical Sciences is not just going to class and talk...educators need to include a variety of teaching methods. One cannot rely on one method; for example, textbook method or story-telling method; you need to include all the methods. Learners need to do research on their own.”* Curriculum Advisor 2 stated that teaching methods have an effect on the results and consequently teachers have to use various methods to teach Physical Sciences. If they resort to one method, only a few or possibly none of

the learners would learn from that method. *“Some learners learn through seeing, some learners learn through doing and some learners learn through hearing being part of the lesson. If teachers resort to one method other learners may be excluded”* (CA2).

The findings reiterated the fact that teachers mostly use the lecture method due to the shortage of resources and large numbers of learners in classes. The lecture method allows teachers to finish the syllabus faster, but as this method is mainly teacher-centred it does not allow learners to participate in class. Therefore, it is of critical importance that educators expose learners to various teaching methods to master scientific concepts, facts, principles and laws especially through practical activities. In addition, educators need time and resources to carry out the prescribed experiments to improve the results. Learning Physical Sciences is best when it is hands-on, practical and experiential. Moreover, teachers should be willing and capable of using laboratories to improve the results. Linking theory and practical work in the classroom assist learners to answer questions correctly and if learners do something practically, they will not forget easily. The discovery method would be ideal if a teacher can come up with a situation that allows learners to investigate themselves making use of the appropriate apparatus and chemicals. Learners need to be exposed to several experiments and must perform the experiments with the teacher and should result in the facilitation of learning. Hands-on activities and projects play a major role to give learners an opportunity to do activities on their own and to improve their results. Practical activities provide learners with a chance to express themselves if they are given enough time. Teaching and learning will be appreciated more by learners if they are involved in practical activities. Consequently, there is a need for an activity-based approach with the regular integration of experiments.

The findings indicate that learners should be given an opportunity to participate in their learning by peer teaching and group work. By dividing learners into small groups and giving them specific tasks to do in class and at home, they can assist each other and share ideas. Learners come together for discussions and then do presentations in class. Small groups are necessary because they can be managed easily and teachers are able to control learners' work and provide feedback on time. However, this may not be possible given the large numbers of learners in the

schools in this study, but group activities motivate learners to work harder and can improve the results.

The analysis further suggests that there is a need to allow learners to develop a deep conceptual understanding of Physical Sciences subject matter through the use of textbooks. The textbook method can provide learners with many activities that they can do such as solving problems at school and at home. However, as mentioned in the previous section, most public schools in rural areas (in which the study was undertaken) experience an acute shortage of textbooks, or have textbooks of a poor quality.

The findings suggest that learners need to be given an opportunity to carry out research on given topics. This research can be used to augment practical activities if schools experience resource shortages.

Although the use of the question-and-answer method gives learners the opportunity to illustrate mastery of content, there is a need for teachers to ask examination-related questions to improve performance. Teachers need to provide assistance to learners by providing the necessary support, especially when answering past examination questions.

Lieberman (2004:89) suggests that learning by teaching is a teaching method. Therefore, there is a need to create opportunity for learners with skills and knowledge to teach their peers. Learners who teach others should study and understand the topics well enough to teach it to their peers. Through participation in peer teaching, learners should become confident and their results should improve.

Though teachers face problems to use teaching methods that allow learners to develop enquiry skills, Palmer (2007:42) suggests that teaching methods should be inventive, encouraging, and beneficial and provide tools that can be applied to the learners' real-life situations. A variety of teaching methods should help to capture the learners' interest during teaching and learning and in so doing possibly improve Physical Sciences' performance. If teachers resort to one method, he or she excludes other learners since they each may have different learning styles. However, the method must depend on the topic and content that needs to be taught and hence the need for multiple teaching methodologies.

5.4.2.3 Supervision of teachers

When teachers know that control and support efforts all converge on the improvement of their professional development, they are more pliable and readily accept assistance (UNESCO, 2007:7). Consequently, this section reports data on control and support as supervision of teachers.

Most principals indicated that there is a need for frequent monitoring and checking of exercise books and syllabus completion to improve the results. However, most principals pointed out that as there are large numbers of learners in a class, the teachers usually do not have enough time to mark exercise books to provide learners with feedback before the next lesson commences. This is substantiated by Principal 3 who stated *“Through frequent monitoring and checking, sometimes you may find out that there are many learners in a class therefore teachers do not have time to check the books in a period of one hour and give learners feedback on time.”*

Principal 5 pointed out that lack of supervision can affect learners' performance negatively; *“...if principals apply the Management by Wondering around principle, those principals can detect teachers who may not be attending lessons. Supervision ensures that learners attend their classes on time and do their work. Educators need to give learners enough work, monitor and control written work. Enough written work can make learners perform well in Physical Sciences.”* If learners are given too little written work to do, and if teachers fail to finish the pace setter on time, it will affect the results. This was pointed out by Principal 4 who mentioned that if you do not supervise teachers' work you find out that in some cases teachers do not give learners work and teachers do not attend classes and teach their lessons. There is no way you can expect learners to pass if teachers are not doing their work or are not teaching. Supervision sees to it that teachers do their work and that they cover work schedules or pace setters as prescribed by the CAPS document.

The principals, HoDs or SMTs should monitor teachers so that they teach at the correct pace to cover the content. Effective supervision by principals, HoDs or SMTs ensures that both teachers and learners are punctual. This is substantiated by Principal 2 who further indicated the following: *“Supervision of teachers and learners should never be left alone; they must be supervised with the head or HoDs. Same applies here, we supervise their work meaning that teachers go to class and teach*

and learners learn something. We make it a point that when the teacher wants to meet the learners, learners must be in the classroom on time.”

Most teachers comment on the role of curriculum advisors on supervision. Teacher 3 stated that curriculum advisors visit schools to check the teachers' progress against the pace setter and the standard set by the Department of Education. They also provide extra materials for educators if there is a problem in teaching some topics. This is substantiated by Teacher 5 who indicated that *“the Curriculum Advisor comes in with a very, very important component, thus communicating the guidelines and any changes in the curriculum. They also monitor if we are moving with the correct pace and whether we are teaching and covering content and the best way to go. At times we get quality previous question papers. In terms of experiments and difficult topics we discuss with the curriculum advisor once a month.”* Most teachers indicated that curriculum advisors communicate the Physical Sciences guidelines and changes in the curriculum and that they monitor whether teachers are teaching and covering the content. The curriculum advisors also provide advice on the best teaching methods to use that could lead to an improvement of examination results. Together, curriculum advisors and teachers discuss experiments and difficult topics on a monthly basis. The value of this was reiterated by Teacher 4: *“They do a lot because they come and ask us our problems and we share experiences. They also bring some learning materials and booklets with past examination papers for learners to practice. They also organise some workshops where teachers meet and share problems.”* Teacher 2 indicated that whenever they have meetings the curriculum advisor ensures that the teachers have the required documents to teach Physical Sciences and that teachers can call them for advice whenever they experience any difficulties. Consequently, curriculum advisors are supportive and can be reached whenever the teachers need them.

The findings suggest that effective supervision ensures that teachers and learners are punctual, which will ensure maximum use of available teaching time. In addition, educators need to give learners enough work, monitor and control written work to improve performance. Kaptelinin, (2005:4-8) suggests that supervision encourages teachers to be committed to their work and that this will ultimately contribute to learner achievement as it has an actual and potential object and purpose. The findings also highlight the need for principals and HoDs to frequently monitor

whether teachers mark learners' exercise books and that teaching proceeds at the required pace to ensure completion of the syllabus. However, because of the large numbers of learners in the schools in this study, teachers found it difficult to monitor the quality of learners' work effectively. Therefore, it is important for principals, HoDs or SMTs to control and support teachers so that learners are given enough written work and ensure that they cover the pace set as prescribed by the CAPS document. In order to identify teachers and learners who may not be attending lessons, the "management by wandering around" principle could be used by principals or HoDs.

5.4.3 Rules

In order for the system to have a positive teaching and learning environment, there is a need to establish behavioural rules that provide direction in the activity system. Norms and regulations within Physical Sciences imposed by the Department of Education are seen as rules. The rules govern the teaching of the Physical Sciences curriculum, the assessment of learners, the teacher-learner ratio and discipline of learners. The Department of Education prescribes the number of tests, homework and class-work a teacher can give per week and the topics to be taught in each grade. As alluded to in Chapter 2, rules refer to formal or informal regulations that can, in varying degrees, constrain or liberate the activity and provide the learner with guidance on correct procedures and acceptable interactions with other community members. In Chapter 2, the researcher identified the rules according to which the findings are discussed.

5.4.3.1 Physical Sciences curriculum

In an attempt to identify possible problem areas in the curriculum, learners in the focus groups were asked which topics they find difficult and why. The learners indicated that Mechanics, Forces, Newton's laws, electric circuits, vectors, chemical change, organic compounds and electromagnetism are considered difficult topics. In mechanics, learners pointed out that they cannot identify the forces and do not know how to go about drawing force diagrams. Learner 6 in Group 4 stated: "*Mechanics is too long and it involves many problems, some of them we do not understand and it is the longest content in Physical Sciences.*" On the topic "electricity", learners mentioned that they cannot solve electric circuit questions. Focus group members,

Learner 2 in Group 1, Learner 6 in group 3, Learner 2 in Group 4 and Learner 4 in Group 5 unanimously indicated that they found the work on the Doppler Effect the easiest because there they only have to substitute formulas. Momentum and the photo-electric effect are the topics that the learners seemed to enjoy the most. Some focus group learners, Learner 4 in Group 3, Learner 2 in Group 4 and Learner 4 in Group 5 indicated that electrostatics and vertical projectile motion are easy topics as well. This is substantiated by Learner 3 in Group 1 who stated: *“The content that is very easy is Vertical Projectile motion and Momentum. These topics are easy and enjoyable and when I write tests I manage to pass them.”* Learner 5 in Group 3 indicated that Newton’s Laws is easy but Learner 6 in Group 3 said it is difficult.

Learner 2 in Group 1 mentioned: *“...organic chemistry is a bit tricky, like equilibrium constant, yes calculating it is difficult.”* This was also indicated by Learner 1 in Group 1 stating *“For me the content which is difficult is organic chemistry and then the one which is very easy is the one I manage to beat my target, that content is Doppler Effect which is enjoyable and easier. When doing it is like fun and that is why I do well. Organic chemistry needs a lot of concentration. In class I manage to concentrate for a short time.”* Learner 3 in Group 2 stated *“In Physical Sciences I have problems in chemistry with chemical reactions.”* Learner 5 in Group 4 stated: *“The topic on vectors, in grade 11 is hard and chemical change, yes quantitative.”*

As far as what could be done to address the situation, Learner 4 in Group 1 and Learner 1 in Group 5 pointed out teachers should give them more practice and revise difficult topics time and again. Learner 1 in Group 1, Learner 2 in Group 3, Learner 4 in Group 5, Learner 2 in Group 5, Learner 4 in Group 2 and Learner 4 in Group 1 unanimously mentioned that they need to work hard and ask for help from the teachers. Further suggestions were indicated by Learner 2 in Group 4 and Learner 1 in Group 4 by citing the need to do calculations in groups and reading the theory at home since they pose a challenge to them. Learner 6 in Group 5, Learner 1 in Group 2 and Learner 3 in Group 3 indicated the importance of paying attention in class during teaching and learning. Learner 2 in Group 3 stated: *“We can study hard and stop playing a lot and also consult our teachers when we need help.”* In addition Learner 6 in Group 1 stated: *“...I will deal with previous question papers and give the subject more time and do some topics which I struggle with.”*

It was found out that Mechanics, Forces, Newton's laws, electric circuits, and vectors, chemical change including equilibrium constant (K_c), organic compounds and electromagnetism are considered difficult topics. In Mechanics, learners indicated that they have a problem with the topics of work, energy and identifying forces and drawing force diagrams. The easiest topics are Doppler Effect, electrostatics, momentum, photoelectric effect and vertical projectile motion. According to the Department of Basic Education, (2011:8), there are six main knowledge areas which inform the subject Physical Sciences, namely; Matter and Materials, Chemical systems, Chemical change, Mechanics and Waves, Sound and Light and Electricity and Magnetism. Problem-solving exercises should be done at all cognitive levels in all knowledge areas and on all scientific concepts. Physical Sciences promotes knowledge and skills in scientific inquiry and problem solving.

The findings indicated that learners cannot identify the forces and do not know how to go about drawing force diagrams and this affects their results. As pointed out earlier, Mechanics is too long and it involves many problems and formulas that some of the learners do not understand. Learners cannot solve problems related to electric circuits. Furthermore, the findings suggest the need for learners to concentrate in class and to work harder and to revise the difficult topics frequently. Learners need to do the calculations in groups and pay attention in class during teaching and learning. It is important for learners to make use of previous question papers and devote more time to the subject to do the difficult topics and improve performance. Teachers need to give learners more practice and revise difficult topics more often. More importantly, learners need to read the theory at home and practice calculations in order to improve their performance.

5.4.3.2 Teacher-learner ratio

According to a report of Department of Education, (2009:17), teaching large classes of 50 or more learners in public schools is one of the many long-standing concerns facing the education system in South African schools and negatively affects teaching and learning. This section reports on the data collected from teachers, principals and curriculum advisors concerning the teacher-learner ratio.

Teachers were unanimous about their opinions of the teacher-learner ratio, stating that there are large numbers of learners in their classes. The numbers varied from

50 to 80 learners and teachers maintained that this was detrimental to teaching and learning. When comparing large classes to small classes, teachers pointed out that it will be difficult to use some of the teaching methods such as the discovery method and in addition there will not be time for individual attention. Teacher 1 indicated: *“Teacher-pupil interaction is greatly reduced and then some learners who are not very well- disciplined will tend to disrupt the smooth flow of the lesson.”* When probed, Teacher 1 pointed out that if classes were smaller he would change his choice of teaching method. Teacher 2 mentioned *“If there are more than 20 learners in a class the problem is that their grasping levels are not the same, others grasp, others appear interested, others are interested and I try to fight with the pace setter, but the biggest problem is time. I am alone in the school and I need to complete the pace setter, it can affect some of the slow learning students.”* Teacher 2 further pointed out that if classes were smaller he will be able to assist learners individually and be able to complete the syllabus.” Teacher 3 stated: *“...if more than 20 learners are in a class, well it comes back to resources. If I had a smaller class it was going to be better. Now with 80 learners it is too big...let alone with one compass and you want to demonstrate the direction of magnetic degradation, it is going to be difficult with a big class than a smaller group.”* In addition, Teacher 3 pointed out that he is more flexible with a smaller group and that there are more teaching and learning methods from which to choose.

Teacher 5 stated *“...if classes are big you will only be limited to one method – the lecture method; you will not be able to use some of the methods. How can you use discovery method in a class of more than 60 learners? You will only use one method...lecture method.”* Teachers unanimously mentioned that if classes on average have 30 or fewer learners there will be enough time to give individual attention to learners. This will create an opportunity to identify problems and assist learners who struggle to master the work. The teaching methods can be diversified. In addition, more work can be given to gifted learners to attempt higher order questions.

Some of the teachers indicated that they would prefer group activities rather than using the lecture method. There are a great variety of teaching methods to use when engaging with a smaller group of learners. In classes with large numbers teacher-learner interaction is greatly reduced, which could result in discipline problems.

Teacher 4 pointed out that *“if there are more than 20 learners, it is a bit difficult to meet them individually, like you give them an assignment, some may have problems in just taking it back to you, so the problem is you cannot individualise if they are more than that number.”*

As far as the teacher-learner ratio is concerned, the principals who were interviewed unanimously acknowledged that the teacher-learner ratio would affect learner academic performance in Physical Sciences since it is a practical subject. Physical Sciences needs ample space for practical activities. Consequently, if classes are overcrowded it will be hard to perform experiments. According to Principal 3, *“the teacher-learner ratio is a serious challenge especially in our rural schools because you may find that educators face more than 50 learners in the Grades 10, 11 and 12. However, the teacher is not able to attend to learners one by-one and this can affect performance of learners as we know Physical Sciences is a practical subject, so sometimes an educator does not even have a chance to do practical activities with them.”* Principal 2 also mentioned: *“Since Physical Sciences is a challenging subject we always want a small group so that the teacher can manage them. If he or she gives a task, he or she may not be able to control the tasks.”* Principal 4 pointed out that if you have a large class, it will be very difficult to give individual attention and Principal 5 elaborated: *“...Physical Sciences is a very practical subject and then it needs ample space so that the learners can be able to manipulate objects.”* Principal 1 supported the preceding by stating *“...for those learners who do not achieve well, teachers do not have time for them because they are always many in the class.”*

In terms of the teacher-learner ratio Curriculum Advisor 2 indicated that in small schools, Physical Sciences educators do not only teach Physical Sciences but may have to teach 4 to 5 different subjects as well. In schools where the teacher-learner ratio is big, the schools may not have enough classes. The teachers may struggle to cope with the big classes and this affects their efforts to do practical work. Furthermore, the shortages of resources make it very difficult for the teacher to do his or her best. Educators do not have enough time for evaluation and controlling written work. This was substantiated by Curriculum Advisor 1.

The findings suggest that if the classes are smaller, learners are less likely to misbehave, noise levels are reduced and group activities can be enhanced. This is

supported by the Organisation of Early Childhood Development (OECD, 2009:372), which states that smaller classes are often perceived as allowing teachers more opportunity to focus on the needs of individual learners and reducing the amount of class time they spend dealing with disruptions. Class size may be viewed as an indicator of the quality of the school system. The findings suggest that a smaller number of learners per class could result in improved performance in Physical Sciences. This is supported by the literature.

Gopal and Stears, (2007:16) indicates that large classes are characterised by insufficient learner interaction and rapport, lack of individual attention from the teacher and inability to ensure adequate provision of learning experiences such as handling apparatus, observation and recording results by each learner during experiments. The findings suggest that the large numbers of learners in Physical Sciences classes are common and seem to be universal in public secondary schools in the Bochum Circuit. This scenario adversely affects teachers in performing individual practical activities, preparation of apparatus, marking of learners' work and providing feedback on time and this will lead to poor results. In such classes teachers resort to the lecture method that may not be appropriate for some learners. In addition, large numbers of learners affect the implementation of practical activities and discipline may be adversely affected. The findings suggest that there are more teaching methods from which to choose when engaging a smaller group. Mwamwenda, (2004:222-229) claims that if classes are large and crowded, it is difficult for the teachers to maintain control.

Dunphy and Dunphy (2003) also indicate that in order for the teacher to provide assistance to the learners, the teacher-learner ratio must be small. The ratio will depend upon the number of factors including the complexity of the tasks that the learners must master. The amount of work that will be given to learners will increase and faster learners can progress better in smaller classes. The findings suggest that if classes on average have 30 or fewer learners, it could create the opportunity to give individual attention to learners and so improve the results.

5.4.3.3 Assessment of learners

The Department of Basic Education, (2011:143) defines assessment as a continuous planned process of identifying, gathering and interpreting information about the

performance of learners using various forms of assessment. In an attempt to find the effect of assessment on learner achievement questions were posed to Physical Sciences teachers, curriculum advisors, principals and Physical Sciences learners in focus groups.

Teacher 4 pointed out that assessment is very important because it helps in improving instructions during teaching and learning. The performance of learners will improve if they are given the right type of assessment continuously or more often. Teacher 1 pointed out that *"...assessment helps teachers to determine if the method of teaching was effective or not and evaluating both the teacher and the learners."* Teachers unanimously mentioned that the teaching approach should be evaluated frequently considering desirable results. However, assessment cannot be avoided because it informs the stakeholders if the results are improving or not. Teacher 3 stated *"...assessment cannot be avoided because it informs learning methods and teaching methods. No doubt assessment cannot be avoided because it informs topics which are difficult."*

Teacher 2 stated *"...assessment should be part of learning because it assists the teacher, first of all to know where he or she is, what he or she has done, what needs to be done, how much has been learnt and how much has been achieved. Assessment is a way of measuring what is happening in the class and it helps not only the teacher or the learner, but the Department of Education to determine whether the targeted objectives have been achieved or not achieved."* Teacher 5 indicated *"If the teacher is teaching a topic such as vertical projectile motion, one wants to know if learners are able to substitute and apply the correct equations or formulae and whether they are grasping the content according to the objectives or guidelines. Therefore, assessment is vital."* Teachers unanimously mentioned that homework; class-work, tests, assignments, investigations, projects and peer assessment can be used during assessment to improve performance of learners. Homework is given to learners to keep them engaged and to revise work at home. Weekly and monthly tests can be given to learners, thus providing them with more practice. Teacher 3 stated: *"Informally we give class-work, homework, tests, and experiments. Formally we have controlled tests and experiments set by the district."* Teacher 1 mentioned *"...end-of-topic tests act as a diagnostic measure and can be*

used to determine retention capacity of learners after a period of time. Basically, assessment can be done daily, weekly, fortnightly or monthly.”

Most of the Principals shared the same sentiments as the teachers concerning assessment. Principal 3 stated: *“If you do not show them their mistakes in time and if you do not give them feedback, obviously it is going to affect their performance. Physical Sciences needs thorough investigations and experiments. You must frequently check learners’ books so that you can be able to identify slow learners, lower achievers and higher achievers.”* Principal 4 further pointed out *“Assessment is one key that helps in improving academic achievement. If you assess your learners well you get them used to questions that will come during the year and with regular assessment you can identify areas which learners are not doing well and regular assessment helps in improving performance in Physical Sciences.”* This was supported by Principal 5 who pointed out that assessment at school plays a very prominent role in the sense that learners who are assessed regularly perform well. Learners understand how questions are asked and from the feedback are able to correct errors. *“If assessment is done and feedback is done then learners will be able to understand the subject.”* Principal 2 mentioned: *“Assessment is important especially if the headmaster has a focus, we make use of previous question papers to assess the learners throughout the year. By so doing the learners know how to answer questions.”* Principal 1 indicated: *“If the learners are assessed now and then so that they write common tests. The pre-tests prepare them for the common task and the learners can improve their academic achievement and then even the results of the informal tests can improve.”*

The curriculum advisors who were interviewed unanimously mentioned that educators should give quality questions during class-work and homework activities because they lead to high achievement in Physical Sciences. Curriculum Advisor 2 pointed out that if learners are engaged in practical work they will understand and improve rather than being merely involved theoretically. In addition, Curriculum Advisor 1 mentioned that writing more informal tasks such as class-work and weekly or monthly tests is essential to improve learner performance. Tests need to be standardised to enhance quality and teachers should provide learners with the necessary skills to answer question papers. Consequently, learners will be motivated because they are assessed and given timely feedback.

During focus group interviews Learner 4 in Group 4 and Learner 5 in Group 3 pointed out that assessment is done to identify their problems in Physical Sciences and finding ways of helping them to improve. Tests help them to remember what they have learnt and help teachers to find out if they are able to answer questions related to the content taught. Learner 6 in Group 3 and Learner 1 in Group 4 both stated that assessment is used to test knowledge and to find out whether they understand. Learner 4 in Group 3 pointed out that assessment is used to make them practice how to answer questions and enables them to gain confidence. Furthermore, Learner 5 in Group 3 indicated: “*Assessment is used to identify problems to help us improve.*” Learner 2 in Group 3 and Learner 4 in Group 4 were of the view that assessment helps them to remember what they have learnt and identify problem areas and get assistance from teachers.

Learner 5 in Group 1 indicated: “*Teachers test us to see if we understand and help us to do well.*” This was also the opinion of learner 4 in Group 5 and Learner 2 in Group 5 pointing out that teachers give tests and ask questions in order to help improve their work, evaluate the standard and identify challenging content. Learner 3 in Group 4 stated: “*Tests are given to make us revise the topics we have covered.*” More importantly learner 4 in Group 2 stated “*...if we do not write tests we will not know our mistakes, so we must write them.*” Learner 3 in Group 2 and Learner 5 in Group 2 agreed that tests help improve results and identify the topics they did not understand.

Learner 6 in Group 2, Learner 4 in group 1 and Learner 1 in Group 1 were of the view that tests help them identify mistakes and motivate them to work harder and gain experience. Learner 3 in Group 1 indicated: “*The reason why our teachers give us tests is to see whether we understand or not. If we do understand there will be possibility for that question to come in the test and I will be able to answer the content.*” Learner 2 in Group 1 also stated: “*Our teacher gives us tests to see if we understand and improving performance.*” In addition Learner 6 in Group 1 mentioned: “*Our teachers ask questions to get information. They give us tests to get our standard in the subject and they want to know if we understand.*” Learner 1 in Group 2 and Learner 6 in Group 4 pointed out that teachers need to see whether we have understood the topic or not. Learner 3 in Group 5 stated “*...to see and test our mind if we understand or not.*”

Learners provided possible solutions on how assessment can be done to improve their performance. Learner 4 in Group 3 indicated “...*writing more tests and doing a lot of revision can make us pass.*” Learner 3 in Group 4 and Learner 4 in Group 5 also pointed out the need to write more tests, do more class-work and homework to improve their performance. Learner 2 in Group 5 stated: “*When the teacher gives us class-work and homework, I must do it on time.*”

The findings suggest that in Physical Sciences informal assessment provides teachers with an opportunity to understand the learning processes to improve learner achievement. Lubisi, (1999:17) also suggests that assessment entails making sense of a learner’s knowledge and skills and it was found that informal or formative assessment remains the most critical process because it allows teachers to observe learning before learners are exposed to summative assessment. Informal assessment allows teachers to gather information about learners and to use the information to improve learners’ performance. Informal formative assessment is a foundation for summative assessments, therefore, is seen to be critical. The findings indicate that informal formative assessment develops learners and increases learning opportunities in Physical Sciences. The Department of Basic Education, (2011:143) indicates that assessment should be both informal (assessment for learning i.e. formative assessment) and formal (assessment of learning i.e. summative assessment). Informal assessment is a daily monitoring of learners’ progress and therefore more class-work, homework, tests and experiments should be given to improve learner achievement.

Dunphy and Dunphy, (2003:48-58) indicate that assessment can motivate learners through the feedback from the educator helping learners to develop self-esteem and confidence in their development. More importantly, teachers should continuously assess learners as it addresses what was done well and how it can be improved. During assessment, teachers need to analyse evidence of learning in learners’ work as a basis for reflecting and improving teaching. Assessment encourages assessing individual strengths and weaknesses. Ideally, assessment is used to identify problems to help learners improve and instil confidence in them. The findings suggest that assessment allows learners to practice how to answer questions and help them to remember what they have learnt.

The findings further suggest that assessment is the main component because it helps to improve comprehension of instructions during teaching and learning. However, it was found to be missing in the schools under study leading to poor results. Performance of learners will improve if they are given the right type of assessment continuously or more often. Moreover, assessment cannot be avoided because it informs the teacher about teaching methods. Assessment is a way of measuring what is happening in the class and it helps not only the teacher or the learner, but the Department of Education to determine whether the targeted objectives have been achieved or not. Therefore, assessment informs the stakeholders of the nature of the results. Assessment is viewed as a vehicle for driving Physical Sciences teaching and learning since successful implementation of the curriculum mostly depends on it (Beets and Le Grange, 2005:190).

It is important to show learners their mistakes and provide feedback on time in order to improve learner performance. However, in the schools in this study, this is not so due to large numbers of learners and this could be a cause of poor results. Regular assessment in Physical Sciences plays a prominent role in enabling learners to understand questions. Consequently there is a need for frequent checking of learners' books in order to identify slow learners and high achievers. The importance of assessment is reiterated and learners need to be provided with the opportunity to revise previous question papers throughout the year to improve performance. Educators need to give quality questions during class-work and homework activities because they lead to high achievement in Physical Sciences. Homework is given to learners to keep them engaged and to revise work at home.

Research by Harlen, (2000:3) has provided a clear indication that using assessment properly does indeed improve learning and raises standards of learners' achievement. Ideally, tests encourage learners to revise the difficult topics that have been taught to improve performance. Furthermore, end-of-topic tests act as a diagnostic measure and can be used to determine retention capacity of learners after a given period. It is important for learners to write pre-tests and post-tests in preparation for formal or common controlled tests to improve achievement. Learners should do more informal tasks such as class-work, and weekly or monthly tests to improve their performance.

5.4.3.4 Discipline of learners

In order to maintain discipline teachers need to control the learners' behaviour in the classroom and the school environment (Olivia, 1994:208). This section reports on the interviews and data related to discipline.

Principal 5 perceived Physical Sciences as a challenging subject. Therefore, learners should be disciplined and prepared to work harder. In addition, Principal 5 stated: "*Discipline goes hand-in-hand with the general performance of the schools in the sense that at times learners behave well in the school premises if the teachers are also displaying that good behaviour and then for the learners to behave well they must be shown the importance of education.*" It is important for teachers to be good role models for the learners so that learners can copy the good things their teachers do and improve discipline (P5).

Principal 4 mentioned: "*Discipline has an impact on learner achievement because where there is no discipline it means the environment is not conducive. Learners need to be disciplined during teaching and learning of Physical Sciences by doing the work they are given.*" Learners need to be given adequate stimulating and interesting work to do at school and at home that keeps them interested and busy all the time. This is substantiated by Principal 1 who stated "*...more work needs to be given to learners in order to keep them busy to avoid loitering and gossiping.*" In addition Principal 1 stated: "*In most cases the learners who are doing Physical Sciences are the most disciplined. They are always busy. Physical Sciences needs a lot of practical activities so they are always busy.*"

Principal 3 indicated that there is no proper way to discipline learners. However, educators can detain learners but it is their responsibility to see to it that learners reach home safely. It is the responsibility of the educator to maintain discipline in the class to improve the results. Principal 4 pointed out that a code of conduct that is enforced is necessary and learners should know what corrective measures will be taken if they misbehave. "*When coming to teachers, they must follow South African Council of Educators (SACE) code of conduct.*"

During the focus group interviews Learner 5 in Group 1 stated: "*It will depend whether I am a disciplined learner or not. If I am a disciplined person I will be able to*

perform well in Physical Sciences because I will be able to do all my assignments. If I am not disciplined I will not give that subject more time and will lead to poor performance.” Furthermore, Learner 6 in Group 1 pointed out that a disciplined learner has time to listen to teachers, read books and do revision without coercion. Learner 1 in Group 5 and Learner 4 in Group 3 stated that they need to work hard, respect teachers and not to play in the classroom during lessons. Learner 1 in Group 2 also mentioned: *“I need to have discipline to read my books and writing my work, I think I can do well.”* Learner 3 in Group 5 has the same opinion by stating that Physical Sciences needs learners who are committed and ready to work harder to improve performance. Also Learner 2 in Group 3 emphasised the need to concentrate on what teachers say in class.

Some learners associated discipline with behaviour. For example, Learner 4 in Group 4 stated *“...even studying like writing class-work and homework, I will not do it if my behaviour is bad.”* Learner 6 in Group 3 and Learner 5 in Group 4 pointed out the need to listen to the teachers when learning and pay attention in class. This was supported by learner 1 in Group 3 who stated: *“I must have good behaviour, doing my work and not make noise in class.”* Learners indicated that it is necessary to behave in class to improve performance (Learner 1 in Group 1; Learner 5 in Group 2; Learner 6 in Group 4; Learner 6 in Group 5; Learner 4 in Group 2 and Learner 6 in group 1). Also, Learner 2 in Group 2 and Learner 3 in Group 1 pointed out that learners who behave well are able to listen, read on their own and do the work assigned and must be able to manage time. Furthermore, Learner 4 in Group 5 pointed out that she needs to display a positive behaviour, love the subject and be eager to learn to improve performance.

According to the findings, the environment will not be conducive to learning if there is lack of discipline. Learners need to be ready to do their work and be able to manage their time to improve their performance. Physical Sciences is perceived as a challenging subject. Therefore, learners should be disciplined and be prepared to work hard. The findings suggest that stimulating work needs to be given to learners in order to keep them busy to avoid poor behaviour.

The findings further suggest that there is a need for a code of conduct in schools that guides learners in terms of discipline. It is important for learners to understand the

rules and what corrective measure will be taken if they misbehave or break them. Joubert and Prinsloo, (2009:106) indicate that discipline is essential for effective teaching and learning. It is vital to have basic standards of discipline that form the basis for further rules of acceptable behaviour and standards in Physical Sciences. More importantly, teachers need to be role models to the learners so that they follow the examples their teachers set. In order to improve achievement in Physical Sciences, learners need to be disciplined, display good behaviour and be kept busy.

According to Rogers, (1998:11), teachers need to lead, guide, direct, manage or confront learners about behaviour that disrupts the right of others during teaching and learning of Physical Sciences. Physical Sciences needs learners who are committed, ready to work harder and who respect their teachers.

5.4.4 Community

According to Engeström (1999:245), the community is a social group with which the learner identifies while participating in the activity system. The community aims to represent the social elements in an activity system. Consequently, in this study the community members in the activity system are the principals, Physical Sciences teachers, Physical Sciences learners, parents and curriculum advisors. The perceptions of teachers, principals, parents, learners and curriculum advisors are described in the following paragraphs. Data gained to describe the different factors was through the questions asked during the interviews.

5.4.4.1 Parental involvement

The influence of the parent determines the conduct of teachers, instructional materials and school environment (Department of Basic Education, 2012:7). In an attempt to find out the extent of the involvement of parents, their perceived responsibilities, roles and their support in the teaching and learning of Physical Sciences, teachers, principals, parents and curriculum advisors were interviewed.

Parents should participate in school activities and discuss their children's problems with teachers. Parents should help teachers by checking their children's work and encourage them to always do their work. Teacher 3 indicated that parents visit the schools at the end of the term to discuss their children's problems. Parents are invited to collect learners' reports and this provides an opportunity to meet the

educators: *"We have a school hotline which they can use to communicate with the principal at any time. There is an open door policy"* (T3). In addition, Teacher 2 pointed out that he expects parents to monitor their children's work; therefore parents need to participate in daily school activities. However, parents normally come at the end of the term to discuss their children's problems. Teacher 4 pointed out that, parents can help teachers by checking learners' work and constantly remind their children to always do their work: *"I mean parents are the ones allowing the learners to come to school. They can help us a lot or in a big way by checking their children's work"* (T4).

Teacher 5 stated: *"We have a very big challenge; we call parents individually to come and hear about their children's performance but they do not come. I only see the parents when we call for a parent meeting once per term."* Teacher 5 elaborated: *"We also have a programme where we call parents for a meeting once a year before trial examinations where teachers and parents discuss learners' performance. Learners are also given the opportunity to explain their problems and reviewing their targets set at the beginning of the year."* Teacher 4 reiterated the same sentiments by pointing out that parents are not as active as he would like them to be.

Principals also shared the same sentiments as the teachers concerning parents' responsibilities, roles and support. Principal 3 indicated that parents need to encourage their children to love the subject, commit themselves to their studies, to have a positive attitude and to always do their work. Principal 4 stated that there are many ways in which parents can be helpful; for example, during trips or career exhibitions, parents need to support their children financially. In addition, Principal 4 indicated *"...if you are an educator and you want to work with learners during the weekend you need the support of parents. Parents play a role in releasing their children to come to school. We need the support of parents and their involvement is vital in improving learner performance."* Principal 1 stated: *"Parents are shown how their children are achieving at school and parents must see to it that their children do their work and must sign after seeing the work."* Principal 2 indicated that parents must support their children by providing those materials which the school cannot provide such as study guides. Parents should support their children by organising Physical Sciences tutors to assist their children at home to improve performance. Principal 5 stated: *"These days there are so many sources which can enable*

learners to perform extremely well in Physical Sciences. Parents at home can assist their children to watch educational television programmes to assist them to improve performance in Physical Sciences. Parents can even allow their children to have extra lessons...their teacher will be playing a prominent role in the school."

When parents were asked to explain what they consider their role to be in improving their children's performance, various responses were received. Parent 4 indicated that there is a need to supplement the school's effort by organising teachers from other schools to assist his child and others after school hours, on Saturdays and during holidays. *"I also find out the problems my child is facing by asking the teacher and checking books. I encourage my child to work hard at school. However, schools need to provide materials so that learners end up doing well in Physical Sciences."* All parents indicated that they provide their children with study guides and allow them to attend extra lessons in an attempt to improve performance in Physical Sciences. Parent 4 mentioned that he visits the school on a monthly basis because he does not want to interfere with daily activities of the school. He only visits the school during meetings and when collecting school reports once a term. Parent 1 stated: *"Sometimes I ask the teacher how my child is performing in Physical Sciences; I provide my child with more time to do her work at home and encourage her to ask some relatives who know Physical Sciences to help her."* Parents need to allow their children to attend lessons offered during holidays and also check the books to see what their children are doing at school. Parent 5 pointed out that he consults teachers once or twice per term and also encourages his child to attend career exhibitions. *"As parents we have an obligation to fulfil for our children. I think as parents one has to pay a certain fee for the school, specifically for Physical Sciences materials to improve performance."* It is important for parents to provide learners with enough time at home to do homework. More importantly, parents need to check exercise books to see if their children are working at school and at home and allow them to attend lessons on Saturdays and during holidays.

Parent 3 mentioned that he does not have Physical Sciences knowledge and consequently has a problem to assist his child with homework. *"Usually every month I call the Physical Sciences teacher at school to find out how my child is performing"* (P3). Parent 2 reiterated by stating *"At our school we have a new laboratory, so I only provided her with a Physical Sciences study guide. I also encourage her to*

attend holiday lessons. However, I don't know Physical Sciences so I have a challenge in assisting her to do homework." It is apparent the parents are not able to assist their children with their homework because they do not have the necessary knowledge to do so.

Curriculum Advisor 1 pointed out that when parents take part in the school activities, learners are more motivated. According to this advisor, parents should monitor their children at home to do homework. Parents are encouraged to buy extra textbooks and provide support during educational tours. However, Curriculum Advisor 2 pointed out that there are resources that parents cannot provide or afford. In addition, this advisor pointed out that though the involvement of parents is essential not all learners have parents to take on the responsibility. Those children whose parents participate in their learning do well because the parents monitor them at home. Children from child-headed families are often absent from school and consequently fall behind in the work.

The findings suggest that some parents visit the schools once or twice per term to discuss their children's problems and performance with teachers but other parents are not as actively involved as the teachers would like them to be. More importantly, parents are expected to monitor their children's work at home and participate in school activities. The Department of Basic Education (2010:5) indicates that when parents participate in the school work of their children they develop and improve the learning of their children. It is important for parents to assist teachers by checking learners' work and constantly remind their children to always do their homework. Teachers and parents should discuss learners' performance before trial examinations and learners should explain their problems, reviewing their targets set at the beginning of the year and commit to work hard at school. The findings suggest that some parents have a challenge in assisting their children with Physical Sciences homework. Therefore, they need the teacher's support. It would help if parents could supplement teachers' effort by hiring tutors to assist their children at home to improve performance, but not all parents can afford this. However, parents can encourage their children to attend extra lessons on Saturdays and during school holidays to improve performance in Physical Sciences.

Parents could also encourage their children to watch educational television programmes at home. The findings suggest that parents need to consult teachers to identify problems their children face at school and encourage them to work hard. It is important for the parents to provide their children with enough time to study and do homework at home. Parents need to encourage their children to commit themselves in their studies, to have a positive attitude and to always do their work.

The findings suggest that the involvement of parents is essential but that some learners do not have parents to take the responsibility and are frequently absent from school.

The Department of Basic Education, (2012:13) suggests that parents should engage, comment and make recommendations based on the performance of learners and provide a meaningful contribution towards performance. The triangle of interaction between the teacher, parent and learner can result in improved performance. Therefore there is a need for continuous communication between teachers and parents through the use of hotlines to parents so that they know what their children are doing in Physical Sciences. Finally, it is important for parents to check their children's work and sign their homework as proof of their involvement.

5.4.4.2 Teacher effectiveness

Teachers are important community members because they carry a huge responsibility in terms of transmitting knowledge, values and promoting ethical behaviour among learners. The power of their influence or lack of it could facilitate or hinder learner academic achievement (Department of Basic Education, 2010:8). In an attempt to identify possible ways on how teachers can improve learner achievement principals, teachers and curriculum advisors were interviewed on what leads to teacher effectiveness in Physical Sciences.

Principal 2 indicated that improved performance of learners is a result of effective teaching and is brought about by the preparedness of the educators implying that the educator should be thoroughly prepared and competent to teach learners effectively. Principal 3 mentioned "*...if the educator is not clear or well-prepared for the lesson it also affects performance of learners and if the teacher goes to class unprepared and does not know the subject matter it is going to be a problem.*" Educators need to be

thoroughly prepared and have mastered the pedagogical content knowledge to teach well.

Principal 1 mentioned *"...if the teacher is effective, automatically the learners will be effective as well and it means their performance will be improved."* Principal 4 indicated *"...if you are having a teacher who is confident, a teacher who knows the content knowledge it improves the performance of learners. Consequently lack of confidence could result in teachers dodging classes or lessons and it impacts negatively on the performance in Physical Sciences."* Principal 5 pointed out that the Physical Sciences teacher must be versatile and must be a person who is prepared to devote of his or her time to the subject. The teacher should show enthusiasm for the subject and allow learners to ask questions. If the teacher is enthusiastic, learners should develop a positive attitude and will consequently lead to good achievement in the subject (P5). Principal 3 mentioned *"...if the educator is not clear that he or she is not good in a particular topic, it affects the learners and if he or she does not source teachers from schools that are doing well it is going to be a problem."*

Principal 4 stated *"...teachers for Grade 11 and 12 classes do extra classes that help them to finish the syllabus early and they do revision early, which is why in Physical Sciences all learners are doing well."* Learners had not been performing well because teachers did not cover the Grade 10 and 11 work properly. The result of this was that learners lacked the basics from previous grades and that affected the results badly (P4). Principal 2 pointed out that the teacher should finish the syllabus on time and must not rush to finish just prior to the examinations.

Most teachers shared the same sentiments as the principals concerning preparation. Teacher 1 mentioned *"...in most cases if I am thoroughly prepared it is easier to achieve the objectives and follow-up on the lesson. Sometimes if I am not thoroughly prepared I end up repeating things, but normally I am always prepared."* Teacher 2 indicated *"I must say each lesson I go to has to be prepared for. I also do extra lessons and give more tests; that improved the performance of learners."* Teacher 3 had a different opinion by stating *"If preparations mean writing lesson plans, they mean very little. If preparations mean teacher reading and making notes that mean a lot but that is not counted and evaluated especially giving notes, you find that the*

evaluation template for the teacher does not look at how many notes the teacher gives, but it looks at the number of homework, class-work and tests given to learners.” Teacher 5 stated that lesson preparation is very vital *“without lesson plans teachers end up waffling. Lesson plans give confidence and teachers will make a lot of errors if they do not prepare. Lesson plans remind teachers of the objectives and also provide them with time to think.”*

Teacher 4 pointed out that preparation guides the way teachers instruct the learners. *“Preparing basically means knowing the objectives or skills you want the learners to understand at any given time and it is easy to pass the message or content to the audience the learners.”* Teachers unanimously indicated that lesson preparation guides the way they teach learners. Preparing basically means knowing the objectives or skills you want learners to acquire at any given time hence improving the results. Teachers remain focused if they prepare for the lessons and it provides confidence. Moreover, teachers perceived lesson preparation as vital and without lesson planning teachers may end up making errors during teaching and learning. Thoroughly prepared teachers check on the CAPS guidelines. This is substantiated by Teacher 5 who stated *“When you prepare a lesson you know the objectives and if you teach without preparing you might end up teaching a topic which you like most forgetting to follow the CAPS guidelines, therefore you will waste a lot of time.”*

Teacher 3 mentioned the following: *“We do morning and afternoon lessons and weekend lessons. We have also done team teaching, winter classes and spring classes to improve the results.”* Teacher 5 indicated: *“We are using peer teaching, giving learners previous examination papers to go and answer at home.”* Teacher 1 mentioned that she encourages learners to come at half past six and finish at 5 o'clock in the afternoon. Sometimes she also gives incentives during tests. *“Sometimes when I give them challenging questions, the first learner to get the answer correct I give a reward. I make use of rewards and punishment in the form of lock-ups and withdrawal of some privileges”* (T1). Teacher 4 indicated *“...here it is basically just going out of my way and being with the learners more often. Besides attending classes during the normal timetable time I create more time to be with learners and convince them to attend, however some of them do not attend the extra classes and it affects performance.”* This suggests that some teachers are dedicated and will offer extra tuition to help learners and prepare them for assessment.

Teacher 4 also indicated *“It shows I still have a lot to do to make teaching accessible to the learners, the way I talk to the learners seem to be foreign to them. The teacher should be the guider in order to be effective and we have to be lifelong learners. Teachers cannot just say learners cannot read...we need to make the subject accessible to the learners. Teachers have a part to play in terms of improving performance in the subject. We need to learn from others.”* If the learners have problems in reading and understanding scientific paragraphs, teachers need to give them time to practice reading and writing scientific paragraphs and terms. Learners need to be kept busy all the time (T4). Teacher 2 mentioned *“You talk of 100% performance at grade 12 but in other grades performance is not satisfactory. I would like to see performance in grades 10 and 11 improving as well.”*

Both of the curriculum advisors who were interviewed had the same opinion as the teachers and emphasised the importance of staff development of teachers. Curriculum Advisor 2 indicated *“...we need the SMTs to encourage the teachers to work hard to improve learners’ performance. We need good communication between the teachers and the management.”* Teachers are frequently invited to attend workshops to brief them on new developments in the curriculum. However, some of the teachers do not attend and this affects results in schools (CA2). In addition, Curriculum Advisor 2 elaborated: *“In case of staff development we realised that we need to involve the School Management Teams (SMTs) and all stakeholders to provide content knowledge and instil confidence in teachers.”* Curriculum advisor 1 mentioned: *“The effective teacher also gives good results because he or she goes to school on time, and always when it is his or her period is in class on time. He or she gives regular work and does assessment regularly. Those teachers when you check they also teach on Saturdays and they give extra work.”* This advisor mentioned that he offers short workshops on content and also informs teachers of new policies for efficacy and to improve the results for Physical Sciences.

The findings suggest that opportunities are offered for teachers to attend workshops and be briefed on developments in the Physical Sciences curriculum. It appears from the interviews that staff development is necessary to improve the results. Creemers, (1999:51-65) states that teachers should understand and apply knowledge of content to motivate and engage learners. Furthermore, the findings suggest that teachers should be lifelong learners and have a part to play in making the subject accessible

to the learners to improve the results. There must be good communication between the teachers and the management to encourage them to work hard to improve the results.

Moreover, the findings suggest that if teachers are thoroughly prepared, it is easier to achieve the objectives and reflect on the lesson. A lack of preparation results in teachers repeating the concepts or topics with which they are most familiar. However, the findings suggest that lesson preparation should not merely result in the writing of lesson plans but that teachers should read further and prepare notes of the concepts to be taught. Preparing basically means that teachers are familiar with the objectives or skills they want learners to acquire in a given time. Through preparation, teachers are forced to check on the CAPS guidelines to improve their results. Consequently, teachers need to make planning or preparation, organisation and execution of teaching and learning a priority in order to maintain high quality teaching and learning. Creemers, (2012:51) deduces that effective teachers provide a variety of activities in the lesson and engage in careful planning and preparation of lessons and are able to simplify the subject matter. Preparation or planning was found to be critical for successful teaching and learning to improve the results. Teachers remain focused if they prepare for the lesson and it gives them confidence.

Finally, the findings indicate that it is important for the teachers to be confident and to have mastered pedagogical content knowledge. Educators need to be versatile and should devote their time to the subject to improve the results. More importantly, there is a need to show a love of, and appreciation for, the subject in order to develop a positive attitude in learners. This is indicated by Rogoff, Matusov and White, (2001:33) who mentioned that teachers should facilitate interaction between the learners and use a range of strategies and resources in order to enable diverse learners to understand and learn. Educators need to provide learners with time to practice reading and writing in an attempt to improve the results. It is also important for teachers to improve learner performance at Grade 10 and 11 and not to only focus on Grade 12. Teachers need to provide learners with previous examination papers and there should be a thorough monitoring of learner's work. Teachers have to be punctual for lessons and the example set by an effective teacher should contribute to commitment of learners and eventually lead to improved results.

5.4.4.3 Management and leadership skills

According to Bush and Heystek (2003:1), the process of deciding on the aims of schools is at the heart of management. This section reports on data related to management and leadership skills of principals and HoDs collected from teachers, principals and curriculum advisors during interviews on the roles, responsibilities and support that principals give to Physical Sciences teachers.

Teacher 2 indicated *“Whenever we request for apparatus and materials for practical activities the principal gives us in time. He supports us in the provision of materials so that teaching in Physical Sciences goes on smoothly.”* Both Teacher 4 and Teacher 5 pointed out that the principal provides the necessary materials that they need to use in the classroom during teaching and learning. Teacher 3 mentioned that the principal ensures that necessary materials and resources are provided. Therefore, some teachers are supported by their principals and ensure that teachers have the necessary resources to teach effectively.

Teacher 2 also stated that the principal reviews learners' achievement during the course of the year and whenever he feels dissatisfied he calls in the learner to discuss the results and this serves as motivation for the learner. Teacher 3 mentioned that the principal communicates with the Department of Education and she is the one who represents government policy and dissemination of the curriculum. *“Really she is the key in the teaching and learning of Physical Sciences to improve learner performance”* (T3). This teacher also elaborated: *“If we want learners to come during the weekend HoDs or SMTs make sure that the rooms are open. The principal makes sure that learners attend and they help by talking to the learners explaining the importance of attending these classes”* (T3). However, Teacher 1 elaborated: *“I have not experienced direct encouragement from the principal concerning the results: he does not comment about specific subject results even end of year results.”* From the preceding findings, one can deduce that some principals talk to learners about their achievement and encourage them to work harder. However, this is not a trend; most principals encourage learners to attend Saturday extra lessons. Only Teacher 5 stated that he appeals for assistance from the principal when he has problems with learner discipline.

The principals were asked to explain what they consider to be their role and responsibilities in improving learner performance in Physical Sciences. Various responses were received. Principal 4 mentioned: *"In 2013 we got 75% and in 2012 it was a bit down around 50%, in 2011 it was better around 60% and 2010 it was around 40%. This means the results are improving each year."* When probed about what led to these results, Principal 4 pointed out that the key issue, especially during the years when learners were not performing well is that learners did not cover the work in Grades 10 and 11 properly; learners lacked the basics from previous grades. The other issue that was raised was that during 2010 and 2011 learners were promoted to Grade 12 without passing Grade 11. Condoning learners hampers the pass rate. This principal mentioned: *"We have now taken care of those factors and that is why our results are improving."*

Principal 2 pointed out that he encourages teachers to start teaching the first day when schools open and that he analyses results after every test. This principal also mentioned that he supervises teachers by ensuring that teachers go to class punctually and that they complete the syllabus in time. Principal 3 stated: *"Through monitoring of teachers and checking learners' exercise books I am able to see those teachers who do not control learners' exercise books and providing feedback on time."* Principal 4 pointed out that supervision assists in making teachers do their work and complete the work schedules or pace setters as prescribed. If teachers are not supervised they may not attend classes nor give learners appropriate written work. Principal 5 mentioned that supervision is needed to ensure that teachers attend to classes and that they monitor and control learners' written work to improve the results. Consequently, through supervision, teachers would take their teaching responsibilities seriously and will ensure that they follow the guidelines set by the principal.

The principals unanimously pointed out that they source well-qualified teachers and resources to keep the learners stimulated. Principal 5 was of the opinion that there is a need for partnerships between schools to share resources such as laboratories so that learners can do practical activities and are constructively occupied. *"...sourcing is a strategy because one educator cannot be able to be a master of all"* (P5). Principal 3 stated that he sources teachers from schools that do well in Physical Sciences. This principal also elaborated: *"We also announce the best learners and*

provide the resources for them” (P3). Principal 4 indicated that they have engaged a non-governmental organisation (NGO) to assist in doing experiments in their school on a weekly basis and this has had encouraging results. Principal 5 mentioned that his school currently has a sponsorship from a bank whose assistance funds practical work and consequently learner achievement has improved. Principal 1 pointed out that learners are given more practice or practical activities and he invites other teachers who are good in Physical Sciences to come and assist. Principal 2 stated “...if the learners do not perform well in Physical Sciences, principals need to source teachers who are good in the subject.” However, Principal 3 mentioned “...teachers’ support materials or resources are not available and we do not get information on time from the Department of Education.” Ideally the partnerships between schools and engaging of NGOs would allow schools to share resources such as laboratories for learners to do practical activities to improve the results. It is important for principals to source teachers who are good in Physical Sciences to assist where needed.

Principal 1 pointed out that he motivates learners by talking to them and giving examples of people who have passed Physical Sciences and who have excelled in their careers. Principal 2 stated “I motivate learners by talking to them about careers that require Physical Sciences to instil love of the subject.” Principal 3 stated that he motivates learners by announcing the top 10 achievers in the subject during the assembly. Principal 4 mentioned “...if learners are motivated achievement is pushed to a very highest level. Sometimes learners fail because they are not motivated and they do not know what they are going to do after passing Grade 12. The learners should know the career paths to follow and this improves performance.” Therefore, it is important for principals to motivate learners in order to push achievement to the highest level.

Principal 1 encourages teachers to give learners more work to do to enhance discipline and to keep learners interested and motivated. Principal 2 pointed out that he ensures that learners follow the code of conduct at school and that they are kept occupied. Principal 4 mentioned that the environment should be conducive to learning and it is important for learners to be disciplined by doing the work given to them. “We have a code of conduct that we enforce and that is why we do not have a

serious problem when coming to discipline” (P4). However, Principal 3 pointed out that it is the responsibility of the educator to maintain discipline in the class.

Principal 5 pointed out that he encourages learners to attend Saturday classes so that teachers can manage to complete the syllabus on time. Principal 4 stated that he organises extra classes and that helps teachers to finish the syllabus early giving sufficient time for revision.

Curriculum Advisor 2 indicated: *“In the case of staff development we realised that having involved School Management Teams and all the stakeholders in the school they have come to understand that it is the responsibility of the school to make available all the necessary apparatus that teachers need. We need the SMTs to encourage the teachers to work hard for learner performance to improve”*. Curriculum Advisor 1 acknowledged that through staff development, teachers gain knowledge and develop confidence in teaching the subject. Curriculum Advisor 2 stressed the need for good communication between the teachers and the management and that SMTs should encourage teachers to work hard to improve learner performance.

The findings suggest that staff development and teacher support should involve principals, SMTs and all stakeholders. Through staff development teachers gain new knowledge and become confident in teaching the subject. The principals and HoDs need to assist in the dissemination of information on Physical Sciences curriculum. In addition, the findings suggest the need for good communication between the teachers and the management to improve the results. The South African Task Team report (1996:27) stressed that management is important because it provides a supportive framework for teaching and learning.

It is important for principals to encourage and discuss the results in Physical Sciences with learners as it serves as motivation. Principals should play a key role to encourage learners to attend extra lessons to improve the results. The findings suggest that principals should ensure that learners are disciplined in the school. It is important for principals or HoDs to monitor teachers to ensure that the work schedules or pace setters are completed and that learners are given enough written work.

Management and leadership skills provide the means for curriculum implementation, through time-tabling, subject allocation, textbook allocation, use of period registers and provision of all instructional materials and competent educators, as well as creating a conducive teaching and learning atmosphere (Bush and Glover, 2002:20). It is important for the principals to create partnerships with other schools to share resources such as laboratories for learners to do practical activities. It is the responsibility of the school or principals to ensure that teachers receive all the necessary apparatus needed. The findings suggest the need for principals to engage NGOs to assist in providing apparatus and do experiments in schools to improve the performance of learners.

5.4.4.4 Learner socio-economic background

Recent data show that there is a significant correlation between the socio-economic background of the learner and learner achievement (Wolfe and Nevills, 2008). This section reports on data collected from curriculum advisors concerning socio-economic background of learners and how it affects achievement.

Curriculum Advisor 1 indicated that learners who are in deep rural areas are not performing as well as those from urban circuits that have access to television and radio programmes. Curriculum Advisor 2 mentioned: *“They cannot even use the cell phones that they have to access the internet.”* Some learners do not have cell phones that they can use to access the internet. Curriculum Advisor 1 pointed out that if learners have access to computers and internet they would be able to search for information when doing homework. Economically most of the learners come from poverty-stricken families which impacts negatively on performance because most of these learners are unable to do what is expected. Socially most of the teachers are struggling with learners that come from very poor communities. This is substantiated by Curriculum Advisor 2 who stated *“Most of our learners come from poverty-stricken families and this impact negatively because most of the learners are unable to do what is expected.”*

Curriculum Advisor 2 mentioned: *“On social positions: most teachers are struggling with learners who abuse alcohol and drugs in these communities, thereby affecting their performance.”* The learners from a poor rural background are frequently absent from school and therefore miss lessons at school. Curriculum Advisor 2 also stated

“...if economic and social systems are in good standing, our results will be much better. If our teachers do not give extra time or lessons, there will be a problem. Most of the parents do not care and are unable to assist their children during weekends and this results in learners not giving enough time to their studies” (CA2).

The findings suggest that teachers who encounter a variety of patterns of behaviour in their classrooms should have some understanding of the impact of social class because much of the behaviour they encounter can be the result of differences in socio-economic status. Nyokong, (2009:4) states that there are millions of gifted and talented young people from poor socio-economic backgrounds who are yearning for opportunities to study and who are capable of becoming our future cohort of engineers, technologists, scientists and researchers. It is critical during teaching and learning to consider the socio-economic background of learners to improve performance.

The findings further suggest that learners who are deep in rural areas (in the schools under study) do not perform as well as learners in circuits which have more access to technology. Consequently, learners should have access to computers to assist them to do research and get more information when doing homework. Most of the learners in rural areas come from poor families and most of these learners are unable to perform well in Physical Sciences.

5.4.5 Division of labour

The activity system acts as a work team. It allows a focus on the inter-relationships, the rules in the system, the division of labour and changing interpretations of the object of activity (Engeström, 1999). In addition, Engeström, (1999) indicates that the unit of activity includes division of labour and is what is being done by whom toward the goal, including both the relatively horizontal division of tasks and the vertical division of power, positions, access to resources and rewards. The division of labour emphasises the need for sharing a common purpose by working together and interacting in order to bring about an improvement in the achievement of Physical Sciences learners. The Physical Sciences teachers need to work with other teachers, principals, parents and curriculum advisors and these are considered as the community members who assist each other in developing test papers, providing resources and solving problems experienced during the teaching and learning of

Physical Sciences. Through the division of tasks between the community members, the workload of teachers should decrease. The division of labour will be linked to the findings and act as a point of departure. In an attempt to find out the effects of workload on teachers and how it is reduced in schools, questions were asked to Physical Sciences teachers, curriculum advisors and principals.

Teachers unanimously mentioned that their workload is too large in terms of the number of learners and what needs to be marked. There is a need to give end-of-month tests and teachers fail to cope with the large numbers of learners. This is substantiated by Teacher 3 who stated “...*the workload becomes an issue when it comes to the number of learners and what is to be marked. For example, for one to give end-of-month tests, I will be looking at a big number of scripts that I have to mark so it is a hindrance. Big classes have big number of scripts that need to be marked.*” Teacher 4 mentioned that if the teacher is overloaded the marking will not be thorough forcing him to end up marking learners’ books once a month. Teacher 5 stated “*The fact that I am teaching Grade 10, 11 and 12 Physical Sciences and also have Grade 8 and 9 Natural Sciences and Technology; this is too much for a Physical Sciences educator. It drains energy and this gives me less time for matric students. It also gives me less time to provide assistance to individual learners and this drops the performance.*” Teacher 2 pointed out that a large workload disadvantages him especially when preparing for each class he has to teach. Teacher 1 substantiated the large workload complaint: “*I have 43 periods of which 24 are for Physical Sciences. If I was to have 24 periods only, it is obvious that I was going to start talking about quality here.*” Large workload in one way or another disadvantages teachers especially when preparing for each class and it contributes to poor performance.

It is important to reduce teachers’ workload to improve learner performance. Teacher 2 pointed out that if the workload is reduced, he would do extra lessons and results would improve. However, Teacher 4 did not complain about the workload: “...*my workload is quite realistic and I am comfortable with it. In addition to Physical Sciences Grade 11, I am teaching Natural Sciences Grade 8. Consequently, if the teacher is overloaded that will reduce his or her efficiency to perform. Workload impacts greatly on learner performance.*”

In an attempt to reduce workload, teachers are provided with support. Teacher 2 indicated *“Whenever we have meetings, curriculum advisors make sure we have documents required to teach Physical Sciences.”* Teacher 3 mentioned: *“Curriculum Advisors do a lot because they come and ask our problems and we share experiments. They also bring some learning materials and recently we were given Winning Teams past examination papers for learners to practice. They also organise some workshops where teachers meet to share content knowledge.”* Teacher 5 also indicated: *“At times we get quality previous question papers. In terms of experiments and difficult topics we discuss with the curriculum advisors once a month.”*

Curriculum Advisor 1 mentioned: *“In terms of workload it affects the achievement in Physical Sciences because teachers are not able to focus on individual learners and some also they are not able to give enough evaluation because teachers are not able to focus.”* Curriculum Advisor 2 stated *“...if the school is very small it means that the teacher does not only teach Physical Sciences, you find that he or she has to teach 4 to 5 different subjects. If it is a big school, you find that the school may not be having accommodation or classes, the teacher may not be able to cope with big classes. Although the teacher has to do practical activities; you find out that shortage of resources will make it impossible for him or her to perform to his or her best.”*

Ideally, curriculum advisors mentioned that they reduce educators' workload by providing formal tasks thus providing teachers with more time to teach learners. This is substantiated by Curriculum Advisor 1 who stated *“When we visit schools we standardise the tests to have quality by providing controlled tests to teachers.”* It appears from the interviews that subject committees are established to encourage teachers to work and share the workload. Subject committees established in circuits assist by bringing teachers together to make common decisions on tasks and experiments ensuring standardisation in the teaching. This is substantiated by Curriculum Advisor 2 who stated: *“Sometimes we visit the schools and assist the teachers in class where possible. We also encourage teachers or schools to outsource, to work together with neighbouring schools to assist one another. We also do this through subject committees where they assist one another.”* In addition Curriculum advisor 1 mentioned: *“We do frequent visits to schools and that is when we provide policies to teachers. Also we do some short workshops on content and also check if educators are implementing new policies in Physical Sciences.”*

Principal 1 stated: *“On the workload, for those learners who do not achieve well, teachers do not have time for them because they are always many in classes.”* Principal 2 pointed out that as Physical Sciences is a challenging subject and learners are given a task, it is important that teachers control the tasks and provides feedback quickly. However, this cannot be done if classes are too large. Similar problems are experienced with practical work. Principal 3 indicated that even though Physical Sciences is a practical subject the teachers do not have the opportunity to do practical activities with learners because of large classes and workload. Principal 4 mentioned *“...just like in all subjects the workload has a direct impact on learner performance. If you are having a large class it will be very difficult to give individual learner attention. The workload plays a negative role in Physical Sciences.”* In an attempt to reduce the workload both Principal 4 and Principal 5 stated that they get assistance from a non-governmental organisation (NGO) which does experiments with learners on a weekly basis.

In summary, the findings suggest that Physical Sciences educators are mostly overburdened because of the large numbers of learners in classes or the number of classes they teach. The situation is worse when they teach other subjects in addition to Physical Sciences. Yamagata-Lynch, (2010) suggests that there is need for sharing of tasks among the community members during teaching and learning. The findings indicate that it is difficult to cope with large classes. It was mentioned that too many periods reduce the time to mark learners' work to provide feedback on time and to prepare experiments. Workload impacts greatly on achievement of learners because teachers are not able to focus on individual learners and evaluate their work properly. A large workload disadvantages teachers, especially when preparing for each class. If the workload is reduced, teachers should be able to do extra lessons in Physical Sciences. Consequently, if a teacher is overloaded his or her efficiency to excel will be reduced. Learners' work will not be marked thoroughly or frequently. Curriculum advisors try to assist with preparation of assessment tasks giving teachers more time to focus on teaching but this is not enough.

Besides providing teachers with formal tasks, subject committees should assist in sharing the workload and performing experiments. The subject committees bring teachers together to make common decisions on tasks and experiments ensuring standardisation in the teaching. It is important that teachers and curriculum advisors

do short workshops on pedagogical practices (content) and share the workload in order to help learners to learn. The schools need to work together with neighbouring schools to assist each other and share resources. The support and value of NGOs to assist in sharing workload by carrying out experiments in schools in rural areas is acknowledged.

5.5 SUMMARY

This chapter has presented the data collected in this research addressing the elements of an activity system by determining factors that affect learner academic performance. Both perceptions of individual teachers, principals, parents, curriculum advisors and learner focus-group interviews have been presented and findings discussed. Analysis of data indicated that factors such as lack of resources, sharing workload, and motivation of learners, teaching methods, teacher effectiveness, parental involvement, management and leadership skills, teacher-learner ratio and discipline of learners have an influence on learner academic performance in Physical Sciences. Presentation of data included the role of the community, rules, artefacts, subject, division of labour and object in improving learner performance. The next chapter provides the summary, conclusions and recommendations of this research.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY

The aim of this study was to determine which issues results in poor performance of Physical Sciences learners in Limpopo rural secondary schools. The objectives were to identify the problems faced by teachers, principals, learners, parents and curriculum advisors with teaching and learning of Physical Sciences; to evaluate the teaching methods used; the availability of resources, teacher effectiveness during teaching of Physical Sciences and the role of assessment to improve learner achievement in Physical Sciences. The research questions were used to identify the factors that affect academic achievement of learners in Physical Sciences. The recommendations provided the intervention strategies to be implemented to improve academic achievement of learners in Physical Sciences in Limpopo rural secondary schools. It is disturbing to note that corresponding trends of low academic achievement in Physical Sciences has been recorded in South Africa (Howe, 2003:15). The study identified and described the factors that affect learner academic performance in Physical Sciences. According to Cameron, (2009: 10) development in South Africa is affected negatively due to a small number of learners taking up scientific careers. The decline in Science graduates reflects the inability of learners to succeed in Physical Sciences at secondary school level. A number of causal factors ranging from lack of adequate Physical Sciences resources such as apparatus and laboratories and shortage of appropriately qualified Physical Sciences educators, large classes and ineffective teaching methods have been identified (Mwanga-Zake, 2008:4-6).

The purpose of the study was to determine what in particular affects Physical Sciences achievement of learners in Limpopo rural secondary schools and provide intervention strategies that could be implemented to improve the academic achievement of learners in Physical Sciences in Limpopo rural secondary schools. Consequently, the problem on which this research focused is as follows: "Which factors impact on learners' academic achievement in Physical Sciences in Limpopo rural secondary schools?" High failure rates in Physical Sciences remain a concern especially in historically disadvantaged rural public schools (Cameron, 2009:16).

Due to the underachievement in these rural secondary public schools, the underlying factors for the high failure rate have not been addressed sufficiently. Corresponding evidence was established from recent results that showed that overall pass rate of Physical Sciences learners in Limpopo Province in 2011 was 50.4%. A critical analysis of the examination results by district showed that performance of learners in Limpopo Province needs further research in order to address the problems. Besides those factors that are in play that cause low academic achievement in Physical Sciences, further contributory factors come into play, hence the need for the study. The intention of the study is to suggest recommendations to improve performance of Physical Sciences learners.

The investigation uses the CHAT framework as lens to study and report the findings of the research problem. CHAT describes the relationship between the subject, community, rules, division of labour, artefacts/tools and the outcome and were linked to the conceptual framework. CHAT offers a broad approach to analysing learning and the contexts of teaching and was used in the analyses of activities in schools, for example, assessment of learners, workload, teaching methods and availability of resources.

The research approach or designs are qualitative design and survey design and were used to discover the factors that affect learner achievement in Physical Sciences. Morse, (2001:77) explains qualitative research as a system of inquiry that seeks to build a holistic, largely narrative description. The approach was therefore, relevant to this study, which seeks to investigate learner academic achievement in Physical Sciences in selected secondary schools in Limpopo Province. Purposeful sampling was used for the collection of data. The sample was chosen because it was likely to be knowledgeable and informative about the phenomenon the researcher was investigating. The power and logic of purposeful sampling is that the case studied in-depth yields many insights about the topic. According to Merriam, (1998:61) purposeful sampling is based on the assumption that the investigator wants to discover, understand and gain insight and therefore must select a sample from which the most can be learned. Interview schedules were used to collect data from five Physical Sciences teachers, five principals, five parents, two curriculum advisors and 30 Physical Sciences learners. Focus group interviews were held with the Physical Sciences learners. The questions asked were semi-structured. The

researcher travelled to schools to interview teachers, principals, learners, parents and curriculum advisors. The data was audio recorded, transcribed and printed. Open coding was used to condense the data by assigning codes to it. Categories and themes emerging from the data were identified. The researcher encoded and interpreted all the data.

In Chapter 5 the findings of the study are reported and discussed. In sum the causes of poor achievement is caused by the lack of motivation of learners, inappropriate teaching methods, a lack of resources such as laboratories, apparatus and chemicals and effective assessment. The study stressed the need to use effective teaching methodologies thus moving away from a teacher-centred to a learner-centred approach. It is therefore important to implement effective discipline and assessment practices to improve learner achievement. Teachers are therefore called upon to implement the CAPS guidelines so that Physical Sciences performance improves. The conclusions are subsequently discussed.

6.2 CONCLUSIONS

This section summarizes major research findings as discussed in Chapter 5 since the main purpose of the interviews was to collect information from Physical Sciences teachers, principals, Physical Sciences learners, parents and curriculum advisors on the causes of poor learner academic achievement in Physical Sciences in Limpopo rural secondary schools. The research links the research findings to other studies found from the literature review.

6.2.1 Research findings

The data obtained in Chapter 5 showed that there are many factors that affect learner academic performance and change is needed. The data reveals that the factors that cause failure rates in Physical Sciences are interlinked and are critical to improve learners' results.

6.2.1.1 Motivation of learners

The findings from interviews expressed the importance of motivation in engaging learners during teaching and learning of Physical Sciences. The finding has shown that motivation is of key importance in Physical Sciences because if learners are

motivated their achievement is pushed to its highest level. Literature by Palmer, (2007:38-42) has revealed that motivation is an essential element that is necessary for quality education. Consequently it is important to keep learners motivated. The study revealed that learners will be self-motivated knowing that they accept the importance of Physical Sciences for their future careers. They persevere despite setbacks and challenges and can only succeed through the support and motivation from the Physical Sciences teachers. If learners are not motivated they end up not enjoying the Physical Sciences and develop a negative attitude towards the subject. By inspiring and stimulating learners, teachers can assist learners to improve performance.

6.2.1.2 Availability of instructional resources

The findings indicated that lack of quality textbooks is a serious issue. Textbooks that are used lack examination-related questions and examples for learners to practice. The shortage of Physical Sciences resources was reiterated and the textbooks that are provided by the Department of Education are inadequate especially as far as textbooks for CAPS are concerned. Literature by the World Bank, (2001:4) has revealed that learning and teaching materials (textbooks) are critical ingredients in learning and the intended curriculum cannot be easily implemented without them. If textbooks are not available learners cannot benefit by doing homework or assist other learners to work on their own. The availability of quality textbooks and learner achievement demonstrate a positive relationship (Schiefelbeen and Simmons, 1981:92). Textbooks should provide exercises and learners should be able to write notes using the textbooks. The shortage of textbooks has cost implications for schools because educators have to photo-copy materials for the learners.

The study revealed that most schools in the district do not have well-equipped laboratories and this results in a lack of practical activities. Learners need to do practical work on their own to perform well in Physical Sciences. This is not unique as Mji and Makgato, (2006:254) and Howe, (2003:2) have shown that there is a serious shortage of physical facilities such as laboratories and science equipment in South African public schools contributing to poor learner achievement. As a matter of urgency, apparatus and chemicals are needed to do experiments. Furthermore,

literature by Bubenzer, (2008:3) has revealed that an increase in laboratory availability could be an answer to improving results in Physical Sciences and as schools are not well-equipped, teachers resort to teaching theory rather than practice. This adversely affects learner results. Laboratory work is important because in Physical Sciences there is a need to do experiments as part of assessment and to help learners understand. Resources such as laboratories help to expose learners to real learning opportunities where they can use all their senses. If resources for practical activities are not available, (even basic science kits) learners' performance will be affected. Physical Sciences is a subject where learners have to discover on their own, therefore, resources to do experiments are essential.

Computers are considered an important resource in Physical Sciences because this offers a new medium of creative expression and communication for teachers and learners. Tools play an important role in human thinking and learning yet technology is frequently absent in schools, or insufficiently used in Physical Sciences (Bernhard, 2003: 313-321). The internet is not accessible to the schools in this study and if computers were available teachers could become facilitators and co-ordinators of learning rather than having to be the centre of knowledge. However, the findings indicated that most learners lack computer skills and this will have to be addressed too. Learners are not able to search for information from the internet because they are not able to use computers. Through computer technology learners could access not only exemplar question papers but it also allows teachers to do simulations or show videos of things that are impossible to do in class.

Television and radio programmes that are broadcast during the school holidays play an important role in improving learner performance. However, learners in rural areas (where the study was undertaken) do not have access to these.

Generally, the schools in this study are under-resourced contributing to poor learner achievement in Physical Sciences. According to Jerkins and Whitefields, (1974:223) whatever a teacher achieves with his or her learners would be influenced by the teaching and learning resources available to him or her. Any lack of resources contributes to poor performance of learners.

6.2.1.3 Teaching methods

The findings reiterated the fact that teachers mostly use the lecture method due to the shortage of resources and large numbers of learners in classes. The lecture method allows teachers to finish the syllabus faster, but this method is mainly teacher-centred and it does not allow learners to participate in class.

Learning Physical Sciences is best when it is hands-on, practical and experiential. Linking theory and practical work in the classroom assists learners to answer questions correctly and if learners do something practically they will not forget easily. The discovery method would be ideal if an educator can come up with a situation that allows learners to investigate themselves making use of the appropriate apparatus and chemicals. The study has shown that hands-on activities and projects play a major role to give learners an opportunity to do activities on their own and to improve their results. It is further argued that practical activities provide learners with a chance to express themselves if they are given enough time. Teaching and learning will be appreciated more by learners if they are involved in practical activities.

The findings indicate that by dividing learners into small groups and giving them specific tasks to do in class and at home they can assist each other and share ideas. Learners come together for discussions and then do presentations in class. This study revealed that small groups are necessary because they can be managed easily and teachers are able to control learners' work and provide feedback on time. However, this may not be possible given the large numbers of learners in the schools in this study. Nevertheless, group activities motivate learners to work harder and improve the results.

The analysis further indicated that the textbook method can provide learners with activities that they can do such as solving problems at school and at home. However, as mentioned in the previous section, most public schools in rural areas (in which the study was undertaken) experience an acute shortage of textbooks, or have textbooks of a poor quality.

The findings revealed that research can be used to augment practical activities if schools experience resource shortages. This research can be used to augment

practical activities if schools experience resource shortages. This study has revealed that question-and-answer method gives learners the opportunity to illustrate mastery of content. It is important for teachers to ask examination-related questions and provide learners with the necessary support especially when answering past examination questions to improve performance.

Literature by Lieberman, (2004:89) has shown that learning by teaching is a teaching method. Through participation in peer teaching learners should become confident and their results should improve.

Though teachers face problems to use teaching methods that allow learners to develop enquiry skills, Palmer, (2007:42) suggests that teaching methods should be inventive, encouraging and beneficial and provide tools that can be applied to the learners' real-life situations. A variety of teaching methods should help to capture the learners' interest during teaching and learning and in so doing possibly improve Physical Sciences' performance. If teachers resort to one method, he or she excludes other learners since they each may have different learning styles. However, the method must depend on the topic and content that needs to be taught and hence the need for multiple teaching methodologies.

6.2.1.4 Supervision of teachers

This research study has shown that effective supervision by principals and HoDs ensures that teachers and learners are punctual, which will ensure maximum use of available teaching time. Literature by Kaptelinin, (2005:4-8) has revealed that supervision encourages teachers to be committed to their work and that this will ultimately contribute to learner achievement as it has an actual and potential object and purpose. The findings also highlight the need for principals and HoDs to frequently monitor whether teachers mark learners' books and that teaching proceeds at the required pace to ensure completion of the syllabus. However, because of the large numbers of learners in the schools in this study, teachers find it difficult to monitor the quality of learners' work effectively.

6.2.1.5 Physical Sciences curriculum

The study revealed that Mechanics, Forces, Newton's laws, electric circuits, vectors, chemical change including equilibrium constant (K_c), organic compounds and

electromagnetism are considered difficult topics. In Mechanics learners indicated that they have a problem with topics related to work, energy and identifying forces and drawing force diagrams. The findings indicated that learners cannot identify the forces and don't know how to go about drawing force diagrams. Mechanics is considered to be too extensive and involves problems and formulas that some of the learners do not understand. It also appears that learners cannot solve problems related to electric circuits.

The easiest topics are Doppler Effect, electrostatics, momentum, photo-electric effect and vertical projectile motion. According to the Department of Basic Education, (2011:8) there are six main knowledge areas which inform the subject Physical Sciences, namely Matter and Materials, Chemical systems, Chemical change, Mechanics and Waves, Sound and Light and Electricity and Magnetism. Problem-solving exercises should be done at all cognitive levels in all knowledge areas and on all scientific concepts. Physical Sciences promotes knowledge and skills in scientific inquiry and problem solving.

6.2.1.6 Teacher-learner ratio

This study found that if the classes are smaller learners are less likely to misbehave, noise levels are reduced and group activities can be enhanced. This concurs with the Organisation of Early Childhood Development (OECD), (2009:372), which stated that smaller classes are often perceived as allowing teachers more opportunity to focus on the needs of individual learners and reducing the amount of class time they spend dealing with disruptions. Class size may be viewed as an indicator of the quality of the school system. The research study revealed that a smaller number of learners per class could result in improved performance in Physical Sciences.

Literature by Gopal and Stears, (2007:16) has indicated that large classes are characterised by insufficient learner interaction and rapport, lack of individual attention from the teacher and inability to ensure adequate provision of learning experiences such as handling apparatus, observation and recording results by each learner during experiments. The study has shown that the large numbers of learners in Physical Sciences are common and seem to be a problem to Physical Sciences performance in public secondary schools in the Bochum circuit where the study was undertaken. This scenario adversely affects teachers in performing individual

practical activities, preparation of apparatus, marking of learners' work and providing feedback on time leading to poor results. In such classes teachers resort to the lecture method which may not be appropriate for some learners. In addition, large numbers of learners affect the implementation of practical activities and discipline may be adversely affected. The study has revealed that there are more teaching methods to choose from when engaging a smaller group. Literature by Mwamwenda, (2004:222-229) has argued that if classes are large and crowded, it is difficult for the teachers to maintain control.

Furthermore, literature by Dunphy and Dunphy, (2003:48) also indicate that in order for the teacher to provide assistance to the learners; the teacher-learner ratio must be small. The ratio will depend upon the number of factors including the complexity of the tasks that the learners must master. The amount of work that will be given to learners will increase and faster learners can progress better in smaller classes.

6.2.1.7 Assessment of learners

The study found that in Physical Sciences informal assessment provides teachers with an opportunity to understand the learning processes to improve learner achievement. Lubisi, (1999:17) suggests that assessment entails making sense of a learner's knowledge and skills and it was found that informal assessment remains the most critical process because it allows teachers to observe learning before learners are exposed to formal assessment. Informal assessment allows teachers to gather information about learners and to use the information to improve learners' performance. Informal assessment is a foundation for formal assessments, therefore, is seen to be critical. The study indicated that informal assessment develops learners and increases learning opportunities in Physical Sciences. The Department of Basic Education, (2011) has indicated that assessment should be implemented both informally (assessment for learning) and formally (assessment of learning). Informal assessment is a daily monitoring of learners' progress and therefore more class-work, homework, tests and experiments should be given to improve learner achievement.

Dunphy and Dunphy, (2003:48-58) has revealed that assessment can motivate learners through the feedback from the educator that helps learners to develop self-esteem and confidence in their development. Assessment encourages assessing

individual strengths and weaknesses. Ideally assessment is used to identify problems to help learners improve and instil confidence in their abilities. The study has shown that assessment allows learners to practice how to answer questions and helps them to remember what they have learnt.

Performance of learners will improve if they are given appropriate class-work, homework and tests continuously or more often. Assessment is a way of measuring what is happening in the class and it helps not only the teacher or the learner, but also the Department of Education to determine whether the targeted objectives have been achieved or not. Therefore, assessment informs the stakeholders if the results are improving or not. Assessment is viewed as a vehicle for driving Physical Sciences teaching and learning since successful implementation of the curriculum mostly depends on it (Beets and Le Grange, 2005:190).

In this study teachers are unable to always provide learners feedback quickly due to large numbers of learners. It appears that the regular assessment and feedback in Physical Sciences plays a prominent role in enabling the learners to understand questions. Homework is given to learners to keep them engaged and to revise work at home.

Research by Harlen, (2000:3) has provided a clear indication that using assessment properly does indeed improve learning and raises standards of learners' achievement. Ideally tests encourage learners to revise the difficult topics that have been taught to improve performance. Furthermore, end-of-topic tests act as a diagnostic measure and can be used to determine retention capacity of learners after a given period.

6.2.1.8 Discipline of learners

According to the findings the environment will not be conducive to learning if there is lack of discipline. Learners need to be ready to do their work and be able to manage their time to improve their performance. Physical Sciences is perceived as a challenging subject therefore learners should be disciplined and be prepared to work hard.

The study further showed that a code of conduct in schools guides learners in terms of discipline. Research by Joubert and Prinsloo, (2009:106) has indicated that

discipline is essential for effective teaching and learning. It is vital to have basic standards of discipline that form the basis for further rules of acceptable behaviour and standards in class.

According to Rogers, (1998:11) teachers need to lead, guide, direct, manage or confront learners about behaviour that disrupts the right of others during teaching and learning of Physical Sciences. The study found that Physical Sciences needs learners who are committed, ready to work harder and who respect their teachers.

6.2.1.9 Parental involvement

The study has revealed that some parents visit the schools once or twice per term to discuss their children's problems and performance with teachers but other parents are not as actively involved as the teachers would like them to be. More importantly parents are expected to monitor their children's work at home and participate in school activities. The Department of Basic Education, (2010:5) indicated that when parents participate in the school work of their children they develop and improve the learning of their children. The study has shown that some parents have a challenge in assisting their children with Physical Sciences homework therefore they need the teachers' support.

The study has shown that the involvement of parents is essential but that some learners do not have parents to take the responsibility. Children from child-headed families are frequently absent from school.

The Department of Basic Education, (2012:13) suggested that parents should engage, comment and make recommendations based on the performance of learners and provide a meaningful contribution towards performance. The triangle of the teacher, parent and learner can result in improved performance.

6.2.1.10 Teacher effectiveness

The research study has revealed that opportunities are offered for teachers to attend workshops where they are briefed on developments in the Physical Sciences curriculum. It appears from the interviews that staff development is necessary to improve the results. Research by Creemers, (1999:51-65) has shown that teachers should understand and apply knowledge of content to motivate and engage learners.

The study further shows that if teachers are thoroughly prepared it is easier to achieve the objectives and reflect on the lesson. A lack of preparation results in teachers repeating the concepts or topics with which they are most familiar. However, the study has shown that lesson preparation should not merely result in the writing of lesson plans but that teacher should read further and prepare notes of the concepts to be taught. Most importantly the findings show that preparing basically means that teachers are familiar with the objectives or skills they want learners to acquire in a given time. Through preparation teachers are forced to check on the CAPS guidelines to improve their results. Literature by Creemers, (2012:51) deduced that effective teachers provide a variety of activities in the lesson and engage in careful planning and preparation of lessons and are able to simplify the subject matter. Preparation or planning was found to be critical for successful teaching and learning to improve the results. Teachers remain focused if they prepare for the lesson and it gives them confidence.

Finally the findings indicated that performance of learners can improve if teachers are confident and have mastered pedagogical content knowledge. This is substantiated by Rogoff, Matusov and White, (2001:33) who mentioned that teachers should facilitate interaction between the learners and use a range of strategies and resources in order to enable diverse learners to understand and learn.

6.2.1.11 Management and leadership skills

The findings showed that staff development and teacher support should involve principals, SMTs and all stakeholders. Through staff development teachers gain new knowledge and become confident in teaching the subject. The South African Task Team report, (1996:27) stressed that management is important because it provides a supportive framework for teaching and learning. The study has revealed that it is important for principals to ensure that learners are disciplined in the school, the work schedules or pace setters are completed and that learners are given enough written work.

Literature has already revealed that management and leadership skills provide the means for curriculum implementation, through time-tabling, subject allocation, textbook allocation, use of period registers and provision of all instructional materials and competent educators, as well as creating a conducive teaching and learning

atmosphere (Bush and Glover, 2002:20). The study showed that it is the responsibility of the school or principals to ensure that teachers receive all the necessary apparatus needed.

6.2.1.12 Socio-economic background of learners

The findings show that teachers who encounter a variety of patterns of behaviour in their classrooms should have some understanding of the impact of social class because much of the behaviour they encounter can be the result of differences in socio-economic status. Nyokong, (2009:4) states that there are millions of gifted and talented young people from poor socio-economic backgrounds who are yearning for opportunities to study and who are capable of becoming our future cohort of engineers, technologists, scientists and researchers.

The study further showed that learners who are deep in rural areas (in the schools under this study) do not perform well when compared to learners in circuits which have more access to technology. Consequently, learners should have access to computers to assist them to do research and get more information when doing homework. Most of the learners in rural areas come from poverty stricken families and most of these learners do not perform well in Physical Sciences.

6.2.1.13 Workload

In summation, the findings showed that Physical Sciences educators are mostly overburdened because of the large numbers of learners in their classes and the number of classes they teach. The situation is worse when they teach other subjects in addition to Physical Sciences. The study indicated that it is difficult to cope with large classes. It was mentioned that too many periods reduce the time to mark learners' work, to provide feedback on time and to prepare experiments. Workload impacts greatly on achievement of learners because teachers are not able to focus on individual learners and evaluate their work properly. A large workload disadvantages teachers especially when preparing for each class. If the workload is reduced teachers should be able to do extra lessons in Physical Sciences. Consequently if a teacher is overloaded his or her efficiency to excel will be reduced. Learners' work will not be marked thoroughly or frequently. It appears that curriculum

advisors try to assist with preparation of assessment tasks giving teachers more time to focus on teaching but this is not enough.

Most importantly, the findings show that the subject committees bring teachers together to make common decisions on tasks and experiments ensuring standardisation in the teaching. Yamagata-Lynch, (2010) suggests that there is need for sharing of tasks among the community members during teaching and learning of Physical Sciences. The support and value of NGOs to assist in sharing workload by carrying out experiments in schools in rural areas is acknowledged.

6.3 RECOMMENDATIONS FROM THE STUDY

This section provides the specific recommendations to be addressed, together with possible strategies that may be implemented. Recommendations for practice and policy are suggested:

Recommendation 1

In order to improve learner performance in Physical Sciences the Department of Basic Education should reduce the teacher-learner ratio to 1:30 or fewer learners in a class. The Department of Basic Education should employ more Physical Sciences teachers. The researcher suggests that the Government should re-open teacher training colleges in the province to train more Physical Sciences teachers to address the problem. The other option is for the Department of Basic Education to introduce a critical skills allowance to attract Physical Sciences graduates to join the teaching profession. A smaller number of learners per class could result in improved performance in Physical Sciences.

The Physical Sciences teachers need more time for the actual teaching to cover the content in the curriculum and improve learner academic performance. Consequently it is recommended that the workload of teachers be reduced by providing more teachers. This allows teachers to do practical activities, mark learners' work and to offer extra classes.

Recommendation 2

The Department of Basic Education should make provision in terms of time to allow teachers to attend workshops or staff development programmes during the course of

the year to improve their level of competence. Principals and HoDs should provide teachers with opportunities to attend workshops and be briefed on developments in the Physical Sciences curriculum. It is important that staff development and teacher support should involve principals, HoDs, SMTs and all stakeholders. It is further recommended that curriculum advisors do short workshops with teachers on pedagogical practices (content) and share the workload in order to help learners to improve the results. It is important for the teachers to be confident and to have mastered the required pedagogical content knowledge.

Recommendation 3

The Department of Basic Education needs to attend to the issue of resources. Firstly, it should provide quality textbooks that have examination-related questions and examples for learners to practice. Textbooks must be aligned with CAPS.

Secondly, it is imperative that the Department of Basic Education and non-governmental organisations (NGOs) work together to provide laboratories, chemicals and apparatus. As a matter of urgency laboratories, chemicals and apparatus are needed to do experiments. Most schools do not have well-equipped laboratories which contributes to poor learner achievement.

Thirdly, the Department of Basic Education should reach the rural areas to roll out computer technology in schools. The internet is currently not available to the schools and if computers were available teachers could become facilitators and co-ordinators of learning rather than having to be the centre of knowledge. The researcher suggests the need for the government to connect broadband coverage in schools so that computers are used.

Fourthly, principals and HoDs should create partnerships with other schools to share resources such as laboratories, chemicals and apparatus. It is the responsibility of the principals to ensure that teachers receive all the necessary apparatus needed to improve the results.

Parents need to encourage their children to watch educational television programmes at home to improve the results. Principals could possibly acquire television and radio sets to provide learners access to programmes that are broadcast during school holidays. It is also recommended that if at all possible,

parents should supplement teachers' efforts by hiring tutors to assist their children to improve performance.

Recommendation 4

It is recommended that Physical Sciences teachers use a variety of teaching methods when teaching the subject. Firstly, teachers should give learners an opportunity to participate in their learning through peer teaching and group work. Group activities motivate learners to work harder and improve the results. Small groups are necessary because they can be managed easily and teachers are able to control learners' work and provide feedback on time.

Secondly, Physical Sciences teachers should allow learners to develop a deep conceptual understanding of Physical Sciences subject matter through the use of textbooks. The textbook method can provide learners with many activities that they can do such as solving problems at school and at home.

Thirdly, Physical Sciences teachers need to use the question-and-answer method to provide learners with the opportunity to illustrate mastery of content. It is important for teachers to ask examination-related questions and to use previous examination papers to improve performance. The Physical Sciences teachers need to give quality questions during class-work and homework activities because they lead to high achievement in Physical Sciences. Teachers need to provide assistance to learners by providing the necessary support, especially when answering past examination questions.

Recommendation 5

It is recommended that Physical Sciences teachers need to attend to the issue of assessment of learners during teaching and learning. Firstly, teachers should provide learners the opportunity to write more informal tasks such as class-work, homework and weekly or monthly tests to improve their performance. It could possibly help if Physical Sciences teachers could give five class-work and homework activities every week and one test bi-weekly or monthly. This allows teachers to identify problems to help learners to improve. Tests act as a diagnostic measure and can be used to determine retention capacity of learners after a given period. It is important that Physical Sciences teachers show learners their mistakes and provide

feedback on time. Regular assessment in Physical Sciences plays a prominent role in enabling the learners to understand questions. Consequently, there is a need for frequent checking of learners' books by teachers in order to identify slow learners and high achievers. Informal assessments is a foundation for formal assessment, therefore is seen to be critical. It is also recommended that principals and HoDs should frequently monitor whether teachers mark learners' exercise books and that teaching proceeds at the required pace to ensure completion of the syllabus. Parents should also play a role in reviewing and contributing to homework given to their children and have capacity to meet learning expectations of the learners. Through attending school meetings, open days and prize giving ceremonies, parents have the opportunity to view their children's work and discuss progress with teachers.

Secondly, Physical Sciences learners should be ready to do their work and be able to manage their time to improve performance. Physical Sciences learners should be willing to do homework, class-work and tests in preparation for formal tasks to improve performance. Parents have an important role in supporting, motivating and encouraging their children to participate in all school work activities. The parents' involvement encourages and improves basic learning and teaching, resulting in excellent outcomes. Parents should provide their children with time to study and do homework. Learners whose parents are concerned with regular school attendance and homework do well in education performance.

Recommendation 6

The research recommends that the Department of Basic Education should provide incentives or a stipend to motivate teachers to engage in extra classes on Saturdays and school holidays. The support and value of NGOs to assist in sharing the workload by carrying out experiments in schools in rural areas is acknowledged.

Secondly, curriculum advisors should assist with preparation of assessment tasks giving teachers more time to focus on teaching to improve performance. Besides providing teachers with formal tasks curriculum advisors should establish subject committees that can assist in sharing the workload and performing experiments. The subject committees should bring teachers together to make generic decisions ensuring standardisation in the teaching. Forming subject committees will result in

sharing knowledge, peer teaching of difficult topics and setting tests during assessments.

Recommendation 7

It is recommended that Physical Sciences teachers need to be committed to be effective in their teaching. Firstly, lesson preparation should not merely result in the writing of lessons but teachers should read further and prepare notes of the concepts to be taught. Teachers need to plan and prepare, organise and execute quality teaching and learning opportunities to ensure excellence in teaching. If teachers are thoroughly prepared it is easier to achieve the objectives and reflect on the lesson. Principals and HoDs should have good communication with teachers to encourage them to prepare lessons and work hard to improve performance. Management provides the means for curriculum implementation as well as creating a conducive teaching and learning atmosphere.

Secondly, Physical Sciences teachers should be punctual for lessons and the example set by an effective teacher should contribute to commitment of learners and eventually lead to improved results. In order to identify teachers and learners who may not be attending lessons the “management by wandering around” principle could be used by principals and HoDs. Effective supervision ensures that teachers and learners are punctual, which will ensure maximum use of available teaching time.

Thirdly, it is more important for Physical Sciences teachers to consider prior knowledge of learners and learner performance in grades 10 and 11. It is critical that teachers in these grades build a solid foundation in preparation for grade 12. If learners lack the basics from the previous grades it affects the results in a negative way. It is important for principals and HoDs to support and monitor teachers to ensure that the work schedule or pace setters are completed as prescribed by the CAPS document and that, learners are given enough written work to improve their performance.

Recommendation 8

It is recommended that principals need to attend to the issue of discipline. Firstly, principals should ensure that Physical Sciences learners are disciplined in the school

by maintaining a school tone and culture which creates a climate for the development of social responsibility. Principals should establish a code of conduct in schools that guides learners in terms of discipline. The environment will be conducive to learning if there is discipline. The learners' conduct and behaviour should facilitate effective teaching and learning. Orderliness in schools is important for effective learning in Physical Sciences.

Secondly, it is important for Physical Sciences learners to understand the rules and what corrective measure will be taken if they break them or misbehave. A well-disciplined learner is orderly, responsible, diligent, sympathetic, co-operative, honest and considerate and always true to do what is right and good. Physical Sciences needs learners who are committed, ready to work harder and who respect their teachers. Parents should consult teachers to identify problems their children face at school and encourage them to work hard. Parents should continuously communicate with teachers through the use of hotlines so that they know what their children are doing in Physical Sciences. The implication of this recommendation is that parents should work with teachers to create an environment that is conducive to the achievement of quality learning at school. The triangle of interaction between the teacher, parent and learner can result in improved performance.

6.4 SUGGESTIONS FOR FURTHER RESEARCH

The findings of this research revealed that the lack of motivation, lack of resources, teacher effectiveness and discipline of learners, management and leadership skills, supervision of teachers, assessment of learners, the teacher: learner ratio, parental involvement and workload are factors that affect the teaching and learning of Physical Sciences in the Bochum circuit. This research forms a baseline for future research. Therefore, further research can also be done using a larger sample of schools and participants.

Secondly, the different activities that take place during teaching and learning in the classroom, for example, lesson delivery, manipulation of apparatus during experiments, discipline of learners and assessment of learners to enhance quality have not been addressed in full. Therefore, it is suggested that further research should entail in-depth classroom observations to reveal if the factors identified are being implemented in the teaching and learning of Physical Sciences.

6.5 CONCLUSIONS

The study has found that teacher: learner ratio, a lack of resources; assessment of learners, teacher effectiveness, and the lack of discipline; a large workload and the lack of parental involvement adversely affects the teaching and learning of Physical Sciences in the Bochum circuit. The lack of laboratories, chemicals and apparatus to do experiments was found to be common in the schools. It was established that parents should be active in the teaching and learning of Physical Sciences. The recommendations suggest the need to reduce the workload and address the teacher: learner ratio to facilitate effective teaching and learning. It is critical that the recommendations are addressed urgently to improve the results of Physical Sciences learners to ensure that the number of science graduates increases.

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UNISA



Research Ethics Clearance Certificate

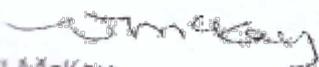
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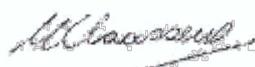
Zenda Rekal [31070647]

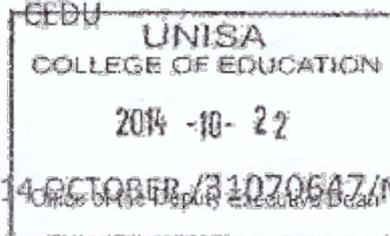
for a D Ed study entitled

Factors affecting academic achievement of learners in Physical Sciences in selected Limpopo rural Secondary Schools

has met the ethical requirements as specified by the University of South Africa College of Education Research Ethics Committee. This certificate is valid for two years from the date of issue.


Prof VI McKay
Acting Executive Dean CEDU


Dr M Claassens
CEDU REC (Chairperson)
medte@netactive.co.za



Reference number: 2014-OCTOBER/31070647/MC

22 OCTOBER 2014

APPENDIX 2



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

CAPRICORN

BOCHUM WEST

29/07/2014

Enq: Ramashala MM

Cell: 082 533 5388

District Senior Manager

Polokwane District

LADANA

Sir

I hereby recommend that permission be granted to Zenda R, to conduct research in Limpopo schools.

Thank you

RAMASHALA M.M

A handwritten signature in black ink, appearing to read 'M. M. Ramashala', written over a horizontal line.

CIRCUIT MANAGER

Cnr. Yster & Blaauwberg, POLOKWANE, LADANNA, 0699
The Heart beat of Limpopo Province

Tel: (015) 285 7300

The District Director

Department Of Education

0699

LADANA

23 July 2014

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN PUBLIC SECONDARY SCHOOLS OF BOCHUM CIRCUIT IN FULFILLMENT OF THE REQUIREMENTS FOR A DOCTOR OF EDUCATION DEGREE IN PHYSICAL SCIENCES (CURRICULUM STUDIES) WITH UNISA.

I am a Physical Sciences educator at Phagamang secondary school in Bochum West Circuit in Limpopo province. I am currently enrolled as a Doctor of Education (Physical Sciences) student under the **supervision of Prof JG Ferreira (012 429 4540) in the Department of Curriculum Studies, College of Education at UNISA.**

As part of my studies, I am required to undertake research in fulfilment of the requirements for attaining my degree. The title of my research is; **“Factors affecting academic achievement of learners in Physical Sciences in Limpopo rural secondary schools.”**

The purpose of the research is to determine factors that are related to Physical Sciences achievement of learners in Limpopo rural secondary schools. The study will suggest ways to improve the teaching and learning of Physical Sciences, which should in turn increase the pass rate of learners who take this subject.

To complete this research five Physical Sciences teachers, five school principals, five parents of Physical Sciences learners and the Physical Sciences curriculum advisor will be interviewed in one-on-one interviews, which will not exceed an hour each. Five focus group interviews will be carried out with six Physical Sciences learners from each selected school and will also not exceed an hour.

Learners will be assured of confidentiality and anonymity and the name of their schools will not be made public. Learners will be asked to voluntarily sign a confidentiality agreement to ensure that the information discussed during the interview will not be discussed after the group disbands. Participation by respondents will be voluntary and they may withdraw at any stage. Anonymity and confidentiality will be assured to all participants. Furthermore, the research processes will not disrupt lessons or other activities at the schools that will participate in this exercise. Enclosed, please find copies of the draft interview schedules to be used for the research. The documents are submitted for your scrutiny and approval to undertake the research study. A written approval to be used as a letter of introduction to targeted schools would be appreciated. I therefore, request your permission to undertake this research at public secondary schools in Bochum circuit.

Thanking you in advance for your assistance.

Yours faithfully

Zenda Rekai

UNISA STUDENT 31070647 Persal Number: 83095268

Cell phone: 0711324455

Email address: zendarekai@yahoo.com

The Principal: High School

Bochum

Limpopo

23 September 2014

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN FULFILMENT OF THE REQUIREMENTS FOR A DOCTOR OF EDUCATION IN PHYSICAL SCIENCES (CURRICULUM STUDIES) WITH UNISA.

I am a Physical Sciences educator at Phagamang secondary school in Bochum West Circuit in Limpopo province. I am currently enrolled as a Doctor of Education (Physical Sciences) student with UNISA, under the supervision of Prof JG Ferreira (tel 012 4294540) in the Department of Curriculum Studies, College of Education, UNISA.

As part of my studies I am required to undertake research in fulfilment of the requirements for attaining my degree. The title of my research is; **“Factors affecting academic achievement of learners in Physical Sciences in selected Limpopo rural secondary schools.”**

The purpose of the study is to determine factors that are related to Physical Sciences achievement of learners in Limpopo rural secondary schools. To complete this research, Physical Sciences teachers, parents and Physical Sciences learners in Bochum Circuit will be interviewed. Focus group interviews will be carried out with the Physical Sciences learners.

Your school was randomly selected from the schools in the Bochum Circuit to participate in this research. I therefore request your permission to undertake this research at your school. An interview of no longer than an hour will be held with the Physical Sciences teacher in your school. I will also appreciate it if I could have an interview with you. Six learners in your school will also be requested to participate in a focus group interview to get insight into what learners experience as problems with Physical sciences. Permission will be sought from the parents. This research could help to improve the pass rate of learners in your school and will be of benefit to you and your teachers and future Physical Sciences learners.

Participation by your school is voluntary and anyone may withdraw at any stage without any penalty. Anonymity and confidentiality is assured for all participating schools and respondents.

Thank you in advance for your assistance.

Yours faithfully,

Zenda Rekai

UNISA STUDENT: 31070647

Cell phone: 0711324455

Email: zendarekai@yahoo.com

Zenda Rekai

C/o Prof Ferreira JG

UNISA

College of Education

Dept of Curriculum Studies

Pretoria 0003

23 July 2014

I, Mr/Mrs----- the principal of -----
- secondary school have granted Mr Zenda Rekai, who is a student with UNISA, permission to undertake a research study for the purpose of his studies with UNISA at my school.

Signature-----Date-----

Signature of researcher-----Date-----

Zenda Rekai

C/o Prof Ferreira JG

UNISA

College of Education

Dept of Curriculum Studies

Pretoria 0003

23 September 2014

The Physical Science Teacher: High School

Bochum

Limpopo

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN FULFILMENT OF THE REQUIREMENTS FOR A DOCTOR OF EDUCATION IN CURRICULUM STUDIES WITH UNISA.

I am a Physical Sciences educator at Phagamang secondary school in Bochum West Circuit in Limpopo province. I am currently enrolled as a Doctor of Education (Physical Sciences) student with UNISA, under the supervision of **Prof JG Ferreira in the Department of Curriculum Studies, College of Education UNISA.**

As part of my studies I am required to undertake research in fulfilment of the requirements for attaining my degree. The title of my research is; **“Factors affecting academic achievement of learners in Physical Sciences in selected Limpopo rural secondary schools.”** The purpose of the study is to determine factors that are related to Physical Sciences achievement of learners in Limpopo rural secondary schools. To complete this research, I need your assistance to collect data, which I will do through an hour-long interview. Your anonymity and confidentiality is assured and you are welcome to withdraw at any stage. The findings of this research will be made known to you and can prove to be of great value to improve the pass rate of our Physical Sciences learners.

Your participation is completely voluntary you may withdraw at any stage without any penalty. Your total anonymity and confidentiality is assured and privacy is guaranteed.

Thank you in advance for your assistance.

Yours faithfully,

Zenda Rekai.

STUDENT: 31070647

Cell phone: 0711324455 Email: zendarekai@yahoo.com

I, Mr/Mrs----- the mother/father/guardian of -----
----- have granted Mr Zenda Rekai, who is a student with UNISA, permission to undertake a research study
with my child-----for the purpose of his studies with UNISA.

Signature-----Date-----

Signature of researcher-----Date-----

Zenda Re kai
C/o Prof Ferreira JG
UNISA
College of Education
Dept of Curriculum Studies
Pretoria 0003
23 July 2014

The parent/guardian of:

Bochum

Limpopo

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN FULFILMENT OF THE REQUIREMENTS FOR A DOCTOR OF EDUCATION IN PHYSICAL SCIENCES (CURRICULUM STUDIES) WITH UNISA.

I am a Physical Sciences educator at Phagamang secondary school in Bochum West Circuit in Limpopo province. I am currently enrolled as a Doctor of Education (Physical Sciences) student with UNISA, under the **supervision of Prof, Ferreira JG in the Department of Curriculum Studies, College of Education, UNISA.**

As part of my studies I am required to undertake research in fulfilment of the requirements for attaining my degree. The title of my research is; **“Factors affecting academic achievement of learners in Physical Sciences in selected Limpopo rural secondary schools.”**

The purpose of the study is to determine factors that are related to Physical Sciences achievement of learners in Limpopo rural secondary schools. To complete this research, I would like to hold a focus group interview with six learners in the same school, one of which is your child. Your child will not be exposed to any harm and his/her name will remain anonymous. Your child may withdraw any stage during the interview, which will be no longer than an hour. The findings of this research may help to improve the past rate of Physical Science learners.

I therefore request your permission to undertake this research with your child. I repeat that participation is voluntary. Anonymity and confidentiality is assured for all participating respondents.

Thank you in advance for your assistance.

Yours faithfully,

Zenda Rekai.

STUDENT: 31070647

Cell phone: 0711324455

Email: zendarekai@yahoo.com

I, Mr/Mrs----- the mother/father/guardian of -----
----- have granted Mr Zenda Rekai, who is a student with UNISA, permission to
undertake a research study with my child-----for the purpose of his
studies with UNISA.

Signature-----Date-----

Signature of researcher-----Date-----

Zenda Re kai
C/o Prof Ferreira JG
UNISA
College of Education
Dept of Curriculum Studies
Pretoria 0003
23 July 2014

The Learner

Bochum

Limpopo

Dear Learner

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN FULFILMENT OF THE REQUIREMENTS FOR A DOCTOR OF EDUCATION IN PHYSICAL SCIENCES (CURRICULUM STUDIES) WITH UNISA.

I am a Physical Sciences educator at Phagamang secondary school in Bochum West Circuit in Limpopo province. I am currently enrolled as a Doctor of Education (Physical Sciences) student with UNISA, under **the supervision of Prof JG Ferreira in the Department of Curriculum Studies, College of Education, UNISA.**

As part of my studies I am required to undertake research in fulfilment of the requirements for attaining my degree. The title of my research is; **“Factors affecting academic achievement of learners in Physical Sciences in selected Limpopo rural secondary schools.”**

The purpose of the study is to determine factors that are related to Physical Sciences achievement of learners in Limpopo rural secondary schools. To complete this research, six learners in your school will be interviewed together in a focus group interview where you can discuss any problems you may have with Physical Sciences. It will not keep you for more than an hour. This is your chance to share your problems and you will be informed of the findings when the research has been completed.

I therefore request your permission to undertake this research and want to ask you to keep the discussions confidential to ensure the anonymity and confidentiality of everyone participating in the interview. Your participation is voluntary and you can withdraw at any time and your name will not be made public and all that you say will remain confidential.

What will be asked and answered during the focus group interview should remain confidential between the focus group and the interviewer. It should not be discussed with anyone outside the interview room. You should not tell anyone of what took place during the interview. The interview will take place at your school in a private room.

Thank you in advance for your assistance.

Yours faithfully,

Zenda Rekai

STUDENT: 31070647

Cell phone: 0711324455

Email: zendarekai@yahoo.com

I, ----- a learner of -----
--- secondary school agree to participate in a focus group interview for research for Mr Zenda Rekai for the purpose of his studies with UNISA. I will keep the information discussed during the interview confidential after the interview has ended.

Signature-----Date-----

Researcher's signature-----Date-----

Zenda Rekai
C/o Prof Ferreira JG
UNISA
College of Education
Dept of Curriculum Studies
Pretoria 0003
23 July 2014

The parent/guardian of:

Bochum

Limpopo

Dear Sir/Madam

RE: REQUEST FOR PARTICIPATION IN RESEARCH FOR THE FULFILMENT OF THE REQUIREMENTS FOR A DOCTOR OF EDUCATION IN PHYSICAL SCIENCES (CURRICULUM STUDIES) WITH UNISA.

I am a Physical Sciences educator at Phagamang secondary school in Bochum West Circuit in Limpopo province. I am currently enrolled as a Doctor of Education (Physical Sciences) student with UNISA, under the **supervision of Prof, Ferreira JG in the Department of Curriculum Studies, College of Education, UNISA.**

As part of my studies I am required to undertake research in fulfilment of the requirements for attaining my degree. The title of my research is; **“Factors affecting academic achievement of learners in Physical Sciences in selected Limpopo rural secondary schools.”**

The purpose of the study is to determine factors that are related to Physical Sciences achievement of learners in Limpopo rural secondary schools. To complete this research, I would like to have an interview with you as parent of a learner who does Physical Science at a selected school in the Bochum District. You will not be exposed to any harm and your name will remain anonymous. You may withdraw any stage during the interview, which will be no longer than an hour. The findings of this research may help to improve the pass rate of Physical Science learners.

I therefore request your permission to participate in an interview. I repeat that participation is voluntary. Anonymity and confidentiality is assured for all participating respondents.

Thank you in advance for your assistance.

Yours faithfully,

Zenda Rekai.

STUDENT: 31070647

Cell phone: 0711324455

Email: zendarekai@yahoo.com

I, Mr/Mrs----- the mother/father/guardian of a learner who does Physical Sciences have granted Mr Zenda Rekai, who is a student with UNISA, permission to interview me-----for the purpose of his studies with UNISA. I understand that I can withdraw at any stage and will be kept anonymous.

Signature-----Date-----

Signature of researcher-----Date-----

APPENDIX 9

DATA COLLECTION INSTRUMENTS

Interview guide to curriculum advisors

Curriculum advisor 1

What problems are faced by teachers in implementing Physical Sciences in schools?

Recently we have CAPS that needs to be implemented so we have new entrance of educators who are not used to the policies, because there are other sections which need to be examined at the end of the year, usually because they are not used to the new syllabus they just teach everything even those things in the old syllabus.

In what ways could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

Yes, in terms of workload it affects the achievement in Physical Sciences because teachers are not able to focus on individual learners and some also they are not able to give enough evaluation because teachers are not able to focus. In terms of teacher-learner ratio they do not have enough time to control written work.

As a curriculum advisor, how can your encouragement and motivation of Physical Sciences teachers improve learner academic achievement in Physical Sciences?

E-ee, as Physical Sciences educator I will request them to work more not to focus on the time provided to them as the educators just to follow the time table and the periods for Physical Sciences they need to have extra classes. The subject needs more practice. If you teach only and not ask learners to do some practical work they won't be motivated. Learners need to be motivated all the time. They need to act as role models and do some presentation to learners so that they are motivated.

To what extent has staff development of Physical Sciences teachers led to improvement of learner performance?

E-ee, it makes a lot of contribution because recently when we do staff development we realised that our educators gained confident in teaching the subject and then because of knowledge content to teach. It pays dividend, recently some of our educators were taken to Curriculum Development Programme (CPDP) were they were given some content workshops.

What is the importance of involving parents in the teaching and learning of Physical Sciences?

Ummm, those learners whose parents are taking part they do well because they do monitor them at home and also make sure that their children are writing the given homework. I think parents contribute a lot, sometimes when we visit the schools, we find that learners who are not performing well belong to child-headed families.

How does a lack of resources such as textbooks, laboratories and computer technology affect learner academic achievement in Physical Sciences?

Lack of resources contribute badly, learners need to work on their own to perform in Physical Sciences and this thing of were learners are able to do practical work especially in terms of laboratory work and also were learners who are able to access the computers, they can go to internet and also the issue of textbooks, we have some exercises in the books and learners are able to make notes using textbooks. Also the television and radio programmes contribute a lot towards the end of the year. During the holidays there are these programmes and those learners who are able to do that perform better.

What was the general performance in Physical Sciences from 2008 to 2012 in the schools you are working with?

We have a great performance because around 2008 within the district we were not doing well and we were around 37% but these days we talk of 61% so there is great improvement.

Probing question: What contributed to the performance?

The issue of supporting our educators and also the impact of parental involvement that is what impacted greatly because when we also check the written work when we support schools, we monitor the written work and also we support our educators by providing them with past exam exemplars. Regular supervision of written work that is what makes these results to go up.

To what extent have you engaged in supporting of Physical Sciences teachers?

We do a lot, that's why I said since our support because we came in 2008 that is when we started supporting our teachers. We had frequent visits to schools and that is when we inform policies to teachers. Also we do some short workshops on content based and also check on new policies to see if educators are implementing policies for Physical Sciences.

Which intervention strategies are employed in schools in order to improve learner academic performance in Physical Sciences?

The issue of writing more informal tasks such as class work and short tests and some schools even go to the extent of writing weekly and monthly tests. They are not only focussing on controlled tests and the standardising the work. When we visit the schools we standardise the tests to have quality. We also check the standard of written work. They are not writing class work or homework just for the sake of doing it.

How has learner economic and social positions influenced learner achievement in Physical Sciences?

Earlier on I stated that where there is computer, they are able to go to the internet. If we check with circuits which are deep in rural areas they are not able to access television, radios and newspapers and are not performing well than circuits which are accessing television and radio programmes. Even the child-headed families we realised that those children are not performing well.

Probing question: Why do you say so?

Learners from child-headed families some times are always absent from school therefore they lose a lot at school. If learners have access to computers they are able to search for information when doing homework.

How does language or medium of instruction affect learner academic achievement in Physical Sciences?

It affects badly because if learner is not able to read the question, really is not going to do well because the learner will not be able to read, they will just cram the question papers and year in year out the question papers does not differ a lot, they just give the same paper and just twist it therefore learners who will not be able to read will not be able to answer the questions well.

Class work, homework, tests and experiments are forms of assessment in Physical Sciences. Through which ways has assessment contributed to learner academic achievement in Physical Sciences?

E-ee, you see the schools that are doing well are the once that are giving more written work and homework, more tests and the issue of experiments, just to do a practical work in the class, learners do not forget easily. We are on record that those schools that are doing well are the schools that provide regular feedback and giving schedules. Learners are motivated because they are assessed and are given timeous feedback.

An effective teacher is one where the average achievement of the learners is higher than the expected, given the background of the learners and the context they are living in. To what extent has teacher effectiveness contributed to learner academic achievement in Physical Sciences?

The effective teacher also gives good results because he or she will be able to go to school on time, and always when it is his or her period is in class on time. He or she gives regular work and do assessment regularly, those teachers when you check, they also teach on Saturdays and they give extra work.

How can teaching methods affect learner academic achievement in Physical Sciences?

They contribute a lot because teaching Physical Sciences is not just going to class and just talk; you need to include all these teaching methods. E-eee, then you cannot rely on one method for example, textbook method or story telling method, you need to include all the methods. Learners need also to do a research on their own.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

Yah! Eish! I am not happy about it because that is what schools usually do because when they realise that they are not doing well in the subject they decide to phase out the subject. I realised that they do not have the correct teacher or teachers. Also doing Physical Sciences and Mathematical literacy, they need to be advised that learners who are doing Physical Sciences should also do pure Mathematics because there are some questions in Physical Sciences that a learner who is doing Mathematical Literacy will not be able to answer some questions. Learners will only answer conceptual questions, explain , state or do some definitions but questions that demand computational questions demand skills in pure Mathematics.

Do you have any other comments concerning learner performance in Physical Sciences?

Yah! Other comments, is that we need dedicated educators who can try to do more, to work extra and also as schools we need to do some remuneration to teachers. We also need some incentives or remuneration to teachers teaching Physical Sciences. We can ask for donors to assist when teachers come to teach on Saturdays in terms of incentives. Teachers teaching on Saturdays and holidays are given some remuneration. It pays dividend because schools which are doing so performance of learners is high. We also need to do some projects or some funny were we need to motivate these learners because motivation pays a lot, we need to see the role models demonstrating and assisting the learners.

Curriculum advisor 2

What problems are faced by teachers in implementing Physical Sciences in schools?

Number 1: Workload

Number 2: The content itself

Number 3: Most are faced with the culture of the schools themselves.

In what ways could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

In terms of workload they go together with teacher-learner ratio. If the school is very small it means that teacher does not only teach Physical Sciences, you find that he or she has to teach 4 to 5 different subjects. If it is a big school where we have big teacher-learner ratio, you find that the school may not be having accommodation itself, the teacher may not be able to cope with big classes. Even he or she has to do practical activities; you find out that shortage of resources will make it impossible for him or her to perform to his or her best level. Sometimes you find out those schools with big enrolment the teachers will not be able to give individual attention to the learners.

As curriculum advisor, how can encouragement and motivation of Physical Sciences teachers improve learner academic achievement in Physical Sciences?

We encourage our teachers to take into cognisance the contextual factors where possible, we address the teachers individually depending with the problem they encounter. In that way if it is in terms of content, we try to help the teachers individually. Even sometimes we visit the schools and assist the teacher in class where possible. We also encourage teachers or schools to outsource, to work together with neighbouring schools to assist one another. We also do this through subject committees where they assist one another.

To what extent has staff development of Physical Sciences teachers led to the improvement of learner performance?

In the case of staff development we realised that having involved the School Management Teams (SMTs) and all the stakeholders in the school they have come to understand that it is the responsibility of the school to make it available all the necessary apparatus that schools need and we say that there must be good communication between the teacher and the management. We need the SMTs to encourage the teachers to work hard were learner performance improve. Sometimes we call for workshops, calling teachers time and again to brief them on developments in the curriculum.

What is the importance of involving parents in the teaching and learning of Physical Sciences?

Parents will assist in monitoring the learners when at home. Parents will know the needs of learners, were there is a need and the schools cannot do especially in our case were the schools are Quintel one, were there is need the schools cannot provide the resources needed, we encourage parents to buy extra textbooks, were necessary if the teachers want to take the learners to educational tours, parents pay for that trip in terms of transport. Teaching without parents cannot be possible and were learners who do not have parents, the learner has to take the responsibility of being a parent. It also have an effect, it means the learner has to carry a responsibility of a learner and being a parent.

How does lack of resources such as textbooks, laboratories and computer technology affect learner academic achievement in Physical Sciences?

Sometimes it is not possible, as indicated it affects to a great extent, there are resources that even if you can ask parents they cannot be able to help even if they have to do practical work, it cannot be possible because of lack of apparatus. Sometimes if they can improvise, you find that learners may not understand. They are not able to search information from the internet. Our learners are not able to handle computers. Though we can encourage them to use their cell phones, they use them differently. Sometimes learners are unable to look for extra textbooks, one textbook they rely on that one. Our teachers choose textbooks without knowing its

content. If they are to ask for extra Learning and Teaching Supplementary materials (LTSM) it is difficult, sometimes schools are unable to make copies from other textbooks for learners.

What was the general performance in Physical Sciences from 2008 to 2012 in schools you are working with?

Generally the trend is that there is improvement every year, improvement quantitatively, but coming to qualitative improvement, the improvement is very slow.

Probing question: What contributed to the performance?

I think it is our coming in 2008 because we came late in 2007 and starting in 2008, that is where we came in and our part we played led to the improvement of the subject. Also I think that it might be the implementation of NCS.

To what extent have you engaged in supporting of Physical Sciences teachers?

We call volunteer content workshops. We visit schools where we have one to one or individual contact with the teachers. As curriculum advisors we provide formal tasks having sense that if we provide formal tasks teachers will be able to have time to teach.

Which intervention strategies are employed in schools in order to improve learner academic achievement in Physical Sciences?

I think it is no longer the same like in the past years; all teachers are now ready to engage in extra classes. Teachers are being supported by being given materials. Neighbouring schools help one another. Teachers are encouraged to give learners more written work than to have oral work using just a question and answer method. Quality work is given even in informal tasks that are what we are encouraging, that quality work must be given. The learners must know the skills of answering question papers and they learn how to respond.

How has learner economic and social positions influenced learner academic achievement in Physical Sciences?

Economically most of our learners come from poverty stricken families. It impacts most negatively because most of these learners are unable to do what is expected even the cell phones that they can use to search for internet, some do not have cell phones which they can access the internet. Economically we can say it is not good. On social positions, our societies are still coming to terms and most teachers are struggling with learners that come from poverty stricken communities. They have to take them out from such communities, where alcohol is not prohibited and drugs are affecting the learners.

Probing question: Why do you say so?

If economically and social system are in good standing, our results will be much better. If our teachers do not give extra time, there will be a problem, socially most of the parents do not care, if a learner goes for a weekend, the learner is out and will not be having assistance and will not give time to his or her studies.

How does language or medium of instruction affect learner academic achievement in Physical Sciences?

It affects negatively because you find that our learners, English as being the language of teaching and learning is not good, they may not understand the terms that are used scientifically, and they use them wrongly. For example, for electricity they say is fire, so they interpret wrongly. Our learners are unable to interpret questions, even if the question is very simple, our learners will not be able to interpret the questions. They always want the teacher to interpret for them. When coming to examinations, if it is a new question the working is new to them. They are unlikely to interpret it correctly.

Class work, homework, tests and experiments are forms of assessment in Physical Sciences. Through which ways has assessment contributed to learner academic achievement in Physical Sciences?

Since the encouragement of giving quality questions during these tasks, class work, homework has led to great achievement in Physical Sciences. During this learners

exercise time management and with practical work, if learners are engaged in practical work they understand and improve rather than involving them theoretically.

An effective teacher is one where the average achievement of the learners is higher than the expected, given the background of the learners and the context they are living in. To what extent has teacher effectiveness contributed to learner academic achievement in Physical Sciences?

We think that it has improved very well because looking at our communities where science is something according to them something that they learn in everyday activities. Teachers have done a great deal in linking what happens in the classroom with what is happening in their communities and their homes, though it is very difficult for a learner to understand some of these things since they will be not there.

How can teaching methods affect learner academic achievement in Physical Sciences?

They have an effect; teachers have to use various methods of teaching Physical Sciences because if they resort to one, only a few or none of the learners learn from that method. Some learners learn through seeing, some learners learn through doing and some learners learn through hearing being part of the lesson. If teachers resort to one, he or she has excluded others. Different methods need to be employed.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

I am against it because it means that if these learners go for simpler subjects, according to them Physical Sciences goes together with Mathematics so in most cases you find out the schools remove Mathematics or remove Physical Sciences. If the school removes Mathematics or removes Physical Sciences or learners are doing Physical Sciences together with Mathematical Literacy. Learners will not go anywhere. It ends up to a community that is not able to solve the needs of the society. They remain at home being part of the problem not being part of the solution.

Do you have any other comments concerning learner performance in Physical Sciences?

My comment is on subject choices, we are having a challenge as curriculum, where we find out that learners in grade 10 choose that they will do Mathematics and Physical Sciences, when it comes to grade 12 our learners resort to do Mathematical Literacy. When it becomes tough, you find that in grade 12 our learners resort to do Mathematical Literacy, they just want to pass. Learners are just interested in passing only these six subjects and not having a vision of where to go. If learners just want to pass six subjects, Physical Sciences is one of these subjects that is thrown away and at the end of the day the performance of Physical Sciences is not good and hence we can say our learners are passing yet, they will be in level 2 and we find that we think that our learners are passing when they are not.

APPENDIX 10

INTERVIEW GUIDE TO PRINCIPALS

Principal 1

What criteria allows for the guidance of learners before they choose Physical Sciences as a subject at grade 10?

The only criteria we are using are we look for careers, careers around the world where learners can work, careers around. Another criteria we use is that those learners who achieve well in Mathematics are in most cases are learners who do Physical Sciences.

How could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

On the workload or teacher-learner ratio, for those learners who do not achieve well, teachers do not have time for them because they are always many in class.

How can motivation affect learners' academic performance in Physical Sciences?

A-aa! U-mm! If they are well motivated and given the examples of people who have done Physical Sciences these learners will be interested in doing Physical Sciences and then for those people who are working, they need to be given examples of such learners.

How does discipline affect learner academic achievement in Physical Sciences?

By coming to discipline, in most cases the learners who are doing Physical Sciences are the most disciplined. They are always busy. Physical Sciences need a lot of practical work so they are always busy.

Probing question: How do you enforce discipline to the learners and teachers?

U-mm! Of course discipline on learners, we give them a lot of work to do so if they have a lot of work to do they do not have time to loiter around and gossiping

because they are always busy. For Physical Sciences teachers, learners attend morning and afternoon lessons.

In what ways can parents assist their children who do Physical Sciences to promote academic achievement?

The parent involvement is that those kids of parents who do Physical Sciences, we show them their achievements, those doing well or not. Parents must see that their children do their work. Parents must see to it that those kids do their work and they must sign after seeing their work.

How can textbooks, laboratories and computer technology affect learner performance in Physical Sciences?

If the learners have, M-mm, a suitable textbook then they can achieve it, if they have laboratories it will be easy for the teacher or learner to do experiments or if they have computer technology they can have exemplar questions and even use of lessons which are taught through television and radio programmes.

What were the grade 12 Physical Sciences results in your school during the past five years?

For the past 3 years it was a little bit lower but for the two years the results improved, we achieved 75% last year 2013.

Probing question: What in your view may be the factors that may have led to these results?

A-aa! For the poor results I can say it was because of the teacher there and the attitude of learners towards that teacher and by now and the past 2 years for the results to improve, I can say the teacher concerned or the new foreign teacher give them more work, learners are given a lot of work. If you visit the class you see learners doing Physical Sciences. Learners do not have a negative attitude towards the teacher, they enjoy the subject.

To what extent does supervision of teachers affect learner performance?

E-ee! When we supervise them, we can see that they are always busy. We can see that they are always reading and we give them methods of how to read and proving

it we see to it that these kids are practising and if they are to pass, these kids need to participate.

What intervention strategies do you employ in your school to improve learner academic achievement in Physical Sciences?

E-ee, learners are given a lot of work to do, a lot of practice or practical activities. Learners attend morning and afternoon lessons and Saturday lessons. Sometimes reinforcement together with teachers reinforce by inviting other teachers who are good in Physical Sciences to come and assist.

In your opinion what effect do career exhibitions or expos, have on learner academic achievement in Physical Sciences?

After attending the career exhibition or expos, the learners when they come back, they return with the application forms and knowledge of the requirements of the careers, learners tend to work harder. They will have seen the requirements or pre-requisite of the careers.

In what way does language or the medium of instruction affect learner academic achievement in Physical Sciences?

I can see that most of the learners cannot interpret the sources, cannot interpret questions and cannot interpret experiment phrases because of language, there is a language barrier.

To what extent can the assessment of learners in Physical Sciences contribute to academic achievement?

E-ee, if these learners are assessed now and then so that they write pre-test before they write common test. That pre-test prepare them for the common task, those learners can improve their academic achievement and then even the informal tests can improve.

To what extent is performance of learners in Physical Sciences linked to teacher effectiveness?

E-ee, if the teacher is effective automatically the learners will be effective. If the Physical Sciences teacher is effective in class the Physical Sciences learners will be effective. If they are effective, it means their performance will be improved.

Which teaching methods can Physical Sciences teachers use in order to improve learner academic performance?

I cannot say this method can improve the results; the type of method is assessing them during and after the lesson. He or she can ask the learners questions and questions asked must be exam related meaning that he or she must use past exam papers.

Probing question: How do they help in improving learner performance?

Teaching methods motivate learners to work harder in class. They allow learners to share through group activities.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

No, no, in our school Physical Sciences as from the coming 3 to 4 years is a compulsory subject because most of the careers require Physical Sciences as one of the pre-requisite, so if you remove Physical Sciences from the curriculum most learners will be disadvantaged in future and overall pass rate cannot be affected by Physical Sciences only. They need to check the other subjects whether they lower the results or not. We cannot say it is Physical Sciences.

Principal 2

What criteria allows for the guidance of learners before they choose Physical Sciences as a subject at grade 10?

Firstly sir, we show them advantages of choosing Physical Sciences, we know that Physical Sciences has many advantages, if one wants to become a doctor, engineer,

then secondly we also ask them the careers they want to pursue after grade 12. We also tell them the careers when they get to grade 10.

How could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

Since Physical Sciences is a challenging subject we always want a small group because we want a small group so that the teacher can manage them. If he or she gives them a task he or she may not be able to control the tasks.

How can motivation affect learners' academic performance in Physical Sciences?

By the term motivation it means that we talk to the learners to instil love of the subject, knowing very well that if they have love for the subject learners will do better.

How does discipline affect learner academic achievement in Physical Sciences?

When coming to discipline both learners and teachers must be prepared to work hard as I have indicated that Physical Sciences is a challenging subject, work hard in the sense that they must be prepared to attend extra lessons. That is why we want hard working learners in Physical Sciences.

Probing question: How do you enforce discipline to the learners and teachers?

Learners are given a lot of work to do at school and at home and this keeps them busy all the time. Learners follow a code of conduct at school.

In what ways can parents assist their children who do Physical Sciences to promote academic achievement?

Thank you! Is a fact that parents must support their children; they must buy them materials in which the school cannot provide, such as study guides. Parents are encouraged to support their children by organising Physical Sciences teachers to assist their children at home.

How can textbooks, laboratories and computer technology affect learner performance in Physical Sciences?

I think with those they help learners increase their knowledge meaning that if they use different textbooks that will help them to improve in Physical Sciences.

What were the grade 12 Physical Sciences results in your school during the past five years?

There is an improvement; in 2009 we obtained 57.1% meaning that the results have improved because they range from 57.1% to 100%. The same applies in the levels there is also improvement. In 2013 we did not have a learner with level 1.

Probing question: What in your view may be the factors that may have led to these results?

When the year starts teachers and learners here are told to do their business at school meaning that the teacher must see to it that he or she finishes the syllabus in time and must not rush to finish the syllabus. The teacher must be together with the learners and Learners must be seen busy all the time.

To what extent does supervision of teachers affect learner performance?

Yes, now with supervision teachers and learners should never be left alone, they must be supervised with the head or HOD. Same applies here, we supervise their work meaning that teachers go to class and teach and learners learn something. We make it a point that when the teacher wants to meet the learners, learners must be in the classroom. Learners must be the first once to be in the classroom.

What intervention strategies do you employ in your school to improve learner academic achievement in Physical Sciences?

Thank you, with this we have many intervention strategies, teachers are told to start teaching from day one, secondly we also organise extra lessons and thirdly we analyse the results after every test.

In your opinion what effect do career exhibitions or expos have on learner academic achievement in Physical Sciences?

Yah, with this I think they are there to advise learners of careers available to make them love the subject.

In what way does language or medium of instruction affect learner academic achievement in Physical Sciences?

Is a fact here that language is a barrier to learning, for example, learners who have a good command of the language that is English always perform better.

To what extent can the assessment of learners in Physical Sciences contribute to academic achievement?

Assessment here is very important especially the headmaster has a focus we make use of the previous question papers to assess the learners throughout the year. By so doing the learners know how to answer questions that is why we have improved.

To what extent is performance of learners in Physical Sciences linked to teacher effectiveness?

Now performance of learners is a result of effective teaching and is brought about by the preparedness of the educators meaning that when the educator goes to class we expect him or her to be thoroughly prepared and give knowledge to learners.

Which teaching methods can Physical Sciences teachers use in order to improve learner academic achievement?

Now by the teaching methods such as working in groups help.

Probing question: How do they help in improving learner performance?

Learners are able to share ideas and help one another in difficult topics.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

Now that we are in 2014, I think it is not a wise thing for the school headmaster to phase out the subject because nowadays Physical Sciences is seen as important subject since many careers require Physical Sciences. I can also say that when learners do not perform well in Physical Sciences, whoever the headmaster is must stand up and outsource. It is very important because it is a good subject.

Principal 3

What criteria allows for the guidance of learners before they choose Physical Sciences as a subject at grade 10?

We do not have criteria due to lack of resources, we only use grade 9 results of Mathematics and then if a learner performs more than 50% in Mathematics we just take it from there. We also take learners who have interest in Physical Sciences.

How could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

E-ee, teacher-learner ratio is a serious challenge especially in our rural schools because you find that educators facing more than 60 learners in the grades at FET. Teacher is not able to attend to learners one by one. This can affect performance of learners as we know that Physical Sciences is a practical subject so sometimes an educator does not even have a chance to do practical activities with them.

How can motivation affect learners' academic performance in Physical Sciences?

We motivate learners by giving them more work and allowing them to attend career exhibitions. We announce top 10 in the subject and grades. We also announce the best learners and provide the necessary resources for them. It is the responsibility of the educator to identify weak learners and assist them.

How does discipline affect learner academic achievement in Physical Sciences?

Since there is no proper way of disciplining a learner who obtains below, there is no proper way, if a teacher detains learner it is his responsibility to see that the learner reaches home safely. It will be difficult for the educator to use this method if learners are more than 40. It is the responsibility of the educator to maintain discipline in the class.

Probing question: How do you enforce discipline to the learners and teachers?

We punish learners who do not do their work. We just assist educators to be patient with them; to be patient is another way of motivating the learners so that you must not treat them with harsh. You must also motivate them to like the subject.

In what ways can parents assist their children who do Physical Sciences to promote academic achievement?

In our school we have a problem of unemployment and illiteracy levels, they just assist them to commit themselves to their work. They cannot do more, they can assist them to do their work and love the subject not to have attitude towards the subject.

How can textbooks, laboratories and computer technology affect learner performance in Physical Sciences?

They can only affect learner performance if they have irrelevant information and if they are not properly used.

What were the Grade 12 Physical Sciences results in your school during the past five years?

2010 they were extremely poor and horrible, 2011 very poor, 2013 we got 40%.

Probing question: What in your view may be the factors that may have led to these results?

We do not have proper monitoring and support from the curriculum advisors and teachers' support materials were not there. Relevant resources are not there and we are unable to reach information in time.

To what extent does supervision of teachers affect learner performance?

E-ee frequently monitoring and checking , sometimes you may find out that because we have many learners in a class we may find that teachers do not have time to check the books in a period of one hour and give learners feedback in time. Teachers do not control learners' books and provide feedback on time.

What intervention strategies do you employ in your school to improve learner academic achievement in Physical Sciences?

We try to outsource internally and externally and we try to come out with morning, afternoon and evening studies. We also try to buy learners some study guides and do camping.

In your opinion what effect do career exhibitions or expos, have on learner academic achievement in Physical Sciences?

We take learners to Wits Watersrand University and they have attended many places in Johannesburg so that they can just improve their performance.

In what way does language or the medium of instruction affect learner academic achievement in Physical Sciences?

It affects the learners in such a way that we must not forget that this is not their mother language is not their mother tongue. You find that they misunderstood the questions and may not answer the questions well. If a learner is not well in English he or she may not be able to answer questions.

To what extent can the assessment of learners in Physical Sciences contribute to academic achievement?

If you do not show them their mistakes in time and if you do not give them feedback, obviously it is going to affect their performance. Physical Sciences needs thorough investigations and experiments. You must frequently check learners' books so that you can be able to identify slow learners, lower achievers and higher achievers.

To what extent is performance of learners in Physical Sciences linked to teacher effectiveness?

I think if educator is not clear or well prepared when going to class, it also affects performance of learners. If you go to class unprepared and if you do not know the subject matter it is going to be a problem. If the educator is not clear that he or she is not good in a particular topic it affects the learners. If he or she does not outsource for the expert it is going to be a problem.

Which teaching methods can Physical Sciences teachers use in order to improve learner academic achievement?

I would advise you to use question and answer method.

Probing question: Why do you say so?

Because it is a practical subject if you give a learner a question to answer and a learner does not answer the question or did not get it correct you will need to show the learner how to answer that question. In Physical Sciences there are many ways of teaching it.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

I do not think it is correct to remove Physical Sciences because we are moving in a world of changes. As you can see now that the country needs doctors and scientists how can you remove the subject which is relevant to the new era. The other thing, I do not think they are removing Physical Sciences because they do not like it but

because we do not have the relevant educators so that they can motivate our learners to have interest in Physical Sciences.

Principal 4

What criteria allows for the guidance of learners before they choose Physical Sciences as a subject at grade 10?

We do not have specific criteria; we just give them a freedom that is their choice. What we do in grade 9 is that we only advise. We do not have criteria.

How could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

I think just like in all the other subjects the workload has a direct impact on learner performance. If you are having a large class it will be very difficult to give individual learner attention. I think workload plays a negative role in Physical Sciences.

How can motivation affect learners' academic performance in Physical Sciences?

I think this one is key in Physical Sciences because if learners are motivated that in itself pushes achievement to a very highest level. Sometimes learners fail because they are not motivated because they do not know what they are going to do after passing grade 12. From grade 10 they should know what career paths they can follow can improve performance.

How does discipline affect learner academic achievement in Physical Sciences?

Discipline has an impact on learner achievement because where there is no discipline it means the environment is not conducive. You need to work in the environment that is conducive to learning. You need learners who are disciplined when teaching Physical Sciences. If you give them work they do that work and if you give them work and they do not do it there is no way they can perform.

Probing question: How do you enforce discipline to the learners and teachers?

M-mm, what we do we have a code of conduct in terms of learners that we really enforce and they do learners need to know on how they should behave themselves. If they do not behave they should know what punishment or correct measure is going to be done to them. When coming to teachers they must follow South Africa Council of Educators (SACE) code of conduct. We do not have a serious problem when coming to discipline.

In what ways can parents assist their children who do Physical Sciences to promote academic achievement?

There are many ways in which parents can be helpful, for example, lets say there is a trip or career exhibition, you will need parents who are going to support their children financially. If you are an educator and you need to work with learners during the weekend you need support from the parents. Parents play a role in releasing their children to come to school. We need the support of parents and their involvement is vital in improving learner performance.

How can textbooks, laboratories, and computer technology affect learner performance in Physical Sciences?

U-mm, these are educational support materials, they assist a lot when you are having technology you can do things like simulations. You do things you are not able to do in class. You show video or things that are impossible to do in class. You take video recorded information and learners can watch that. If you are working with generators you can show how they work. Technology is very much important. Also the issue of laboratory you cannot stress, for example in Physical Sciences we have to do experiments as part of assessment and to help learners to understand.

What were the Grade 12 Physical Sciences results in your school during the past five years?

Last year we got 75% that is 2013, and in 2012 it was a bit down around 50%, in 2011 it was better around 60% and 2010 it was around 40%. Now it means it is going up.

Probing question: What in your view may be the factors that may have led to these results?

E-ee, I think one thing which is key especially during the years when learners were not performing is that learners did not cover the grade 10 and 11 work well. Learners lacked the basics from previous grades 10 and 11 so lack of basics played a great role. The other one, I think for grade 10 and 11 in 2010 and 2011 as leadership we made a mistake by passing learners who failed grade 11 to move to grade 12 when actually they did not pass, so this thing of condoning learners was a problem. We have now taken care of those factors and that is why you see our results have an upward trend now.

To what extent does supervision of teachers affect learner performance?

Eish, to a great extent if you do not supervise teachers' work you find out that in some cases teachers do not give learners work and teachers do not attend classes. There is no way you can expect learners to pass if teachers are not doing their work and not attending classes. Supervision sees to it that teachers are doing their work and they cover work schedules or pace setters as prescribed.

What intervention strategies do you employ in your school to improve learner academic achievement in Physical Sciences?

U-mmm, number one we do have the help of NGO (TRAC) which come weekly to do experiments with our learners and that is one thing that is helping in improving our results. For teachers for grade 11 and 12 classes we have extra classes that help us to finish the syllabus early and in that case we are able to do revision timeously, that is why in Physical Sciences all learners are doing well.

In your opinion what effect do career exhibitions or expos, have on learner academic achievement in Physical Sciences?

I think career exhibitions or expos have an impact, if you are dealing with learners who know what career path to follow the learners will be focused. Learners know that they must pass at this level but dealing with learners who do not know where to go every achievement is fine to them.

In what way does language or the medium of instruction affect learner academic achievement in Physical Sciences?

It does have an impact but I do not think is actually a significant impact, sometimes when you mark the work, you can see that the learner has an idea but cannot express it correctly. Sometimes the learner has to use vernacular to answer the questions so language creates a barrier to learning.

To what extent can the assessment of learners in Physical Sciences contribute to academic achievement?

U-mm, assessment I think is one key that helps in improving academic achievement. If you assess your learners well you get them used to questions that will come during the year and with regular assessment you can identify areas which learners are not doing well and regular assessment helps in improving learner performance in Physical Sciences.

To what extent is performance of learners in Physical Sciences linked to teacher effectiveness?

A-aa, I think this one, you know if you are having a teacher who is confident, a teacher who knows the content knowledge it improves in terms of performance because if you are having a teacher who is not confident and does not know the content very well, for example, if you are having a teacher who is not confident it impacts negatively on performance in Physical Sciences. If you have a teacher who is not confident that is when we have a problem of a teacher dodging the classes.

Which teaching methods can Physical Sciences teachers use in order to improve learner academic achievement?

I think it has to be a combination of teaching methods, sometimes a teacher has to do lecturing where he or she just tell learners a concept but also need to apply methods which are learner centred approach. You need to apply learner centred approach. You need to do activity based approach in Physical Sciences regularly, you need to integrate this thing of experiments.

Probing question: How do they help in improving learner performance?

Yes they help in improving performance in quite a number of ways, for example, a teacher knows how to use learner centred approach. Learners can learn to do things on their own and teacher can come in to give assistance to learners and also if you want to treat past exam question papers learners learn to do things on their own. The teacher can come in and give assistance to learners unlike with the teacher doing things for the learners.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

I think may be the problem in those schools is that the schools have teachers who are not qualified in the subject or teachers who are not committed to the work. As far as I am concerned Physical Sciences is not necessarily a very complicated subject. If you have well qualified teachers who are committed to their work, there is no way you can remove the subject and also that will be working against government policies. In general we have shortage of professional skills and careers of people who are doing Physical Sciences so you cannot take out Physical Sciences.

Principal 5

What criteria allows for the guidance of learners before they choose Physical Sciences as a subject at grade 10?

Normally learners from grade 9 are doing Natural Sciences and then for one to guide them in choosing Physical Sciences it will be based on their performance in Natural Sciences particularly the Physical Sciences part and then learners who are performing well in Natural Sciences mostly the Physical Sciences part may be advised to take Physical Sciences in grade 10 depending on one's performance.

How could workload or teacher-learner ratio affect learner academic achievement in Physical Sciences?

Workload or teacher-learner ratio can affect learner academic achievement in Physical Sciences in the sense that Physical Sciences is a very practical subject and then it needs ample space so that the learners can be able to perform practical

activities and be able to manipulate objects. Learners can be able to use chemicals in an open space. If classes are overcrowded the teacher-learner ratio cannot correlate and sometimes it can be hard to perform experiments.

How can motivation affect learners' academic performance in Physical Sciences?

Motivation is always needed to learners particularly to encourage them to perform well so in Physical Sciences motivation is needed. You can at times outsource specialists for Physical Sciences from other institutions or you can form partnership with other institutions whereby you know that they are well resourced so that learners will be able to face this subject.

How does discipline affect learner academic achievement in Physical Sciences?

Mostly Physical Sciences is rated as one of the challenging subjects so as a result learners taking Physical Sciences as their main subject should be able to be disciplined and should be able to work harder with the help of their educators.

Probing question: How do you enforce discipline to the learners and teachers?

Discipline goes hand in hand with the general performance of the schools in the sense that at times learners behave well in the school premises if the teachers are also displaying that good behaviour and then for the learners to behave well they must be shown the importance of education. Teachers should be good role models to the learners so that learners can copy the good things their teachers will be doing hence there will be discipline in the school.

In what ways can parents assist their children who do Physical Sciences to promote academic achievement?

These days there are so many sources which can enable learners to perform extremely well in Physical Sciences. Parents at home can assist their children to watch television programmes such as extra learning whereby experts are teaching Physical Sciences. Parents can even allow their children to have extra lessons whereby they will be taught by experienced or experts hence their teacher will be playing a prominent role in the school.

How can textbooks, laboratories, and computer technology affect learner performance in Physical Sciences?

If learners are well supplied with textbooks or if all learners in a class have got textbooks it will be easier for the teacher to use the textbooks as one of the resources or learning aids because if learners do not have textbooks the teacher needs to photocopy each and everything that he or she thinks might be needed by learners. Learners can use the textbooks at home when they are doing their homework. As one of the practical subjects it needs to be taught in a laboratory hence in most cases if there are no laboratories in the schools learners will resort to theory than practice. If they complete grade 12 they might experience problems if they use the resources for the first time at the tertiary hence the laboratory can facilitate teaching and learning in the classroom. Computer technology is very necessary because most of the things can be done through the use of computers. If learners are taught using computers some of the things which are not accessible to them like chemicals, as they see them it will be more like they are doing those things.

What were the Grade 12 Physical Sciences results in your school during the past five years?

In the past five years the grade 12 Physical Sciences results in our school were not that good because at our school we did not have the laboratory and we were faced with a great challenge whereby our learners spent most of their time without a qualified teacher. The school depended on educators from outside and this affected our results in the last five years.

Probing question: What in your view may be the factors that may have led to these results?

The factors that have led to these results like I said earlier amongst other things, I talked about our school not having a Physical Sciences teacher for some years because most of our Physical Sciences educators came and went because of promotional posts. You find out that the learners will have no teacher for a month or more. Sometimes it took the department a long time to supply us with a Physical

Sciences teacher who can teach these learners. In most cases we depended on Life Sciences teachers to teach the subject which will be easier because it will be part of Physical Sciences.

To what extent does supervision of teachers affect learner performance?

Supervision of teachers can affect learners negatively so but now as a principal if one is applying Management by Walking Around (MBWA), if principals use this method they can detect or identify teachers who are not attending lessons and teachers who are absconding classes and teachers who are not attending their periods. Supervision is needed to ensure that teachers attend to their classes and educators give learners enough work. Educators need to monitor and control written work because enough written work can make learners perform well in Physical Sciences.

What intervention strategies do you employ in your school to improve learner academic achievement in Physical Sciences?

Our school is presently using a sponsorship partnership with African bank which is sponsoring TRAC which come to our school once a week to do experiments with the learners. They make use of computer technology in teaching experiments as a result our results are improving bit by bit. We are also encouraging learners to attend Saturday classes. I believe they can manage to complete their syllabus and be able to face each and every question paper. Even that of outsourcing is a strategy; one educator cannot be able to be a master of all.

In your opinion what effect do career exhibitions or expos, have on learner academic achievement in Physical Sciences?

I think career exhibitions or expos are playing a very prominent role in the academic achievement of learners in Physical Sciences in that normally learners attending them they meet experts from various institutions offering various fields. Learners feel self motivated knowing very well that the career path that they want to follow needs them to pass Physical Sciences at a particular level as a result they get motivated in trying to work hard in order to achieve. Learners know what to do and the requirements of the career. If one learner wants to be a doctor and that learner is not conversant that for him to be a doctor he or she needs to have level 6 or 7. Hence

these career exhibitions or expos expose the learners to the field of study they want to pursue in future.

In what way does language or medium of instruction affect learner academic achievement in Physical Sciences?

Normally Physical Sciences is taught through the medium of English and learners should be conversant with English as a medium of instruction so that they will be able to understand Physical Sciences language. I think a language teacher on the other hand must be a master of language, which makes the learners understand the language and the language that is used in Physical Sciences. If a learner does not understand English as a medium of instruction then that learner may face a problem of comprehending some of the questions asked in Physical Sciences.

To what extent can the assessment of learners in Physical Sciences contribute to academic achievement?

In fact assessment at school plays a very prominent role in the sense that learners who are assessed regularly perform well. Learners understand how questions are asked and review of feedback. If assessment is done and feedback is done then learners will be able to understand the subject.

To what extent is performance of learners in Physical Sciences linked to teacher effectiveness?

A Physical Sciences teacher must be a versatile somebody and must be a person who is devoting too much of his or her time to the subject. The teacher must show the learners love and must allow the learners to question whatever they want to question because if learners are not performing well and the teacher is de-motivated it will be a disaster. If the teacher is showing appreciation of the subject, learners will also develop a positive attitude hence that will lead to good achievement in the subject.

Which teaching methods can Physical Sciences teachers use in order to improve learner academic achievement?

Like I said earlier Physical Sciences is a practical subject and I think textbook method can be one of those methods that can be used whereby the teacher can

frequently ask the learners questions. Discovery method can be used whereby the educator can come up with a situation where learners can make use of chemicals. Since experiment method can also be used and learners must be exposed to several experiments and must perform those experiments with the teachers as individuals and as in groups, as a result teaching and learning will be facilitated.

Probing question: How do they help in improving learner performance?

Experiment method can help in improving performance of learners because if learners do something practically they will not forget easily. Let us assume learners are faced with a situation that 2 hydrogen and one oxygen can be used at room temperature with enzyme platinum so as to form water. Learners can talk about how water is formed, then they know that with 2 hydrogen and one oxygen with enzyme water is formed. Practical work plays a prominent role in teaching Physical Sciences.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate which ends up affecting the overall pass rate of the school. What are your views on this issue?

In the past five years our school was not performing well in Physical Sciences according to my view a school without Physical Sciences is just like a torso because these days learners are forced to do Physical Sciences and Mathematics, the reason being that there are so many challenges that the government is facing, there is a need for engineers. If we do not have engineers, the mining sector will suffer and if there are no doctors the health sector will also suffer. That is why our country have a lot of Cuban doctors because there are so many doctors in Cuba but in our case if those schools are not doing Physical Sciences it means that those fields which need Physical Sciences will be duped.

APPENDIX 11

INTERVIEW GUIDE FOR PHYSICAL SCIENCES TEACHERS

Teacher 1

Tell me about the Grades and the subjects you teach.

I am teaching grade 8 Technology and Life Orientation, I am also teaching grade 9 Technology, I am also teaching grades 10, 11 and 12 Physical Sciences and I am also teaching grade 12 Life Orientation.

What kind of problems do you encounter as teacher if there are more than 20 learners in a class?

Teacher-pupil interaction is greatly reduced and then some learners who are not very well disciplined will tend to disrupt the smooth flow of the lesson.

Probing question: What will you change in your teaching if your classes were smaller?

I would change my teaching methods.

To what extent does your lesson preparation contribute to learner achievement in Physical Sciences?

Oh! To a greater extent, in most cases if I am thoroughly prepared I realise that it is easier to achieve the objectives and follow up on the lesson and sometimes when I am not thoroughly prepared I end up repeating things, but normally I am prepared.

Probing question: Why do you say so?

I think I have answered that.

Which resources would you like to have that would help you improve your learners' achievement?

I do not have textbooks for a start, learners' textbooks are not available and then resources for practical activities are not there at all: even the basic kit is not available and this is affecting learners' performance seriously because some of the activities need hands on approach and then in the absence of the resources is the setback.

Probing question: How can these resources assist with improving performance?

As I alluded above is that some of the approaches need hands on approach, if the resources are not there it is a minus.

To what extent has language or the medium of instruction affected learner performance in Physical Sciences?

Ya, this is a major, major, major barrier, in fact it is a learning barrier. The way I see it is that the learners have a serious language barrier. They cannot understand what the question is asking for and even if they can read on their own and again myself I am not well versed with the home language.

Probing question: Why do you say so?

I teach in English and learners do not understand especially were explanations and descriptions are required like in Chemistry and those who are too slow is a problem they cannot express themselves well.

In what ways do you as teacher encourage your Physical Sciences learners to work harder?

I encourage them in many ways by talking to them about some careers which are rewarding like engineering, medicine and chemistry related careers and Biology related career. I try to explain to them as much as I can how rewarding these careers are. I encourage them to come to school at half past six and to come in the afternoon at 5 o'clock and most of them are enjoying it.

Which teaching methods do you find help learners to understand Physical Sciences content better?

A-aa, I have realised that if I group them in small groups and give them some content to work on and later present those items, a follow up assessment shows that they perform better than if I use the lecture method, since we don't do practical activities so this method of research and presentation is more effective as far as I am concerned.

Probing question: Why do you say so?

I say so because from experience I have seen learners motivated and the performance improving.

Why is assessment part of teaching and learning?

To evaluate, is a way of evaluating concept mastering on the part of the learner and then also as a way of formative evaluation on the part of the teacher. Is a way to see if teaching method was effective or not. It is a way of evaluating both learners and teacher to improve performance.

Probing question: How do you assess learners to improve their performance in Physical Sciences?

Normally I use end of topic test as diagnostic measure and then sometimes I also have some summative test at the end of the month just to determine retention capacity after a period of time.

How do parents involve themselves in the teaching and learning of their children in Physical Sciences?

U-mm, I have never encountered that I have not seen any parent talking about that. A-aa, no they do not talk about that.

How does the principal assist with helping you improve learner performance?

Laughing, specifically in Physical Sciences, Eish, of late he has been encouraging other teachers to also teach in English so that at least learners get used to the language of instruction in a way it helps Physical Sciences but direct encouragement, I have not experienced it even end of results he does not comment about specific subject results. I do not know.

How does the curriculum advisor help you improve learner performance?

E-ee, curriculum advisor, E-ee, I have not received much help from the Curriculum advisor because when we meet they will be talking about results and sometimes but is very infrequent let me say is seldom, that we seldom meet may be once or twice a year talking about CAPS.

What intervention strategies do you use in order to improve the achievement of your Physical Sciences learners?

Like I have said it in question 6 that I am encouraging them to come at half past six and finish at 5 o'clock in the afternoon. Sometimes I also give a little bit of incentives in tests. Sometimes when I give them challenging questions and the first learner to get the answer correct will be rewarded. I make use of rewards and punishment in the form of lock ups and withdrawal of some privileges.

How does your workload affect your teaching of Physical Sciences?

To say affecting is an understatement, the workload, E-ee, is too much that I am saying I am operating at 50%, I have 43 periods, of which of the 43 , 24 are for Physical Sciences. If I was to have 24 only is obvious that we were going to start talking about quality here.

What was your Grade 12 pass rate from 2010-2012 in Physical Sciences?

In 2009 it was 29%, 2010 it was 34%, 2011 it was 47% and 2012 it was 75%.

Why do learners not perform according to your expectations?

Yah, just because of language barrier and then indiscipline, overall school indiscipline, learners are undisciplined and motivation is very poor and lack of role models within their vicinity and then the idea of non-science material learners forced to do Physical Sciences, that's a serious one. Learners do not choose to do Physical Sciences as you know it needs some learners who are mathematically orientated and some are science orientated. We cannot force learners to do Physical Sciences because learners who are forced are not prepared to go an extra mile. If learners can be given opportunity to choose Physical Sciences subject they will be intrinsically motivated. If I am allowed to deal with truly Physical Sciences learners the work will be much easier.

Do you have any comments regarding learner performance in Physical Sciences?

Some learners are very good but they are very few and others are good but too slow to catch up.

Teacher 2

Tell me about the grades and the subjects you teach.

I teach Grades 10, 11 and 12 Physical Sciences, Grade 10 Mathematics and Grade 9 Natural Sciences and Technology.

What kind of problems do you encounter as teacher if there are more than 20 learners in a class?

OH! If there are more than 20 learners in a class is that, E-ee, the problem is their grasping levels are not the same, others grasp, others appear interested, others are interested and I try to fight with the pacesetter but the biggest problem is time, I am alone in the school and I need to complete the pacesetter, it can affect some of the slow learning students.

Probing question: What will you change in your teaching if your classes were smaller?

I will be able to assist learners individually and be able to complete the syllabus.

To what extent does your lesson preparation contribute to learner achievement in Physical Sciences?

I must say each lesson I go to has to be prepared but not only lesson preparation but the input by the students themselves, the extra lessons that we give and the extra testing, I think they are the once that has improved performance.

Probing question: Why do you say so?

Lesson preparation alone I think may not be enough, though I may not enter the class without lesson preparation.

Which resources would you like to have that would help you improve your learners' achievement?

We have the new laboratory, it has all the apparatus and chemicals and other resources. Maybe internet which can be accessible to the learners and where they have problems may check and find answers. Other apparatus maybe the internet but most of the resources we have access to them.

Probing questions: How can these resources assist with improving performance?

Resources such as laboratories help to expose learners to real things, they all use their senses, seeing, touching, hearing, smelling and even tasting in some instances.

To what extent has language or the medium of instruction affected learner performance in Physical Sciences?

Yah! Language issue has led even to students to lose attention because some of them when they know you are going to teach in English they believe that they will not understand.

Probing question: Why do you say so?

I feel a few of the learners are affected because they do not understand English very well, but I think the majority are still trying even though most of the instructions are in English.

In what ways do you as teacher encourage your Physical Sciences learners to work harder?

I encourage them to work harder in Physical Sciences, first of all we do not talk about Physical Sciences but we talk to them about possible careers. We encourage them to work hard when they write exams their marks are displayed on the notice board and when they see the marks it acts like motivation because they want to perform like their top counterparts.

Which teaching methods do you find help learners to understand Physical Sciences content better?

Better teaching methods would be carrying out experiments where learners have hands on activities. Most of the things being taught will be appreciated by the learners. Learners see them physically but the problem is the time for demonstrations and we need to cover the topics. If we were so many teachers teaching Physical Sciences in the schools it will help in improving performance.

Probing question: Why do you say so?

Learners share ideas and use their hands and understand better.

Why is assessment part of teaching and learning?

According to me assessment should be part of learning because it assist the teacher to know where he or she is, what he or she has done, what needs to be done, how much has been done and how much has been achieved. So assessment is a way of measuring what is happening in the class. It helps not only the teacher but the department of whether the targeted objectives have been achieved or not.

Probing question: How do you assess learners to improve their performance in Physical Sciences?

Class work during instructions and homework at home so that they keep engaged and revise their work. Weekly tests are of help to keep them focused during the week. Eventually we have other assessments like exams and tests.

How do parents involve themselves in the teaching and learning of their children in Physical Sciences?

Normally parents are expected to monitor their children's performance and participating in line with everyday activities but at school they normally come end of term and when they come they discuss their children's problems. So it happens every time at the end of term parents visit the school.

How does the principal assist with helping you improve learner performance?

Always, whenever we request for apparatus, materials for practical activities he gives us in time. He supports us in the provision of materials so that teaching in Physical Sciences goes on smoothly. He also looks at learners' achievement and whenever he feels dissatisfied he calls the learner to discuss the results and this act as a motivation.

How does the curriculum advisor help you improve learner performance?

Ok! Whenever we have those meetings they make sure we have documents required to teach Physical Sciences and sometimes when we get stuck we call them and they give us advice. They keep on enquiring and sometimes when we get stuck we call them, their numbers are accessible.

What intervention strategies do you use in order to improve the achievement of your learners?

I do extra lessons in the morning, afternoon, and Saturdays. I practise peer teaching when other learners teach other learners. We do outsourcing of teachers doing well in Physical Sciences and giving more class work, homework and attending career exhibitions.

How does your workload affect your teaching of Physical Sciences?

I must say I have a large workload, in one way or the other it disadvantages me especially when preparing for each class I have to get to. I have a feeling that if I do not have much workload I would do extra lessons and results would improve.

What was your Grade 12 pass rate from 2010-2012 in Physical Sciences?

In 2010 it was 62%, in 2011 it was 95%, in 2012 it was 100% and in 2013 it was 100%.

Why do learners not perform according to your expectations?

I think it is expected that not all learners will perform the way you expect them to perform, like lack of interest, others may have their issues such as family background and others have attitude. So some learners will not perform the way you like them to do.

Do you have any comments regarding learner performance in Physical Sciences?

U-mmm, a few comments I can make, I think there is a room for improvement. You talk of 100% performance at grade 12, but in other grades performance is not satisfactory. I would like to see performance in grade 10 and 11 improving as well.

Teacher 3

Tell me about the Grades and the subjects you teach.

I am teaching grade 8 Mathematics, grade 10 mathematics and Physical Sciences and grade 11 and 12 Physical Sciences.

What kind of problems do you encounter as teacher if there are more than 20 learners in a class?

If more than 20 learners in a class, well it comes back to resources for example, we have one pendulum and I have got a class of 80 learners and I can't use one pendulum effectively to teach 80 learners. If I had a smaller class it was going to be better. Now that with 80 learners it is too big with one pendulum, let alone with one compass and you want to demonstrate the direction of magnetic degradation, it is going to be difficult with a big class than a smaller group.

Probing question: What will you change in your teaching if your classes were smaller?

Well, I could easily move away from the lecture method to group activities. It is about teaching methods, I am more flexible with a smaller group and there are many choices of teaching and learning methods than with a bigger group.

To what extent does your lesson preparation contribute to learner achievement in Physical Sciences?

Preparations if it means writing lesson plans they mean very little. If preparations mean teacher reading and making notes that means a lot but that is not counted and evaluated especially giving of notes, you find that the evaluation template does not look at the notes but it looks at how many class work and homework has been given. It looks like Physical Sciences is being evaluated like English whereby the concept is evaluated within 5 minutes. There is taking of notes, understanding of notes and writing of notes. A big concept like Doppler Effect you have to teach and write notes.

Probing question: Why do you say so?

I say so because lesson planning only guides the teacher but what is important is to understand the concept to be taught, which means reading and taking notes is important as a way of preparing.

Which resources would you like to have that would help you improve your learners' achievement?

If I have an overhead projector for example, it is easier to teach with an overhead projector with our big classes. Also textbooks, like now I do not have CAPS aligned textbooks until now even in grade 12.

Probing question: How can these resources assist with improving performance?

If each learner has got a textbook that can supplement teaching and learning in the absence of the educator plus when the classroom activities have got to be written there is point of reference, that is let go to page 111 or 84. If they do not have textbooks, it becomes laborious and there are some diagrams you cannot draw without using a projector or textbook.

To what extent has language or the medium of instruction affected learner performance in Physical Sciences?

OH! OH! That is a very big question, what is considered to be a competence level in language learning is not always enough literacy when it comes to Physical Sciences. Physical Sciences really is a subject that is based on competence in language. Our learners most of the time are found lacking in English. It is a very big barrier and our learners cannot converse well in English.

Probing question: Why do you say so?

For example, if we say in Mathematics, how long, some learners will think it is distance and others think it is time. It is now depending on mastery of language. In this case it is how long in terms of time or how long in terms of distance especially when dealing with time, velocity and speed. Some learners end up answering the wrong question.

In what ways do you as teacher encourage your Physical Sciences learners to work harder?

Well, it starts with every topic, for example, I was just teaching Pythagoras theorem, I started with his basic history of Pythagoras emphasising that he failed his Matric

because he wrote about his theorem in his era until such a time when people knew him after his era. In most cases topics like Pythagoras are associated with the professionals; topics with probability are associated with actuarial science so learners learn a topic which has a direct bearing on their lives.

Which teaching methods do you find help learners to understand Physical Sciences content better?

Experiments, pragmatic approach, practical activities but there is a limitation to the number of resources, for example, I was saying one pendulum with a class of 80 learners. Although it is effective, it cannot be desirable or first choice given the available resources.

Probing question: Why do you say so?

I am forced to use other methods besides experiments because of shortage of resources and the large number of learners.

Why is assessment part of teaching and learning?

No doubt, there is need to change a teaching approach if it is not yielding the desired results or if our learners do not understand then the explanation might be the teaching approach, so teaching approach time and again must be evaluated against desirable results. Therefore, assessment cannot be avoided because it informs learning methods against teaching methods. No doubt, assessment cannot be avoided because it informs choice of teaching methods against learning methods. If there is a mismatch, learners are evaluated after a teaching method has been implemented.

Probing question: How do you assess learners to improve their performance in Physical Sciences?

E-ee, informally is class work, and homework, controlled tests and formal tests, I mean those tests set by the district.

How do parents involve themselves in the teaching and learning of their children in Physical Sciences?

Well, E-ee, they are invited to come to school and collect reports at the end of the term and that provide them with an opportunity to the educators. Number two , we have a school hotline which they can communicate with the manager at any time. There is an open door policy.

How does the principal assist with helping you improve learner performance?

Well, she communicates with supplier ministry, Department of Education and she is the one representing government policy and dissemination of curriculum. Number two, she links the teaching and learning process as an assessor and buys chalks and provide materials and other things that we need. Really she is key in the teaching and learning of Physical Sciences to improve performance.

How does the curriculum advisor help you improve learner performance?

E-ee, she visits to check on our progress against the pacesetter or standard set by the employer and also if we have problem topics, she provides extra material for the educator.

What intervention strategies do you use in order to improve the achievement of your Physical Sciences learners?

To start with we have got morning and afternoon lessons and weekend lessons and m-mmm, we have also done team teaching, winter classes and spring classes.

How does your workload affect your teaching of Physical Sciences?

I want to say the workload is comfortable in the number of lessons, it only become an issue when it comes to the number of learners and what has got to be marked, for example, for me to give end of month tests, I will be looking at a big number of scripts that I have to mark so it is a hindrance. Big classes have big number of scripts that need to be marked.

What was your Grade 12 pass rate from 2010-2012 in Physical Sciences?

We had 31% in 2010, then 54% in 2011, then 48% in 2012 and 42% in 2013.

Why do learners not perform according to your expectations?

E-ee, at times is a question of language barrier. I want to think is language barrier.

Do you have any comments regarding learner performance in Physical Sciences?

Yes, E-ee, Physical Sciences is not for everybody, but more often than not learners choose to do Physical Sciences against things like democracy. Educators are not well placed to advice like doctors and lawyers, you might end up advising somebody against his or her wishes but at times wishes do not always match abilities. You wish to be a doctor but you end up being a lawyer. We might end up having learners who are not good in Physical Sciences but better elsewhere. Like wishes to be a doctor, maybe in grade 11, I might change and do Arts. The curriculum we have does not have an option.

If we have a situation where a learner is doing Mathematics and Arts may face a problem where a learner who is in grade 12 is faced with a problem and has to continue whether it is difficult or not. Grades 8 and 9 are not full proof that if you pass grades 8 and 9 Natural Sciences is a proof that you can do Physical Sciences. Mathematics is used as an applied subject in Physical Sciences; their background is weak in Mathematics. You end up teaching how to substitute in Physical Sciences because they have not mastered Mathematical skills.

Teacher 4

Tell me about the Grades and the subjects you teach.

I am teaching Physical Sciences grades 10, 11 and 12.

What kind of problems do you encounter as teacher if there are more than 20 learners in a class?

If there are more than 20 learners is a bit difficult to meet them individually, like you give them an assignment, some may have problems in just taking it back to you, so the problem is you cannot individualise if they are more than that number.

Probing question: What will you change in your teaching if your classes were smaller?

A-aa, the change basically will be that I will individualise my instructions, catering for individual differences in our learners. Now if they are in groups you tend to favour one side, the one being favoured will be the average learners, so you find that those doing better you do not give them what they deserve to excel.

To what extent does your lesson preparation contribute to learner achievement in Physical Sciences?

That one guide the way we instruct our learners, preparing basically means for me what are the objectives you want or the skills you want your learners to know in any given time you have with them. If you know them you make it easy to pass the message to the audience the learners.

Probing question: Why do you say so?

I say so because from experience if you go without a plan you end up diverging from the topic. You plan so that you remain focused.

Which resources would you like to have that would help you improve your learners' achievement?

A number, like first textbooks, secondly the learning space, accommodation where they sit, then we need a laboratory for experiments.

Probing question: How can these resources assist with improving performance?

U-mmm, let me take one by one, the laboratory, it means some abstract concepts we can make them easily accessible when we do experiments in class, so that learners are used to equipment. For sitting arrangement, if you talk to someone who is not sitting well this can be a problem to them during the learning process.

To what extent has language or medium of instruction affected learner performance in Physical Sciences?

This one is a major challenge which requires them to explain, they may be able to calculate to get a value but the problem is ours we have to give them time to practice reading and writing.

Probing question: Why do you say so?

If learners are able to read it means they will be able to answer questions well. In Chemistry learners are required to read paragraphs and answer questions using scientific terms therefore if a learner lacks language skills then the learner will provide wrong answers.

In what ways do you as teacher encourage your Physical Sciences learners to work harder?

A-aa, the way I have tried is at least showing them my enthusiasm by coming to work even when I am not being paid on Saturdays. I think that has paid in trying to make them read the subject well, giving them time to read to develop those skills. Basically, giving more quality time, explaining things to them and giving them practice to read.

Which teaching methods do you find help learners to understand Physical Sciences content better?

A number, when I say a number I mean there is no one method used to cover all the space that we have in Physics and Chemistry. Practical activities have to be done , projects can also be used so that we give them chance to do the things on their own and will be able to express themselves if we give them the time. So the method depends on the topic and content you want to cover. In one lesson you can involve so many methods. Specifically I believe in multiple representation, why because we have a mixed class and this can be appealing to the other and not good to others.

Probing question: Why do you say so?

I say so because our classes will be of mixed abilities, actually they are different, so if you use one method you may prefer one group to the other.

Why is assessment part of teaching and learning?

That one is a main component, first it helps us to improve in our instructions when passing on whatever we are teaching to our learners. Secondly, which is basically the major thing, you find out that the performance of learners will just improve if you give them the right type of assessment continuously or more often.

Probing question: How do you assess learners to improve their performance in Physical Sciences?

Yah! is like mainly in the form of tests which can be after every fortnight or after completing a chapter then we also have daily work or class work. Whenever you present you need to give learners work to write. Basically assessment daily, during fortnightly or anytime, it is assessment throughout.

How do parents involve themselves in the teaching and learning of their children in Physical Sciences?

Parents are not as active as I would love them to be for now. I think they are playing a part because the moment we have learners at school it means there is someone who says go to school. I mean parents are the ones allowing the learners to come to school. They can help us a lot or in a big way by checking their children's work, just checking that way they will remind their children and just showing concern, by just asking their children where are your books and just reminding their children.

How does the principal assist with helping you improve learner performance?

The principal make sure we have things that we need in our classrooms, things like apparatus that we want for mainly here prescribed experiments but we need more. If we want learners to come during the weekend they make sure that the rooms are open and the principal make sure that learners attend and they help by talking to the learners explaining the importance of attending these classes.

How does the curriculum advisor help you improve learner performance?

They do a lot because they come and ask us what are your problems and we share experiences. They also bring some learning materials and recently we were given

Winning Teams past exam papers for learners to practice. They also organise some workshops where teachers meet and share.

What intervention strategies do you use in order to improve the achievement of your Physical Sciences learners?

Here is basically just going out of your way and being with your learners more often, that is the only thing besides attending classes during the normal timetable time, you just need to create some more time and convince them so that they come, talking to them so that they understand why they are coming to extra classes and convince them so that they understand the importance of attending extra classes.

How does your workload affect your teaching of Physical Sciences?

But for me I do not want to lie my workload is quite realistic, I am so comfortable with it, in addition to Physical Sciences grade 11, I am teaching Natural Sciences grade 8. For my own position I think this for now is not a problem, the thing is if you are overloaded that will reduce your efficiency to perform. I was talking about tests once per month, it impacts on a number of things. Even the marking won't be thorough you end up marking after a month.

What was your Grade 12 pass rate from 2010-2012 in Physical Sciences?

In 2010 it was 31%, 2011 it was 40% and 2012 was 48% and 2013 it was 75%. So we were slightly below 50% for the past two years and we were underperforming and so the other two years from underperforming to 75%.

Why do learners not perform according to your expectations?

A number of factors here, one it concerns the ability to read and understanding the memorise things; you will be able to answer questions if you master the concepts. They have the basics in terms of junk and crammed knowledge.

Do you have any comments regarding learner performance in Physical Sciences?

Yah! They continuously perform badly, I think I can first comment on part of my side as a teacher that it shows we still have a lot to do so that we make our stuff accessible to the learners, the things that we take for granted, I think the way we are

talking to the learners seem to be foreign to them. The teacher should be the guider in order to be effective, we have to be lifelong learners and when we say our learners cannot read, we cannot just say that. We can make the subject accessible to the learners. We have a part to play in terms of improving performance in the subject. We need to learn from others.

Teacher 5

Tell me about the Grades and the subjects you teach.

I teach Physical Sciences grades 10, 11 and 12.

What kind of problems do you encounter as teacher if there are more than 20 learners in a class?

“Laughing” many problems, in fact I have got about 55 learners in grade 12, 62 in grade 11 and 70 in grade 10, the teaching and learning will not be effective. You will not be able to use some of the methods. There will be no time for individual attention to learners; there will be no time to use discovery method. You will only be limited to one method, lecture method. You will not be able to use some of the methods. How can you use discovery method in a class of more than 60 learners? You will use only one method, lecture method.

Probing question: What will you change in your teaching if your classes were smaller?

If classes are average like 30 learners and below then one would have enough time to do individual attention to learners. Slow learners will have enough time to question, the methods also change, and the lecture method will also change. Also the amount of work you give will also change and you won't even finish the marking. If they are 30 you can give fast learners higher degree questions and you have time to call the learner and if they are 30 you can give more work.

To what extent does your lesson preparation contribute to learner achievement in Physical Sciences?

Lesson preparation is very vital, without lesson plan you end up waffling. Lesson plan gives confidence. You will make a lot of errors if you do not prepare. It gives you

the objectives and it also gives me time to think. Lesson preparation will affect teaching and learning of learners. It gives you preparation of the topics to teach and stops you from making mistakes.

Probing question: Why do you say so?

When you prepare a lesson you know the objectives like the CAPS guidelines, unlike if you just go and teach without preparing earlier you might end up teaching a topic which you like most forgetting to follow the CAPS guidelines, so you will waste a lot of time there, so lesson preparation has a lot of sense.

Which resources would you like to have that would help you improve your learners' achievement?

We are facing a lot of challenges in terms of apparatus and chemicals. Also textbooks we use do not have a lot of questions for learners to practice and worked examples for learners to do on their own. As an educator I will be very happy to have these. More importantly Physical Sciences is a subject where the learner has to discover on his own, so we need apparatus and chemicals to do experiments. We are teaching Physical Sciences as if we are teaching History. If you want to check for a double bond in organic compounds and you want to test for ethene and there is no bromine solution. It will be difficult to do it.

Probing question: How can these resources assist with improving performance?

Like I said, if a learner hears something he can easily forget but if a learner sees something may not forget. It is important that we do experiments, what they see they will not easily forget and what they hear they will forget. Textbooks help learners to work on their own. The textbook that we have now is not good, it is just a donated Siyavula and so we want textbooks.

To what extent has language or medium of instruction affected learner performance in Physical Sciences?

The learners we have understand very well their mother tongue, some struggle even to write a complete sentence in English. I have discovered that it is not because they do not know the principles of Physical Sciences but it is language barrier. I have to

repeat and repeat the same concept so that they can understand the questions. The language itself is a barrier; I teach expressively in English and if they do not understand more learners will fail.

Probing question: Why do you say so?

If a question comes in a paragraph like more learners will not understand but simple and short questions many learners will understand better. The moment a question wants the learner to apply and analyse then the learner faces a problem of identifying the key words.

In what ways do you as a teacher encourage your Physical Sciences learners to work harder?

There is a group that help other learners so that there is learner to learner assistance or learner teaching others. I encourage grade 12 learners to practice the previous examination papers so that they can help their peers. I also help them to answer questions they are not able to do well and tell them that there is no one who will struggle after finishing grade 12 and passing Physical Sciences and Mathematics. Apart from that I use the opportunities that arise after passing Mathematics and Physical Sciences and it acts as a motivator.

Which teaching methods do you find help learners to understand Physical Sciences content better?

Given the numbers, I have mostly when introducing the topic I would use the lecture method and I will also use peer learning where some learners take the role of an educator. When discussing the questions I give learners chance to help others but because of these large classes mostly we rely on lecture method.

Probing question: Why do you say so?

With a class of more than 55 and the time Physical Sciences is allocated you won't be able to finish the syllabus and also the problem with language so the lecture method will help us to push faster.

Why is assessment part of teaching and learning?

Isn't it that when you teach you want to see whether the learners have understood what you have taught so you want to see whether the learners are grasping according to the objectives or guidelines to see if they are able to do questions at that level, for example, if you are teaching mechanics or vertical projectile motion, you now want to see if they are able to substitute and use those equations. Therefore, assessment is very vital, you will teach and to see if you are teaching and nothing will be happening.

Probing question: How do you assess learners to improve their performance in Physical Sciences?

Assessment is made for one to check records and improvement you can use other strategies like, homework, class work, tests and assignments to assess and also as I say on peer teaching I also assess when they are doing peer teaching. I also assess when learners answer questions and there is also classroom assessment when you give mainly is homework, class work and tests to find out if learners are improving and if not we try to find a remedy.

How do parents involve themselves in the teaching and learning of their children in Physical Sciences?

That is a very big challenge we call parents to come to hear about their children's performance. With grade 12 you only find the parent when you call a parent meeting once. If you call a parent individually, parents won't come. The grade 10 and 11, parents will not come but I am sure with time they will come and if we have serious problems as individual. We also have a programme were we call parents once a year before trial.

How does the principal assist with helping you improve learner performance?

Mostly the principal comes in, in terms of discipline, if I have any learner who is giving me problems discipline wise and without discipline learning and teaching will be affected. The principal has been very handy in maintaining discipline and the principal also issue textbooks. The principal makes sure the teacher gets teachers' copy and that is working well with us.

How does the curriculum advisor help you improve learner performance?

The curriculum advisor comes in with a very, very important component communicating the guidelines and any changes in the curriculum. They also monitor if we are moving with the correct pace and whether we are teaching and covering content and the best way to go. At times we get quality previous question papers. In terms of experiments and difficult topics we discuss with the curriculum advisor once a month.

What intervention strategies do you use in order to improve the achievement of your Physical Sciences learners?

I would like to also say assignments for learners, I give them questions which they go and solve to see if there are still above the rest. We are using peer teaching, giving learners previous exam papers to go and answer and that needs thorough monitoring of learners' work and is a way of motivating these learners.

How does your workload affect your teaching of Physical Sciences?

The fact that I am teaching grade 10, 11 and 12 and grade 10 is two classes and grade 11 and 12 one class each and apart from that I am teaching grade 8 and 9 Natural Sciences and Technology. I feel that this is too much for the Physical Sciences educator. I have less time to learners for the matric students. It drains energy and it gives you less time in class. If it is less time, it also gives less time to each learner and drops the performance.

What was your Grade 12 pass rate from 2010-2012 in Physical Sciences?

In 2009 the pass rate was 39%, in 2010 it was 59,7%, in 2011 it was 65%, in 2012 it was 99% and in 2013 it was 84%.

Why do learners not perform according to your expectations?

There are many reasons (1) language barrier is a problem and the other one is that learners do not have the basic knowledge of Mathematics and Physical Sciences and when they come to grade 10 and everything becomes new. Physical Sciences is a subject that uses Mathematics as a language if a learner is not good in Mathematics then will struggle. Learners are not well advised in the subject choices

and learners who are not good in Mathematics and Physical Sciences will struggle. The promotion also affects performance and some learners are condoned and that will affect their performance in the next grade.

Do you have any comments regarding learner performance in Physical Sciences?

Yah! If learners are well advised on careers depending on their abilities and learners are advised to choose careers and subjects which go in line with performance of learners in that grade. I do not think we should have more than 65 learners in a rural class where learners cannot write. Most of the learners are taught using English as a second language. If learners are advised at grade 10 and especially when condoning is removed totally and remain with those who deserve will improve performance.

APPENDIX 12

FOCUS GROUP INTERVIEW GUIDE FOR PHYSICAL SCIENCES LEARNERS

GROUP 1

Interviewer: You have been chosen to participate in this research as Physical Sciences learners at this school and what you are going to say is going to be recorded and used to improve the subject. So the first question I would like to ask is what motivated you to choose Physical Sciences as a subject at Grade 10? You are free to talk and who is going to be the first?

Learner 1: What made me to choose Physical Sciences in grade 10 is that most job opportunities, the decent one come from Physical Sciences. In our country most people who did Physical Sciences are rich and so I want to be rich in future.

Learner 2: Yes, I chose Physical Sciences because I like to be an engineer.

Learners: (Laughter)

Learner 3: Personally, I followed my friend, my friend motivated me.

Learner 4: I see that many people who do Physical Sciences get a lot of money, I like the subject and I chose it.

Learner 5: I usually think of my career, I want to be an electrician, so I chose the subject.

Learner 6: U-mm, with me, I like the way things are done in Physical Sciences, so it was my choice.

Interviewer: Ok, that's fine, I want to ask another question, what problems do you encounter when doing homework at home?

Learner 3: The problem that we have at home is that most of the books in here do not have enough information.

Learner 5: In our school there are no books that we can use.

Learner 1: Yes, yes, we do not have enough textbooks.

Learner 2: I don't have time to do the homework; I am always playing with my cell phone.

Learner 4: Yah, I do not have someone to help me to do the work at home, yes that is a problem to me.

Learner 6: I have a problem in reading and I don't understand when I read alone, I need help.

Interviewer: That's fine, u-mm, I also like to know your performance in Physical Sciences, how is it? How is your performance in Physical Sciences?

Learner 6: Ok! My performance in Physical Sciences is that sometimes I do not get the marks that I wish I could get but I want to get serious in Physical Sciences. When I feel I am going to get 50% and when the results come and I do not get it so it affects my performance in Physical Sciences.

Learner 2: My Physical Sciences performance, I am just trying, for me is bad and I just want to try to get some marks.

Learner 3: My Physical Sciences performance is poor, I try hard to get more marks so every day when I sleep I start to read and do some questions to see how can I do it more and more.

Learner 4: I feel I am better, but I want to do more than that.

Learner 5: Yes, my performance is average, I want to read more to do better.

Learner 1: Ok, I am sometimes getting higher marks and sometimes I am getting lower marks. I want to do more.

Interviewer: Fine, so since I can see your performance is not very high, I have another question here, what problems do you experience in learning Physical Sciences?

Learner 4: I have a problem in calculations.

Learner 2: E-ee, most of the time I do not do practical activities and I understand better when I use my hands.

Learner 3: Textbooks are not enough.

Learner 5: I have a problem in reading, I do not understand the questions, I want to try very hard.

Learners: Laughing

Learner 1: We do not do practical work in Physical Sciences, yes, there is no laboratory, it is hard.

Learner 6: Yes, no laboratory, we lack experience, but we are trying.

Interviewer: Well, I can see there are problems, but now I want to know what can your teacher do to help you improve your results?

Learner 1: Our teacher can supply us with past papers so that we have more practice.

Learner 6: Our teacher can teach us with extra lessons and maybe to come to school at holidays, weekends so that we can get more information to improve our performance.

Learner 2: U-mm, I think our teacher can simplify the content and explain to us so that we understand.

Learner 3: Yes, yes, our teacher can teach us during Saturdays and holidays.

Learner 4: Our teacher can teach us how to answer questions and be with us always.

Learner 5: I support him (laughing) we need time so that we understand.

Interviewer: Now you must tell me which content is difficult in Physical Sciences?

Learner 1: For me the content which is difficult for me is organic chemistry and then the one which is very easy is the one I manage to beat my target, that content is Doppler Effect which is more enjoyable and easier. When I do it is like funny and

that's why I do well. Organic chemistry needs a lot of concentration. If I attend in the class I just manage to concentrate for a short time.

Learner 5: To me as a grade 11 learner is when we do electromagnetism. Yah! Newton's laws, these ones are easy to me.

Learner 3: E-ee, vectors in grade 11, hey it is difficult for me.

Learner 4: Ok, the topic is mechanics in grade 10.

Learner 2: Oh, yes in grade 12 again, organic chemistry is a bit tricky, like equilibrium constant (K_c), yes calculating it is difficult.

Learner 6: I am not good in electricity.

Interviewer: Well now I want to ask you a question that is opposite to that one and I think you will like it. Which content is easy?

Learners: Laughing

Learner 3: The content that is easy is Vertical Projectile motion and momentum. These topics are very easy and enjoyable. When I write tests I manage to pass.

Learner 2: Doppler Effect.

Learner 1: I like momentum.

Learner 4: Electromagnetic waves in grade 10, yah is better.

Learner 5: I like the topic on forces, it's funny.

Learner 6: I like the topic about moles in grade 11.

Interviewer: Ok, my next question is why do you think teachers give you tests or ask questions?

Learner 6: Our teachers ask us questions to get information. They give us tests to get our standard in the subject and they want to know if we understand.

Learner 2: Our teacher gives us tests to see if we understand and improving performance.

Learner 3: The reason why our teachers give us tests is to see whether we understand or not. If we do understand there will be possibility for that question to come in the test and I will be able to answer the content.

Learner 4: I think tests help us to improve our performance, yes we gain experience.

Learner 5: Teachers test us to see if we are understanding and help us to do well.

Learner 1: Also, teachers give us tests to motivate us to work harder and make us see our mistakes.

Interviewer: Now I want to hear from you about your experience regarding your behaviour. To what extent can your behaviour in class contribute to your performance in Physical Sciences?

Learner 5: E-ee, that one will depend whether I am a disciplined person or not, if I am a disciplined person I will be able to perform well in Physical Sciences because I will be able to do all my assignments and homework on time. If I am not disciplined I will not perform well in the subject and I will not give that subject more time and that will lead to poor performance.

Learner 4: Ok, if I do not behave well, my performance will be affected.

Learner 6: Yes, my behaviour is important; I will be able to do my work at school and at home.

Learner 3: I feel if one is not behaving well or respecting teachers, it can be a problem, you can fail.

Learner 2: My behaviour make me improve my standard.

Learner 1: Ok, those learners who don't behave are not doing well in Physical Sciences, so I think my behaviour must be good.

Interviewer: What I would like to know now is how can the number of learners in a class contribute to your performance in Physical Sciences?

Learner 1: Many learners in class cause a lot of noise and teacher will have a problem in disciplining us.

Learner 6: Physical Sciences is a difficult subject and I need teacher's help so if we are many this will be a problem.

Learner 2: Yes, if we are many some will make noise and we won't get enough help from the teacher.

Learner 3: When we are doing experiments, the apparatus will not be enough and others will play in class.

Learner 4: Ok, many learners make it difficult for the teacher to mark our books.

Learner 5: The teacher will not be able to help us one by one.

Interviewer: Now I want to know, What do you think you can do in order to improve your performance in Physical Sciences?

Learner 5: I think I want to try hard to get more marks to perform well in the subject.

Learner 4: I want to try hard in Physical Sciences because it is my subject future, that is why I should do it hard.

Learner 3: I think group studies will work, some people do not understand other topics so group studies will work.

Learner 6: Oh! What I will do to improve my marks I will deal with previous question papers and give the subject more time and do some topics which I struggle with.

Learner 1: Ok, i think if we discuss in groups and helping each other, I think I can improve.

Interviewer: My last question is what will help you improve your performance in Physical Sciences?

Learner 1: I think what will help me to improve my performance in Physical Sciences is working hard every day. I have to read this subject and I have to do group studies and do some things that will help me get more marks.

Learner 3: To improve my performance in Physical Sciences I can go to learners who are good in Physical Sciences so that he or she can help me.

Learner 2: U-mm, If I can do experiments and work with others, I think I can improve.

Learner 4: Our teachers must give us more practice and revise difficult topics, time and again.

Learner 5: I think we must read books and do our work at school.

Learner 6: Yes, I think our teachers must give us more class work, homework and tests it will work. We also need textbooks.

FOCUS GROUP INTERVIEW

GROUP 2

Interviewer: What motivated you? I am a Physical Sciences teacher and I want to ask you questions as Physical Sciences learners and we are going to talk freely and I am not going to use your names, and the first question is, what motivated you to choose Physical Sciences as a subject at Grade 10?

Learner 1: Discovering my place of interest, I discovered that I was interested in medicine.

Learner 4: I think that the fact that I grew up with my uncle, we always like fixing cars and it motivated me to do mechanical engineering.

Learner 2: Yah, the job I want to do, I want to be a doctor and Physical Sciences is needed.

Learner 3: I passed grade 9 mathematics, and most of my friends are doing it.

Learner 5: Ok, I always admired those learners who were doing it so I was motivated to choose it.

Learner 6: The teachers, yes, teachers told me to choose Physical Sciences.

Interviewer: Right, so my second question is what problems do you encounter when doing homework at home?

Learner 3: Lack of assistance from others.

Learner 2: I have problem because I like group discussion when I am alone at home I find it difficult.

Learner 1: Sir, sir, we do not have textbooks so it's hard to do homework.

Learner 4: Yes, sometimes we are just given homework and I don't have anyone to help me. It is difficult sir.

Learner 5: It is true sir, there are no textbooks and no one help me at home.

Learner 6: Sometimes I get help from teachers near my home and my parents pay them. It is not easy.

Interviewer: Fine, now I want to know your performance, how is your performance in Physical Sciences?

Learner 6: My performance is not quite good because in terms of calculations that is where I discovered my difficulties.

Learner 5: My performance is very good especially in paper 1 (Physics) but in chemistry I find it hard.

Learner 4: Sir, to tell the truth my performance is average, sometimes I struggle to pass.

Learner 3: I am working hard and I am trying my best and I am promising to pass my matric.

Learner 2: I am good and I want to continue working hard.

Learner1: Ok, I am also trying my best and I am improving in Physical Sciences.

Interviewer: It shows that there are some problems by the way you are telling me about your performance and my next question is what problems do you experience in learning Physical Sciences?

Learner 3: We do not have enough textbooks and if available the content in them is shallow and explanations are not clear.

Learner 2: I have a problem in language when I read the books sometimes I do not understand the explanations in English.

Learner 4: Oh! I do not know how to solve paper 1 questions especially calculations. I feel confused especially the topic Work, Energy and Power.

Learner 1: Ok, sir, I have a problem in calculations.

Learner 5: We do not do practical activities, no laboratory.

Learner 6: Yes, no textbooks, our school is poor.

Interviewer: Now since you have told me your problems, I want to find out what can your teacher do to help you improve your results?

Learner 1: He might try doing afternoon studies so that we make sure that what we did not do well in class we help each other.

Learner 5: We must try to revise the topics before we move to another topic.

Learner 3: He can give us class tests every Friday.

Learner 4: Yes, yes, more tests can help us and try to do more practical work with us.

Learner 2: Yah, practical work, when I do it I don't forget.

Learner 6: We need textbooks so that we practice reading and answering many questions.

Interviewer: I see, now tell me about the content, which content is difficult in Physical Sciences?

Learner 4: In grade 12 I find Vertical Projectile motion difficult.

Learner 2: Me in Physical Sciences I find problems in force and motions.

Learner 3: In Physical Sciences I have problems in chemistry-chemical reactions.

Learner 1: In grade 12 mechanics, that one sir is difficult.

Learner 5: I think vectors, the topic is challenging.

Learner 6: Sir, sometimes two-body diagrams, Newton's second law is hard (laughing)

Interviewer: Which content is easy?

Learner 6: Balancing chemical equations.

Learner 2: Mechanics

Learner 3: Momentum

Learner 4: Electric circuits and electromagnetism

Learner 5: When we do the topic on light, yes, I like it.

Learner 1: I like equations of motion I just substitute.

Interviewer: I can see you are excited, now I would like to know, why do you think teachers give you tests or ask questions?

Learner 1: To see whether we have problems and can help us to improve.

Learner 2: To see whether we have understood the topic or not.

Learner 3: I think to make us improve and to help us when we have problems.

Learner 4: That is it, if we do not write tests we will not know our mistakes, so we must write them.

Learner 5: Ok, teachers can use the tests to help us and to see the topics that we did not understand.

Learner 6: Yes, I will see my mistakes and put more effort.

Interviewer: The next question is about you, and I would like to know to what extent can your behaviour in class contribute to your performance in Physical Sciences?

Learner 4: If I am disciplined I get time to read books and revise my work.

Learner 2: Learners who behave well are able to listen, read on their own and do the work assigned. I will be able to manage my time and respect my teachers.

Learner 3: Yes, I think if I don't behave I will fail, I will not have time to do my work.

Learner 1: It's true, I need to have discipline to read my books and writing my work, I think I can do well.

Learner 5: U-mm, this subject does not need learners who play, those who play fail it.

Learner 6: If I am not behaving sir I will not do my work so it is important to listen to our teachers.

Interviewer: Ok, how can the number of learners in a class contribute to your performance in Physical Sciences? Who is going to start?

Learner 6: Well the fact that we are too many u-mm, some of us will not understand what the teacher will be saying because many learners can make noise.

Learner 2: I understand that if learners are many in a class our teacher will not be able to do individual help and doing practical activities may take much of our time.

Learner 3: A small class can help us improve in Physical Sciences.

Learner 4: Sir, if we are many other learners will make noise and I will not understand.

Learner 5: If we are many textbooks will not be enough and I will not get help from the teacher.

Learner 1: When we are not many the teacher can help us.

Interviewer: The next question in this group is that I want to know, what do you think you can do in order to improve your performance in Physical Sciences?

Learner 1: I must always be attentive when teachers are teaching in class and revise our work.

Learner 5: To make group discussions.

Learner 3: To make group discussions and ask questions were you do not understand.

Learner 4: I think if I work hard my performance will improve.

Learner 2: Yes, I like group discussions, they help me to understand.

Learner 6: I would like to write more tests and attending during Saturdays.

Interviewer: Now this is my last question in this group, what will help you improve your performance in Physical Sciences?

Learner 5: If we can be given more time to improve such as morning and afternoon and weekends may be I can improve.

Learner 2: We need textbooks, laboratories to do experiments; these can help us because we are using all our senses during learning.

Learner 3: I think if we discuss in groups it can help.

Learner4: Sir, if we can have more textbooks and more time to revise I can pass.

Learner 1: Yes sir, I don't forget if I do practical work, so I am happy we have a new laboratory.

Learner 6: If our teacher can give us more work and do more experiments, I think I can improve.

FOCUS GROUP INTERVIEW

GROUP 3

Interviewer: I am a teacher and I am researching on Physical Sciences and I want to ask you some questions about the subject, you are free to answer all the questions and my first question is what motivated you to choose Physical Sciences as a subject at Grade 10?

Learner 5: It is because I like nature and Physical Sciences talks about natural things which are surrounding us.

Learner 2: Physical Sciences do things that are practical. We experience that our country needs people who know science so when we do Physical Sciences we can be better people who know science.

Learner 3: My career, I want to be a pharmacist so Physical Sciences is needed.

Learner 4: Also my career needs Physical Sciences.

Learner 1: Ok, at grade 9 I passed Mathematics and Natural Sciences and I just chose it.

Learner 6: I just like the subject, when I saw other learners doing it, I feel like doing it.

Interviewer: Ok, my second question is what, what problems do you encounter when doing homework at home?

Learner 6: When we are doing our homework we do not have textbooks and enough materials related to Physical Sciences.

Learner 5: I do a lot of work at home, so I am always disturbed and I am the older sister.

Learner 4: Yes, I like talking in groups, so at home I am alone, it is difficult.

Learner 3: I live next to a beer hall, it is noisy and I am always disturbed during study.

Learner 2: We don't have enough textbooks and it is difficult to do homework.

Learner 1: Truly speaking at home there are many disturbances.

Interviewer: Well, another question is how is your performance in Physical Sciences?

Learner 4: My performance is good and I am good in chemistry.

Learner 2: My performance is that I am good in Physics but I am struggling in chemistry because chemistry deal too much with experiments and in the school we do not have materials like laboratory.

Learner 5: My performance in Physical Sciences is better because we have teachers who help us. The problem is when we do experiments and we do not have laboratory.

Learner 3: My performance is good but sometimes it is bad because I do not have enough time and chemistry is difficult for me.

Learner 1: I am good in other topics and poor in other topics but I am trying my best.

Learner 6: U-mm, my problem is that of calculations and understanding English.

Interviewer: This is interesting and now my next question is what problems do you experience in learning Physical Sciences?

Learner 3: Textbooks are not enough.

Learner 2: We do not do experiments and we do not have a laboratory.

Learner 4: Our classes are too big and we are 82 in our class doing Physical Sciences. It is difficult to have help from the teachers.

Learner 1: Sir, to tell the truth we do not have a laboratory and our teacher take us to other schools to do experiments.

Learner 5: We do not have enough textbooks; the ones we are using are old.

Learner 6: We are many in our class; others make noise and disturb us during study.

Interviewer: Now the next question is what can your teacher do to help you improve your results?

Learner 4: Our teachers must take time so that we do revision in Physical Sciences to repeat things that make us improve our performance in Physical Sciences.

Learner 2: Our teachers can have us in the morning and afternoon lessons and they can also give us more homework to do.

Learner 3: I think our teacher can explain and make topics easy to us.

Learner 5: I realised if our teacher gives us more tests to practice, I can do better.

Learner 6: U-mm, our teacher must do experiments with us.

Learner 6: I think so, I understand when I use my hands during experiments.

Interviewer: Now I want to know which content is difficult in Physical Sciences?

Learner 6: Newton's laws.

Learner 2: Transverse waves.

Learner 3: In our class the content that is difficult is Electricity and in chemistry because we find it difficult to balance the equations.

Learner 4: Chemical change and vectors in two dimensions.

Learner 5: Sir, work, energy and power, especially work is difficult for me.

Learner 1: I have a problem with vectors at grade 11.

Interviewer: Which content is easy?

Learner 4: Electrostatics.

Learner 5: Newton's laws.

Learner 3: When one studies periodic table we find it easier and also Transverse waves and sound.

Learner 2: I like the topic of light, yes; diffraction at grade 11 is easy.

Learner 1: Ok, sir, the topic of water is easy to me.

Learner 6: Doppler Effect sir, I like it.

Interviewer: Alright, the next question is that, why do you think teachers give you tests or ask questions?

Learner 6: To test our knowledge and to find out whether we have understood the topic.

Learner 2: Help us to not to forget what we have learnt.

Learner 3: They just ask to find out whether we have understood what they have taught us.

Learner 1: E-ee, I think is to make us know.

Learner 4: Sir, to make us practice how to answer questions and gain confidence.

Learner 5: A-aa, to identify our problems and help us to improve.

Interviewer: Of course, but I want to know this again, to what extent can your behaviour in class contribute to your performance in Physical Sciences?

Learner 6: Listen to the teacher when learning and pay attention and not play in class.

Learner 2: We must concentrate on what teachers are saying.

Learner 5: We must listen attentively and also ask questions if we do not understand.

Learner 4: We must respect our teachers and not to play in the classroom when they are teaching.

Learner 3: Sir, behaviour is good, if you don't listen and you don't do your work you will fail. I want to respect my teacher.

Learner 1: Sure, I must have good behaviour, doing my work and not making noise in class, I think I can do well.

Interviewer: I would like to know again, how can the number of learners in a class contribute to your performance in Physical Sciences?

Learner 1: When we are more in the class other learners can make noise so that you cannot hear what the teacher says.

Learner 4: When we are few in a class we can pass because when we are few the teachers can help us.

Learner 3: When we are few in a class every learner will be attended to and she or her will be able to concentrate there and no noise will be in the class.

Learner 2: In our class we are many and I think is not good.

Learner 5: If we are many in class textbooks will not be enough and problem when we do experiments, we make noise.

Learner 6: Yes sir, there will be noise in class and textbooks will not be enough.

Interviewer: Now, what do you think you can do in order to improve your performance in Physical Sciences?

Learner 5: We can read our books and our teachers can give us experiments so that we can improve our performance.

Learner 2: We can study hard and stop parting a lot and also consult our teachers when we need help.

Learner 3: I must read many books and pay attention in class.

Learner 4: Sir, writing more tests and doing a lot of revision can make me pass.

Learner 1: I think, doing experiments, sir, and the teacher teaching us during Saturdays.

Learner 6: If we can write a lot of class work and tests, more revisions, I think we can pass.

Interviewer: My last question is what will help you improve your performance in Physical Sciences?

Learner 6: If we can have enough textbooks and study guides that will help us improve our performance in Physical Sciences. If we have morning and afternoon lessons we can improve our performance in Physical Sciences.

Learner 5: Working in groups can help, sir.

Learner 4: I think if we can do experiments it will help.

Learner 3: Yes, we need to do experiments.

Learner 2: We also need to form study groups.

Learner 1: Well, we need to help each other and having enough time with the teacher.

FOCUS GROUP INTERVIEW

GROUP 4

Interviewer: I am doing research in Physical Sciences and I would like to ask you some questions, be free to answer, and the first question is what motivated you to choose Physical Sciences as a subject at Grade 10?

Learner 1: I chose Physical Sciences because I have experienced that in South Africa there are less engineers so there are many job opportunities that are available for the people who has chosen the career of Physical Sciences and because of less people who have done the subject. I also chose it because I like the way they ask questions and they are challenging but what you need to do is to use your mind.

Learner 4: I chose the subject because I love the way they are doing things in Physical Sciences and there they are getting a lot of money and engineering is a kind of job that you get a lot of money. I am just inspired with it and I have noticed that.

Learner 3: I chose Physical Sciences because I like it and I have noticed that in South Africa there are a lot of jobs like doctors and engineers which need Physical Sciences.

Learner 2: Sir, I love it and it is interesting.

Learner 5: Sure sir, many careers need Physical Sciences and I like it.

Learner 6: My teacher told me to choose Physical Sciences.

Interviewer: The next question is that, what problems do you encounter when doing homework at home?

Learner 5: Sometimes we do not understand what the questions mean like when you doing a problem at school you have the chance to ask teachers but at home we do not have the opportunity to do so.

Learner 2: We face challenges like time management because at home we are given many chores and we do not have chance to do the homework. If they are challenging we do not have anyone to ask, I think it is very challenging to do it at home.

Learner 3: No textbooks sir, sometimes I have to ask my friend from another school to give the textbooks.

Learner 4: Sir, sometimes at home I don't have enough time to do the work.

Learner 1: I like to work in groups so at home I am always alone so it's hard.

Learner 6: Sure sir, group work is good and I understand better.

Interviewer; Alright, now I want to know your performance, how is your performance in Physical Sciences?

Learner 6: My performance in Physical Sciences is very bad because I do not get higher marks in it.

Learner 2: My performance in Physical Sciences is good but I have to try to do my best so that I can achieve many things in life.

Learner 3: My performance in Physical Sciences is poor because of lack of practice and lack of group discussions.

Learner 4: I am struggling it's hard.

Learner 5: But myself I am improving, my marks are improving.

Learner 1: I am trying my best.

Interviewer: The next question is, what problems do you experience in learning Physical Sciences?

Learner 1: I think in Physical Sciences there are many practical questions and if the school is not having a laboratory we have the problem of not doing the practical activities after learning in the class.

Learner 3: When coming to the questions you might find out you do not understand the questions and it is difficult to answer questions and using the formula. Also reading instructions is difficult because it is hard and boring.

Learner 2: I don't understand the questions, I am poor in English.

Learner 4: No textbooks sir, we want textbooks so that we can read.

Learner 5: Another problem is that we don't have a laboratory and we don't do practical work.

Learner 6: Time is not enough and sometimes I don't understand the topics, like mechanics.

Interviewer: Ok, now what I would like to know is what can your teacher do to help you improve your results?

Learner 5: I think they should give us the tests at the end of every chapter or at the end of every week so that we can gain more experience of solving the questions and

the other thing is that they can give us more questions so that we can be able to answer the questions when they come. The other thing is that they can introduce morning and afternoon lessons.

Learner 2: If the teachers can teach us during the weekend, we can do revision on Saturdays and they teach us during the week thus Monday to Friday we are learning some of the chapters and during the weekend we do revision of the work we have done.

Learner 3: We must write more tests, class work and homework.

Learner 4: Sure, writing a lot of tests and attending during weekends.

Learner 1: We can do a lot of revision with the teacher.

Learner 6: The teacher can teach us how to read and do experiments.

Interviewer: U-mm, what I would like to know from you now is which content is difficult in Physical Sciences?

Learner 1: Mechanics is very difficult for us because we face some questions which are difficult for us.

Learner 6: Mechanics is too long and it involves many problems, some of them we do not understand and it is the longest content in Physical Sciences.

Learner 4: I find electricity and magnetism difficult in grade 11 because sometimes they just give us a complicated circuit diagram and we do not know how to approach it.

Learner 3: E-ee, Work, Energy and Power is the most difficult, they just give us many forces or diagram with many forces and sometimes we add or subtract.

Learner 2: Organic chemistry and work, energy and power.

Learner 5: The topic on vectors sir in grade 11 is hard and chemical change, yes quantitative one.

Interviewer: I see, the next question is which content is easy?

Learner 2: In Physics Doppler Effect is the easiest chapter because you just substitute in the formula and if you want the source of velocity you just substitute.

Learner 1: Momentum is the best topic where we get more marks and we enjoy the questions that are asked.

Learner 3: I like the topic Matter and Materials it is easy, compounds, I like them.

Learner 5: I am good at calculations, but my English is bad.

Learner 6: When I do experiments, I do well and I like the topic of waves and light.

Interviewer: My next question is why do you think teachers give you tests or ask questions?

Learner 1: They want to test whether you have heard and to check whether you understand what they are teaching or they want to improve our knowledge and understanding.

Learner 5: They want to know if we understand what they have taught you. They just want to know if we understand the topic. They give you tests about what we did to show that we understand.

Learner 6: Yes to see if we understand the topic.

Learner 3: Another thing is to make us revise the topics we have covered.

Learner 4: I think to identify our problems and help us.

Learner 2: Ok, to motivate us to work hard.

Interviewer: The next question is for you, let's start from this side and we all need to talk, to what extent can your behaviour in class contribute to your performance in Physical Sciences?

Learner 6: I think the behaviour might be not listening when the teacher is teaching and not giving the teacher the full attention, it is not good.

Learner 2: Explaining other things to the learners, you might find out that learners did not understand what the teacher has said and if the teacher can explain and also helping each other.

Learner 3: Sir, if I don't listen I will fail.

Learner 4: E-ee, even studying like writing class work and homework, I will not do it if my behaviour is bad.

Learner 5: I see that those learners who pay attention in class do well.

Learner 1: I want to behave well to improve my standard.

Interviewer: Right, how can the number of learners in a class contribute to your performance in Physical Sciences?

Learner 3: We are 29 and our class is very controllable, it has a lot of space and we are able to share some of the things because we are not many.

Learner 1: If we are more than 50 in a class, you will not have a teacher and others will make noise and will not be working in groups when others are working in groups, they will just be disturbing others who are working in groups.

Learner 4: The teacher will not be able to help us one by one.

Learner 2: Sometimes, there will be a lot of noise in class, it disturbs.

Learner 5: Yes, if we want to read, you can't because there will be a lot of noise.

Learner 6: When we are doing experiments we will be too many in a group, we cannot get a chance to do it.

Interviewer: Doing what?

Learner 6: Touching the apparatus.

Interviewer: My next question is what do you think you can do in order to improve your performance in Physical Sciences?

Learner 4: I can read instructions and questions and look further into the question and see what is being asked and answer.

Learner 5: I think we can work in groups in order to achieve our performance during the exams and we can read carefully and write formulas exactly they are in the question papers.

Learner 3: I must read my books.

Learner 2: When the teacher gives us class work and homework I must do it on time.

Learner 1: I need to understand the language and practice every day.

Learner 6: Yes, I must practice with many past examination papers.

Interviewer: My last question in this group is what will help you improve your performance in Physical Sciences?

Learner 1: If we work in groups and practising more challenging questions everyday and doing practical activities can help us.

Learner 2: If we can do the calculations in groups in Physical Sciences and reading the theory alone at home and do calculations in groups sometimes they are the once which are difficult.

Learner 3: I think we must ask questions were we do not understand because as learners we are afraid of our teachers to ask questions because of the language English.

Learner 4: If teachers can give us many tests our performance can improve.

Learner 5: I think coming to school on Saturdays can help.

Learner 6: When I do experiments I feel motivated.

Interviewer: We have come to the end of our interview thank you very much.

FOCUS GROUP INTERVIEW

GROUP 5

Interviewer: I am carrying out a research and everyone is free to answer the questions and my first question is what motivated you to choose Physical Sciences as a subject at Grade 10?

Learner 6: It is an exciting subject and also the career I want requires Physical Sciences.

Learner 4: I chose Physical Sciences because it is one of the subjects I like.

Learner 3: The career I want to take requires Physical Sciences and it has always been one of the subjects that I have been keen on and material revolves around Physical Sciences.

Learner 2: My career choice is I want to be an engineer.

Learner 5: My parents motivated me to choose Physical Sciences.

Learner 1: I passed grade 9 so I chose Physical Sciences.

Interviewer: Ok, another question is what problems do you encounter when doing homework at home?

Learner 4: You find out that some questions need to be done thoroughly in groups. When I am at home it requires a group kind of work and most of the learners will not be there.

Learner 5: You find out some of the questions require more attention and understanding the question.

Learner 3: Most of the times when you are doing homework alone you find it difficult; it requires group work where we help each other.

Learner 2: Yes, I also like group discussions.

Learner 1: My parents are not able to help me so it is a problem.

Learner 6: We do not have enough textbooks and it is a big problem.

Interviewer: My next question is how is your performance in Physical Sciences?

Learner 1: My performance in Physical Sciences is moderate and is not good or bad.

Learner 5: My performance in Physical Sciences is not good and I am not happy with it.

Learner 3: It is not pleasing but I think I can do better.

Learner 4: Not good.

Learner 2: It is better but I want to do more.

Learner 6: I think I am doing well but I want to improve my levels.

Interviewer: What problems do you experience in learning Physical Sciences?

Learner 5: Physical Sciences has a lot of content so all the things they require you must always memorise them all at once and sometimes it is hard to study.

Learner 3: Physical Sciences require physical strength and commitment in doing all the activities as it is a challenging subject.

Learner 6: In Physical Sciences the most important thing is to understand the questions and if you do not understand you will fail.

Learner 4: We do not have enough textbooks.

Learner 2: Even the laboratory, we don't do practical work all the time.

Learner 1: Sometimes other learners disturb us in class.

Interviewer: As a follow up to that question, what can your teacher do to help you improve your results?

Learner 4: Instigate intensive revision on a daily basis.

Learner 2: I think the teachers should explain not just to write notes in textbooks. Teachers need to explain the content.

Learner 5: Teachers should try and must summarise the notes in textbooks and explain to us.

Learner 3: Teachers should know what we are capable of and try to improve our performance.

Learner 1: We can do more experiments

Learner 6: Giving us more tests and attending during Saturdays.

Interviewer: Now, I want to know something about the content you learn, which content is difficult in Physical Sciences?

Learner 4: For me in grade 12 it is Mechanics.

Learner 1: Chemistry not because it is difficult I do not find it exciting.

Learner 2: Electricity and charges

Learner 3: Mechanics

Learner 5: Vectors and chemical change in grade 11.

Learner 6: I have a problem in balancing equations.

Interviewer: Which content is easy?

Learner 6: Vectors and forces

Learner 4: Waves and light specifically Doppler Effect and Photoelectric effect.

Learner 1: Electricity and electromagnetism

Learner 3: Electricity

Learner 5: I like Lewis diagrams.

Learner 2: Momentum is easy to me.

Interviewer: Order please, my next question is why do you think teachers give you tests or ask questions?

Learner 4: Teachers give us tests and ask questions in order to improve our work and evaluate our standard and to identify where we are struggling.

Learner 2: The motive is to improve our work and evaluate our standard and to find out where we are not doing well so that we can be helped.

Learner 3: To see and to test our mind if we understand or not.

Learner 5: Teachers want to see our standard.

Learner 6: Ok, teachers can find our problems and help us.

Learner 1: Sir, to give us practice in answering questions.

Interviewer: The next question is to what extent can your behaviour in class contribute to your performance in Physical Sciences?

Learner 4: If you are positive to the task you tend to do well. The more positive you are the more eager you are to learn and the more you improve your performance.

Learner 3: I think you ought to love the subject and if you are not working hard in Physical Sciences, you require a lot of commitment.

Learner 6: Positive behaviour results in improving our standard.

Learner 5: Respect your teacher and love your subject.

Learner 2: If I am behaving well I will pass.

Learner 1: I need to work hard and respect my teacher.

Interviewer: That is fine, now I want to know how can the number of learners in a class contribute to your performance in Physical Sciences?

Learner 1: Sometimes if there are fewer learners in a class there will be no competition performance of learners will be less because there will be no individual attention.

Learner 4: It all depends with learners and if the learners are positive where they experience problems they ask.

Learner 3: I think if there are larger numbers this can help the learners to work together and learners can put their heads together to help each other so that they can all understand it.

Learner 2: No, No sir, if we are many we make noise and it is difficult for the teacher to help us.

Learner 5: The teacher is able to assist us.

Learner 6: E-ee, small classes are good.

Interviewer: Why do you say they are good.

Learner 6: I get help fast.

Interviewer: My next question is what do you think you can do in order to improve your performance in Physical Sciences?

Learner 6: Paying attention to our teachers and I find it helping.

Learner 4: Another important thing is to tell your teacher where you have problems and also to study hard. Work hard when you are having a problem tell your teacher so that he can help you.

Learner 3: Try to find help and most importantly you must learn to be independent.

Learner 2: Hard work, dedication and loving what you are doing.

Learner 1: Stop delaying and do revision last minute, we need to always do revision and understand the topics in time.

Learner 5: I must revise my work, yes, past examination papers can help.

Interviewer: You are participating very well and my last question is what will help you improve your performance in Physical Sciences?

Learner 6: I think doing experiments about what you have learnt can help.

Learner 4: We need to collect past exam question papers and revise them always.

Learner 5: Yes we need more textbooks, we just use Siyavula.

Learner 3: The teacher can teach us how to read and understanding and teaching us during weekends.

Learner 2: We must have enough textbooks.

Learner 1: Our teacher must have more time with us and revising difficult topics like work, energy and power.

APPENDIX 13

INTERVIEW GUIDE TO PARENTS

Parent 1

What problems if any does your child have with Physical Sciences?

I as a guardian, I do not see any problem and I always see her doing her homework and I see that she is enjoying the subject.

What do you as parent do to improve the academic achievement of your child in Physical Sciences?

I try to get her some question papers with questions in Physical Sciences.

Are you aware of any lack of resources that may influence your child's performance in Physical Sciences?

Yes, I am very much aware of that and our schools are in rural areas and then there is a lot of lack of resources in schools.

Probing question: What can you as parent do about a lack of resources?

I think may be if the school and the community and principal may try to guide us how to get those resources and maybe as parent may put into our pockets to buy those resources.

What intervention strategies can teachers employ in order to improve learner academic achievement in Physical Sciences?

I think teachers must go extra mile, may be during the weekends or in the afternoons to help our learners.

In what ways can career exhibitions or expos, seminars or festivals contribute to your child's performance?

It contributes a lot to my child but I think it may be done twice a year, maybe my child can understand what she is doing.

Probing question: How have you as parent supported your child during the career exhibitions?

Ok! I try to help her maybe to gather more information by means of one going to exhibition to get some resources and having some resources to write down some information when they are at the exhibition.

What assistance do you provide your child with homework at home?

I try to give her more time to do her work and I sometimes ask her maybe to ask some relatives who know more about this Physical Sciences to help her.

How often do you consult with Physical Sciences teachers or principals about the academic achievement of your child?

Sometimes I ask the teacher how my child is performing in Physical Sciences so regularly.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate, which ends up affecting the overall pass rate of the schools. What are your views on this issue?

My view is that this Physical Sciences should not be taken out of schools because it is marketable. E-ee, I think when my child can pass this subject she may be better in her life.

Do you have any other comments concerning your child's performance in Physical Sciences?

Yes, my comment is that I think our schools should have more afternoon classes and during weekends to help my child.

Parent 2

What problems if any does your child have with Physical Sciences?

No, she does not have a problem.

What do you as parent do to improve the academic achievement of your child in Physical Sciences?

I can go and buy some Physical Sciences study guides to show her where she can read and understand how to do Physical Sciences.

Are you aware of any lack of resources that may influence your child's performance in Physical Sciences?

No, we have a Physical Sciences teacher and he is doing very well at Physics. I do not see any problem.

Probing question: What can you as parent do about a lack of resources?

I try to buy some extra books for my child and at our school we have a new laboratory.

What intervention strategies can teachers employ in order to improve learner academic achievement in Physical Sciences?

I think they can employ more Physical Sciences teachers to teach our children and to improve their performance. Also we have laboratory here where learners can do practical activities.

In what ways can career exhibitions or expos, seminars or festivals contribute to your child's performance?

If I know if there are teachers teaching Physical Sciences at Bochum during the holidays I can give her money to go there.

Probing question: How have you as parent supported your child during the career exhibitions?

I provide food and money for registering and transport. I also encourage her to behave during the trips.

What assistance do you provide your child with homework at home?

I can try to assist her to do homework in Physical Sciences. I do not know Physical Sciences.

How often do you consult with Physical Sciences teachers or principals about the academic achievement of your child?

I consult them if I see the report is not right I ask them what went wrong and maybe she can obtain position one.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate, which ends up affecting the overall pass rate of the schools. What are your views on this issue?

I do not think is good because there is a shortage of science professionals in South Africa so if it is removed it will affect the economy.

Do you have any other comments concerning your child's performance in Physical Sciences?

Nowadays, Physical Sciences is very important in our child's life and when you pass grade 12 at tertiary they check if you have Mathematics and Physical Sciences you cannot get a space and bursaries to go further.

Parent 3

What problems if any does your child have with Physical Sciences?

As far as I know there are minor problems, like isn't it that Physical Sciences is divided into paper 1 and paper 2 so my child has a problem with paper 2. I try to invite local teachers who are teaching the subject to come and teach my child.

What do you as parent do to improve the academic achievement of your child in Physical Sciences?

My child during the first week he told me that there are some books needed at school and I bought those books for him to improve. He also needed books with memorandum. I try to support him by buying those books since he was not doing well.

Are you aware of any lack of resources that may influence your child's performance in Physical Sciences?

He told me that there are some lack of apparatus so I think the best way to help is to get some resources is for the principal to ask the department of Education to buy those resources.

Probing question: What can you as parent do about a lack of resources?

As a parent when experiencing lack of resources sometimes it is my responsibility and is important to buy the resources not depending solely on the school because is my child and the future is his.

What intervention strategies can teachers employ in order to improve learner academic achievement in Physical Sciences?

What I think the teacher could do, if the teacher is teaching Physical Sciences and is facing problems he must work with others or ask someone locally sort of outsourcing. I think outsourcing is the only solution.

In what ways can career exhibitions or expos, seminars or festivals contribute to your child's performance?

I think on the line of career exhibitions or expos a child will be able to see, sometimes they bring audio visual and learners will be able to see other learners at the university doing Physical Sciences and they will be encouraged to follow suit. Learners are shown different faculties and encouraged to apply.

Probing question: How have you as parent supported your child during the career exhibitions?

Umm, I support my child, I lend him my camera and tablet so that he can take photos and bring the photos and sit down and discuss. We could be able to watch them at home and make a choice and where to go next year.

What assistance do you provide your child with homework at home?

As I have indicated I am not specialised in Physical Sciences. I ask my neighbour who teaches the subject to assist my child at home. When my child comes home and show me tasks in Physical Sciences, I ask my neighbour to come and assist him.

How often do you consult with Physical Sciences teachers or principals about the academic achievement of your child?

Usually, every month I will call a Physical Sciences teacher and ask him how my child is performing and will tell me the performance is below expectations. I would ask the teacher how I can inform the local teacher to help my child in the garage. Most learners locally come to my home to do Physical Sciences.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate, which ends up affecting the overall pass rate of the schools. What are your views on this issue?

No! I think it is very wrong to do away with Physical Sciences because not everything in Physical Sciences is difficult. You find that a learner can have problem in paper 2 and pass paper 1 and some chapters are too easy. We are in an era where Physical Sciences plays an important role in moving the economy.

Do you have any other comments concerning your child's performance in Physical Sciences?

U-mm, I think my comment is that I would like to thank teachers for helping learners with problems.

Parent 4

What problems if any does your child have with Physical Sciences?

I feel that my child will do better or doing very well in Physical Sciences if he was good at the language in which he is taught. I wish some of the books used in schools especially in Physical Sciences translated some of this vernacular language. I think my child will have fewer problems as far as Physical Sciences is concerned. Then

the other thing is that those books written in English are not enough and every child is not having a book. The shortage of textbooks has caused my child to develop reading problems. My child cannot understand when he reads the textbooks. Also the type of people my child associates with these peers show that they spent most of the time playing with his friends and has no time to read.

What do you as parent do to improve the academic achievement of your child in Physical Sciences?

I supplement the schools effort by hiring tutors for my child and if ever I hear of a good Physical Sciences teacher I take my child to the tutors so that my child is able to perform and I offer to pay. Also if I hear about places with holiday lessons I sent my child to those places so that he can improve. I also try to find out what problems my child is facing by checking the books. I want to see my child doing his work.

Are you aware of any lack of resources that may influence your child's performance in Physical Sciences?

Yes, there are no textbooks so that could be one of the reasons that make my child fail to do well. Another thing is that schools are not well equipped as for experiments and science equipment are not available in schools so that Physical Sciences is taught in the same way History is taught and that is removing experiments from Physical Sciences.

Probing question: What can you as parent do about a lack of resources?

As a parent I afford my child the chance of attending extra lessons and I can also make contribution financially so that the school is able to buy missing things that are not readily available at school such as equipment for experiments and chemicals.

What intervention strategies can teachers employ in order to improve learner academic achievement in Physical Sciences?

The teachers can have extra lessons and teachers can also give more tests. The school or the principal can outsource from the schools that is if one other school is doing well in Physical Sciences, schools can encourage outsourcing and offer to incur some extra money to whomever, will be coming to help in teaching Physical Sciences.

In what ways can career exhibitions or expos, seminars or festivals contribute to your child's performance?

Career exhibitions or expos make my child interested and motivate my child to do the type of career that he wants to do in future and during these career exhibitions or expos there are some experiments that are carried out and this makes my child to do more in Physical Sciences.

Probing question: How have you as parent supported your child during the career exhibitions?

I have done that by providing the money to get to places where these career exhibitions or expos are being carried out or are being done. I also give my child permission to attend. I have supported and encouraged my child to attend those places and learn as much as he can.

What assistance do you provide your child with homework at home?

What I am able to do I help but the things that I do not know I hire knowledgeable people to try and assist. I also encourage my child to do homework.

How often do you consult with Physical Sciences teachers or principals about the academic achievement of your child?

I do not usually like interfering so I do not visit the school very often. I only visit the school when there are meetings and when collecting school report and I can say once a term.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate, which ends up affecting the overall pass rate of the schools. What are your views on this issue?

Yah, removing Physical Sciences is not a good thing and I would not encourage schools to remove it because education minus Physical Sciences is just as good as no education at all. I would encourage those schools to do Physical Sciences because it is the backbone of the current economy and most of the jobs require Physical Sciences. Most of the things that are done in the country they hinge upon Physical Sciences.

Do you have any other comments concerning your child's performance in Physical Sciences?

I want to see my child working hard in Physical Sciences and I also want to see the schools to provide well qualified teachers so that my child might end up doing well in Physical Sciences and do the type of career he wants and this job wants the knowledge of Physical Sciences.

Parent 5

What problems if any does your child have with Physical Sciences?

I do not think is having a problem and is doing well.

What do you as parent do to improve the academic achievement of your child in Physical Sciences?

What I have done is that I only organise teachers who are science literate from other schools to just come and help him during the holidays and also after hours.

Are you aware of any lack of resources that may influence your child's performance in Physical Sciences?

As from now I am not aware of any lack of resources.

Probing question: What can you as parent do about a lack of resources?

I think as parent one has to pay a certain fee for the school specifically just for Physical Sciences resources. As parents we have an obligation to fulfil for our children.

What intervention strategies can teachers employ in order to improve learner academic achievement in Physical Sciences?

Nothing else than keeping learners busy by all the time and organise extra classes as many as you can. We need to keep them busy early in the morning. Weekends has to be used to do Physical Sciences by all children doing it and learners must be kept busy by teachers.

In what ways can career exhibitions or expos, seminars or festivals contribute to your child's performance?

The only way is to have experts, those who know much of Physical Sciences not like those who are not much literate in Physical Sciences. What I have realised is that they bring those who do not know Physical Sciences well.

Probing question: How have you as parent supported your child during the career exhibitions?

The only way is paying for the transport to attend career exhibitions. That's the only way to contribute.

What assistance do you provide your child with homework at home?

As I have said earlier on I do have teachers from different schools where he is attending at my own cost after school hours.

How often do you consult with Physical Sciences teachers or principals about the academic achievement of your child?

Not more than two times per term, it can be once or twice. I consult once or two times a term.

Some schools are opting to remove Physical Sciences as a subject, citing high failure rate, which ends up affecting the overall pass rate of the schools. What are your views on this issue?

U-mmm, my view is that people should not take failure as a way to remove Physical Sciences out. In short I am not opting to remove it out because I know Physical Sciences is one of the valuable subject in all the countries. To me a pass should have to be of quality. If learners pass without Physical Sciences they will have a pass that will be of no quality. One should have a pass that will allow them to be able to be admitted to other institutions. Learners should gain access to quality courses and we will experience a society with quality people.

Do you have any other comments concerning your child's performance in Physical Sciences?

Nothing else than to say he is performing very well as from now.

APPENDIX 14

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13 January 2015 **TO WHOM IT MAY CONCERN**

This letter serves to confirm that I have edited and proofread Mr Z. Rekai's dissertation entitled: "**FACTORS AFFECTING THE ACADEMIC ACHIEVEMENT OF LEARNERS IN PHYSICAL SCIENCES IN SELECTED LIMPOPO RURAL SECONDARY SCHOOLS.**"

I found the work easy and enjoyable to read. Much of my editing basically dealt with obstructionist technical aspects of language which could have otherwise compromised smooth reading as well as the sense of the information being conveyed. I also formatted the dissertation. I hope that the work will be found to be of an acceptable standard. I am a member of Professional Editors Group and also a lecturer in the Bureau of Market Research at the University of South Africa.

Thank you.

Hereunder are my particulars:

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