BARRIERS TO EFFECTIVE SCIENCE TEACHING AND LEARNING IN SECONDARY SCHOOLS IN GRADE TWELVE

By

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DISSERTATION

Submitted in fulfillment of the requirements for the degree of

MASTER OF EDUCATION

IN THE

SCHOOL OF EDUCATION

UNIVERSITY OF VENDA

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2011

DECLARATION

I Tsiga George hereby declare that all sources noted throughout the dissertation have been acknowledged by a complete list of references and that this study is my original work and have never been submitted for any other degree or examination at any other university.

Tsiga George

Signature---

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation and gratitude to all those who assisted and showed interest in the compilation and completion of this study.

Special thanks and appreciation goes to my special supervisor, Dr Mutshaeni H.N, for her unwavering support and her expert professional guidance during my study. Her experience, knowledge and skills were of paramount importance in the completion of this study. I wish her peace and blessings.

I am also sincerely grateful to my co-supervisor Mr Kaheru, S.J.M, for his assistance, had it not been him, this task would not have been possible to accomplish.

I am also thankful to Dr Kutame A.P, who assisted me in statistical analysis of the results.

Many thanks to Mr Benzi, P, for his prayers and unwavering support throughout the study period, May God Bless him.

I am also grateful to Mr Runokunda, W, for proof reading the document.

Ms Manazhe Aluwani, your effort and unwavering support is also appreciated. Be blessed.

Many thanks to my God given loving wife, Loice for her support, encouragement, patience and persistence. My angels Ropafadzoyashe, Tadivanashe, Rutendonashe and my fourth born son Anotidaishe, your love and support is appreciated.

Many thanks to school principals, educators and learners who participated in my study.

Finally, I thank the almighty God for granting me strength and perseverance to complete this project. Father God may your name be blessed forever and ever.

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ABSTRACT

BARRIERS TO EFFECTIVE SCIENCE TEACHING AND LEARNING IN SECONDARY SCHOOLS IN GRADE TWELVE

This study investigates the barriers to the effective teaching and learning of Science in Secondary schools. Several aspects in Secondary schools constitute to barriers that affect the effectiveness of Science teaching. The literature review covered aspects that are essential for effective Science teaching and learning in secondary schools. Sibasa circuit Secondary schools formed the bases of the study as Science pass rate for the past four years is on a free fall. The empirical investigation was conducted using individual interviews and questionnaires. Individual interviews with Secondary school principals in Sibasa circuit of Limpopo Province were conducted whilst educators and learners responded to questionnaires.

The findings revealed the following:

- Barriers to effective Science teaching and learning contribute to poor Science results in Sibasa Secondary Schools especially in grade twelve.
- All secondary schools in Sibasa Circuit have similar problems of lack of educational resources which in turn is causing ineffectiveness in Science teaching and learning.
- Adequate educational resources can promote effective Science teaching and learning in schools.

This study is concluded by making recommendations aimed at solving the identified problems of barriers to effective Science teaching and learning in Sibasa circuit Secondary Schools of Vhembe District in Limpopo Province.

CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Science education in schools is a critical area of study that drives the industrial development of every nation if properly articulated. This is so mainly because the manufacturing industries are strengthened by development in Science and technology and this development is assured when the national population is properly educated in Science. Farmery (2002:17) asserts that the benefit of Science is ultimately embedded in its relevance to the modern world and its direct link to future employment. Department of Education (1999a) reports that the study of Science contributes to "technical change, industry, business and medicine". Shipman (1975) pointed out that Science education fosters a sense of responsibility and co-operation into students. Science diligently socialises learners to suit industry resulting in division of labour as portrayed by the provision of highly skilled and academically minded workforce.

It is also industry that creates employment for the national youth who have studied Science at school. The Education Reform Act of 1988 (ERA) placed a statutory responsibility upon school to provide a curriculum that would, amongst other things, prepare learners for the opportunities, responsibilities and experiences of adult life (NCC,1990). For most learners these will include employment opportunities, and the key skills developed through the science curriculum are highly transferable in a working economy. So it is desirable that all school learners be equipped with sufficient Science knowledge to make them employable and perform well in their chosen vocations, since the most humble form of employment requires some Science knowledge. Therefore it is prudent for the schools to ensure that there is effective Science teaching and learning by removing barriers that may retard the processes of Science teaching and learning in secondary schools.

1. 2 STATEMENT OF THE PROBLEM

The existence of barriers in schools results in ineffective Science teaching and learning. Annually secondary schools perform poorly in Science due to barriers that retard the Science teaching and learning process. The main question that was posed is: What are the barriers to effective Science teaching?

1.3 AIMS OF THE STUDY

The aim of the study was:

- To investigate the barriers to effective Science teaching and learning in schools.
- To examine whether the lack of educational resources is a barrier to effective Science teaching and learning.
- To investigate whether adequate educational resources can promote effective Science teaching.
- To establish ways of removing barriers to effective Science teaching and learning in secondary schools.

1.4 RESEARCH QUESTIONS

The main question that was posed is:

- What are the barriers to effective Science teaching?

The following sub-questions were posed:

- Does the existence of barriers contribute to ineffective Science teaching?
- To what extent do barriers affect effective Science teaching and learning in schools?
- How do adequate educational resources facilitate effective Science teaching and learning?
- How can the barriers to effective Science teaching and learning be removed?

1.5 PRELIMINARY LITERATURE

1.5.1 CLARIFICATION OF CONCEPTS

1.5.1.1 Barrier

According to Longman Dictionary (1987:72) a barrier is something that prevents activity. Collins Dictionary (2000:130), views a barrier as anything that prevents progress. For the purpose of this study, a barrier refers to obstacles that hinder the achievement of good Science results in schools.

1.5.1.2 Educator

Compton's Encyclopedia (1995 vol 7:81) an educator is an educated professional; someone who is well versed with the subject matter and best methods of organizing and presenting it. An educator knows how to inspire interest in learning effectively communicates information and skills and maintains discipline as to enable someone to learn. According to Longman Dictionary (1987:325) an educator is a professional person who educates. In this study, educator refers to a person who teaches learners in a formal setting so that they acquire Science knowledge and skills. The words educator and teacher are used in this study interchangeably.

1.5.1.3 Learning

According to Fraser, Loubser and Van Rooy (1993:20) learning is "the recording, collecting, processing and reproduction of information". According to Wydenman (2002:127), learning is the acquisition of knowledge and skills as well as attitudes and values. According to Collins Dictionary (2000:939), learning is the act of gaining knowledge or knowledge gained by study. In this study learning refers to acquiring information, knowledge and values which are regarded as desirable qualities in the society.

1.5.1.4 Learner

Longman Dictionary (1987:594) defines a learner as "a person who is learning". Government Gazette Nov (1996) in Hughes (2002) defines a learner as any person receiving education or obliged to receive education in terms of Act no 86 of 1996. In this study a learner refers to a person who is learning in a school situation. The following words, learner, student and pupil are used interchangeable in this study.

1.5.1.5 Science

Farmery (2002:9) defines Science as a subject "that involves the symbiotic relationship between evidence, interpretation and the establishing of accepted knowledge". According to Collins Dictionary (2008:1491) Science is the systematic study of nature and behavior of the material and physical universe, based on observation, experiment and measurement and the formulation of laws to describe these facts in general terms. In this study Science refers to a subject that involves the study of knowledge which can be made into a system and which usually depends on seeing and testing facts stating general natural laws (Longman Group 1987:934)

1.5.1.6 Teaching

Collins South African School Dictionary (1999:870) defines teaching as to educate, instruct or train. According to Wydenman (2002:185), teaching is a system of activities intended to cause learning and comprising the deliberate and systematic creation and control of those conditions in which learning occurs. In this study teaching refers to the process by which educators assist learners to learn Science.

1.6 RESEARCH DESIGN AND METHODOLOGY

1.6.1 METHODOLOGY

According to Mouton (1998:156) the inclusion of multiple sources of data collection in research project is likely to increase the reliability of the observations. Considering the above opinion, I combined qualitative and quantitative approaches in this research study in order to facilitate triangulation. Triangulation is the cross validation among data sources. I also used different types of triangulation as proposed by De Vos (2000:359) cited in Duffy (1993) and Thomas & Nelson (1996:376), these include theory triangulation, data triangulation and investigator triangulation.

1.6.2 POPULATION

Mouton (1996:134) says population is a collection of objects, events or individual having some common characteristics that the researcher is interested in studying. In this study the population consists of all school principals, all science educators and all grade twelve Science learners from secondary schools in Sibasa circuit.

1.6.3 SAMPLING

Sampling is the process of selecting a number of individuals for a study in such a way that the individual represents the larger group from which they were selected. Grinneri (1993:154) views sampling as the selection of some units who represent the entire set of population. It means taking any portion of a population as representative of the population. As pointed out by Neuman (1997:201), sampling should be viewed as the process of selecting a number of individuals for a study in such a way that the individual represent the larger group from which they were selected. The key concept of sampling is representativeness. Ten secondary schools were selected for this study from schools in Sibasa Circuit. To select the sample, I did purposive sampling as it was the most suitable for this study. Singleton, Straits, and Straits (1993) say in purposive sampling "... the sample will be composed of elements which contain the most characteristic, representative or typical attributes of the population". On the basis of my knowledge of the population, I made a judgment on which subjects to select to provide the best information to address the purpose of this study.

I employed single-stage sampling design as I had access to Science educators, school principals and secondary schools in Sibasa circuit. According to Creswell (1994:119), a single-stage sampling procedure is one in which the researcher has access to names in the population and can sample the respondents directly.

1.6.4 DATA COLLECTION

I employed different techniques to collect and gather information. These techniques assisted me to effectively carry out the research. The techniques were interviews and questionnaires. Fox (1976:225) assets that "interview is a technique in which the researcher poses a series of verbal questions for the respondents in a face to face situation". According to Tuckman (1972) an interview provides "access to what is inside a person's head, makes it possible to measure what a person knows, what a person likes, or dislikes, and what a person thinks". Creswell (2005:214) believes that interview occurs when researchers ask one or more participants general open- ended questions and record their answers. The interview techniques used were structured and unstructured interviews. The interview has many advantages including the following, according to Strydom and De Vos (1998:300) the advantages of unstructured interview enables an interviewer to obtain an inside view of the social phenomenon as well as to explore other cues of research emerging from the interview. The disadvantage is that it is time consuming due to the fact that vast amounts of data are collected; this makes recording and interpretation difficult. It usually needs to be conducted by researchers themselves and not by other interviewers.

1.6.5 DATA COLLECTION INSTRUMENTS

1.6.5.1 Quantitative data

In collecting quantitative data, I used questionnaires. According to Education Facilitators (1998:66), a questionnaire is an instrument with open or closed questions or statements to which a respondent must react. Science educators and Science learners responded to questionnaires in relation to barriers to Science teaching and learning.

1.6.5.2 Qualitative data

Interview schedules were used in collecting qualitative data. Data was collected from school principals in relation to barriers to effective Science teaching and learning in schools.

1.7 DATA ANALYSIS

Quantitative data was analyzed using the computer statistical package for social sciences (SPSS) version 17. Qualitative data was organized into categories and relationships among the categories were identified.

1.8 DELIMITATIONS AND LIMITATIONS

- **DELIMITATIONS**

The study was conducted in Sibasa Circuit of Vhembe District in Limpopo Province. The study comprised of school principals, science educators and grade twelve Science learners in ten of the Public Secondary Schools in Sibasa Circuit.

- **LIMITATIONS**

Time was the limiting factor since I am an employee in the department of education. Funds were another limiting factor as the study required a lot of funds since I was traveling to schools to gather data.

1. 9 ETHICAL CONSIDERATIONS

I wrote a letter to the Department of education Vhembe District Senior Manager, Circuit Managers and School Principals to seek for permission to conduct research in their schools. I designed a consent form for all participants stating how information was to be collected, procedures to be followed during the investigation, how the data was to be stored, the possible advantages, disadvantages and dangers to which respondents may be exposed. Gray (2009:61) asserts that respondents should give their views voluntarily, their privacy should be safeguarded and information they provide should be treated confidentially. I treated all participants with respect and due considerations. Miller and Bell (2002:67) suggest that "keeping a constant record of decisions made is a good safeguard against sloppy thinking and inadvertent overlooking of ethical issues". I used research diary to document decisions made throughout the research process. Strydom and De Vos (1998:330) indicate that strategies to maintain confidentiality are critical in reducing the risk of harm related to embarrassment and administrative or legal punishment to those studied.

1. 10 SIGNIFICANCE OF THE STUDY

This study revealed the factors that hinder progress in the teaching and learning of Science in Sibasa Circuit of Vhembe District in Limpopo Province of South Africa. The significance of this study is in the fact that Science is a subject of importance for employment in industry, especially in the manufacturing industry. It is therefore prudent that learners in schools learn and pass Science education before they can be employed for progressive national development. The learning can only be effective and of the correct levels when there are no obstacles in the teaching and learning processes of Science. Good Science results in schools can also be achieved only when there are no shortfalls to teaching and learning in schools, hence the study. It is hoped that this study will add value to the body of knowledge.

1. 11 STRUCTURE OF THE RESEARCH CHAPTERS

Chapter One focuses on the background of this study in terms of its problem, aims, research question, significance, limitations and delimitations.

Chapter Two presents detailed literature review related to barriers to science teaching and learning focusing on views of scholars. The main focus of this chapter is to relate the findings of this study with other related studies done in the field of barriers to science teaching and learning.

Chapter Three deals with research design, methodology, population of study, sample and sampling procedure, data collecting instruments, actual data collection and data analysis procedures.

Chapter Four focuses on data analysis and interpretation of data.

Chapter Five provides the discussion of research findings, recommendations and conclusions.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter focuses on literature relating to barriers to effective Science teaching and learning in schools. The following topics are discussed; approaches to effective Science teaching and learning, strategies for effective Science teaching and learning, characteristics of an effective Science educator, the nature of educational barriers and effective Science teaching and learning.

2. 2 APPROACHES TO SCIENCE LEARNING AND TEACHING

2.2.1 Introduction

Teaching includes learning and therefore may be described as a system of activities intended to cause learning and comprising the deliberate and systematic creation and control of those conditions in which learning occurs (Wydeman 2002:185). This is the reason for putting more emphasis on effective Science teaching. Taking into cognisance the various formal, non-formal and informal Science teaching -learning situations, it is clear that there are varied conditions or requirements for effective Science teaching. A study of different teaching procedures shows certain fundamental principles on which effective Science teaching is based. In formal Science teaching – learning environment teachers could use these principles in an organized, meaningful and systematic way to ensure that effective Science learning takes place.

2.2.2 The principle of activity

For the learner to learn effectively, he/she has to do something either mentally or physically. The principle of activity is concerned with the active participation of the learner in learning Science. As children are active by nature, the aim of this principle is to channel the ever-present activity of the learner into the learning situation in order to enhance effective learning (Steyn, Badenhorst and Yule 1981:25).

According to Farrant (1991:133) "teaching that uses active learner participation is a co-operation effort and not a one man's act". Rousseau (1912:76) cited in Teacher in Zimbabwe November (1995:14) explained that teaching should be a discovery process, based on practical work rather than generalisation. Dewey also advocates direct engagement in projects. Froebel emphasized the need for methods of teaching and learning through doing, drawing, imitating and dramatization. Therefore it is the educator's task to promote active participation in learners during Science lessons.

According to the behaviorist Jean Piaget (1950), all learning should appeal to all senses that is seeing, hearing, feeling, touching, tasting, and smelling. This is also supported by Morrison (1988:43) when he says the best way to make learners receptive to experiences is to train their senses. Thus Science educators should develop an awareness of life through captivating sensory learning in learners, this forms the basis for original work.

Children should be actively participating at least half of the learning period. This will allow learners to express their thoughts, feelings, interests and understanding feelings, roles and work of others Thus principle of activity makes learners understand concepts faster and will retain information since they will be learning by doing.

Active participation provides learners with first hand information and opportunities to learn about their world. Learners will learn to use scientific methods as they gain skills like observing, collecting information and drawing conclusions. The principle of activity enables learners to function in a society that stresses certain social, intellectual and moral values.

2.2.3The principle of perception

Perception means becoming aware of one's environment through one's senses, it is when sensory awareness results in an inner experience which includes thought and language. As a didactic principle, perception implies that teaching can be successful only if representative facets of reality are placed within the perceptual reach of the learner (Wydeman 2002:187). The teacher attempts to present abstract concepts to the learner in the form of concrete and observable examples. Thus the teacher has to progress from the known to the unknown.

2.2.4 The principle of interest and motivation

Interest implies a deliberate focus of attention. In order to ensure effective learner participation it is necessary to stimulate interest in the learners and to motivate them to participate in the science teaching- learning situation.

Motivation implies two basic concepts, namely intrinsic motivation and extrinsic motivation. Intrinsic motivation is inherent in the teaching-learning situation as learning content itself evokes interest in the learner. Extrinsic motivation can take two forms, positive motivation in the form of rewards or negative motivation in the form of punishment (Wydeman 2002:187).

In order to succeed in cultivating intrinsic motivation, science educators should be enthusiastic towards what they do, because one of the sources of motivation is satisfaction of learning, that is if learners are not satisfied with the learning they receive, they may not have the continued motivation to learn.

Farrant (1980:115) has this to say "motivation is all important for getting children to learn once their attention has been captured, once children wants to learn, the battle is half won".

2.2.5 The principle of totality

This principle implies that learners should be viewed as whole persons. This wholeness comes on different levels, for example

- On physical level: the learner is a whole person with emotions, body, intellect and complete personality.
- On subject level: learners should be guided to see the relevant connections through integrating various subject fields with one another.

- On an institutional level: there should be cooperation between the school and the learner's home.

The principle of totality is also emphasised in Gestalt psychology. Perkins (1969: 357) says Gestaltists emphasizes the idea of globalisation or formation of wholes (gestalts) in human consciousness. The whole takes precedence over the parts and is more than the sum of the parts. Principle of totality is also supported in Allport's theory of holism whereby the individual is viewed as integrated totality.

2.2.6 The principle of individualisation and differentiation

The didactic principle of individualisation and difference is based on the fact that each individual is unique and differs in regards to interest, abilities, aptitudes, environment, intelligence, learning style, cultural background and motivation (Wydeman 2002:189). This principle implies that the teaching-learning situation should be conducted in such a way that each learner will work and develop to his/her maximum potential within the classroom. Educators should cater for individual differences.

2.2.7 The principle of purposefulness

The principle of purposefulness implies that both the teacher and the learner should have a clear idea of what they are doing and what they want to achieve by doing it. This means that proper planning and effective communication should take place (Wydeman 2002: 190). Educators should present facts in such a way that meaningful teaching will take place.

2.2.8 The principle of integration

This principle of integration implies that the teacher would attempt to make learners perceive these contexts by guiding them to compare things, to relate cause and effect and to understand how one matter is influenced by another. Learners can understand concepts more easily and more effectively if they can see them in relation to existing concepts.

2.2.9 The principle of example

The principle of example implies that the learner should be taught through examples to unlock the features of much larger related fields. The learner is then led from the particular example to the general of the whole as represented by example.

2.2.10 The principle of evaluation

The purpose of evaluation as one of the didactic principles is to monitor the progress of the teaching- learning event. According to Education facilitators (1998:17) the value of evaluation includes the following:

- For effective teaching, the teacher should constantly evaluate continuously whether the aims of the teaching-learning process have been reached.
- Without evaluation it would be impossible for the teacher to gear his/her teaching to the level of the learners.
- Through evaluation the teacher is able to discover misconceptions, comprehension backlogs and learning difficulties.

2.2.11 The principle of actualization

The principle of actualization implies that the educator and the learner are active together with the aim of actualizing the learner's potential. This means that teaching-learning process should be conducted in such a way that each learner will learn to the best of his/her abilities and realize his/her potential in doing so.

2.2.12 The principle of socialization

Socialization means the learner's adaptation to their physical, psychological and social environment through interaction with other people. The didactic principle of socialisation implies that the educator arranges the teaching-learning process in such a way that favorable social relationships prevail is the classroom.

2.3 EFFECTIVE SCIENCE TEACHING AND LEARNING STRATEGIES

According to Kramer (1999:91), there are three main strategic choices that an educator must make in terms of the approaches to be used. Each of these decisions lies on a continuum. The three strategic choices are:

1. Direct (teacher-centered) vs indirect (learner-centered) teaching.

2. Independent (individual learner) vs cooperative (group learning) strategies.

3. Reception (memorization, rote learning) vs discovery (meaningful) learning.

2.3.1 Direct instruction

Direct instruction is educator-centered. It is useful for the presentation of facts, information, concepts and new ideas. Even though it is an important component of teaching and learning, it is often used exclusively without considering other methods. Examples of direct instruction include the following:

Lectures, dictation, presentation, drill and practice, guided worksheets, videos and films, didactic questioning, demonstrations, guided reading and writing, team teaching and visitor presentations (Wydenman (2002:200).

2.3.2 Indirect instruction

According to Wydeman (2002:200), the main characteristic of indirect instruction is that learners create their own understanding of concepts by analyzing the evidence gathered through their learning activities. The learning is learner-centered with the teacher moving to the role of a facilitator rather than manager of the learning. According Spodeck, Saracho and Davies (1987), Montessori put more emphasis on children being independent. Rusk and Scotland (1979) says education should be a self-activity which leads to self-direction.

The main benefit of this strategy are that it allows for learner differences while taking advantage of learners' natural curiosity and creativeness in learning. On the other hand it is very time consuming and its results are very difficult to predict. Examples of indirect instruction strategies include the following:

Oral presentations, concepts maps, case studies, delivering lessons, theme poster and collage, role play and simulations, design-and- make activities, group projects, research articles, field trips, investigations and experiments, debates, interviews and surveys.

2.3.3 Independent strategies

Independent learning is when a learner undertakes a learning task by him/herself. The educator still plays an important role but more as a resource for learning than a manager of learning. This strategy has the following benefits:

- Learners rely on their own efforts.
- It pinpoints possible weaknesses that learners may have.
- It is also the best way to allow for different learning styles.
- It allows for learning at home or outside of the classroom.

The following examples fall under this type of teaching strategy:

Homework, research projects, report projects, interview tasks, assigned questions, computer-assisted learning, learning centers, writing assignments, self-assessment, worksheets, crossword puzzles.

2.3.4 Co-operative strategies

Group work forms an important part of Science teaching and learning because (Kramer 1999:96)

- It is authentic (most activities in real life involves people working together in some or other way)
- It allows learners the opportunity to recognize and practice the skills needed to work with others in an organized way

- It provides opportunities for learners to develop attributes such as independence, self-discipline, self-confidence, self-reliance and the handling of conflict situations.

It is of paramount importance to understand that learners do not necessarily have the skills to participate effectively in group work and that these skills need to be taught and practiced.

The following are some of the examples of group learning strategies:

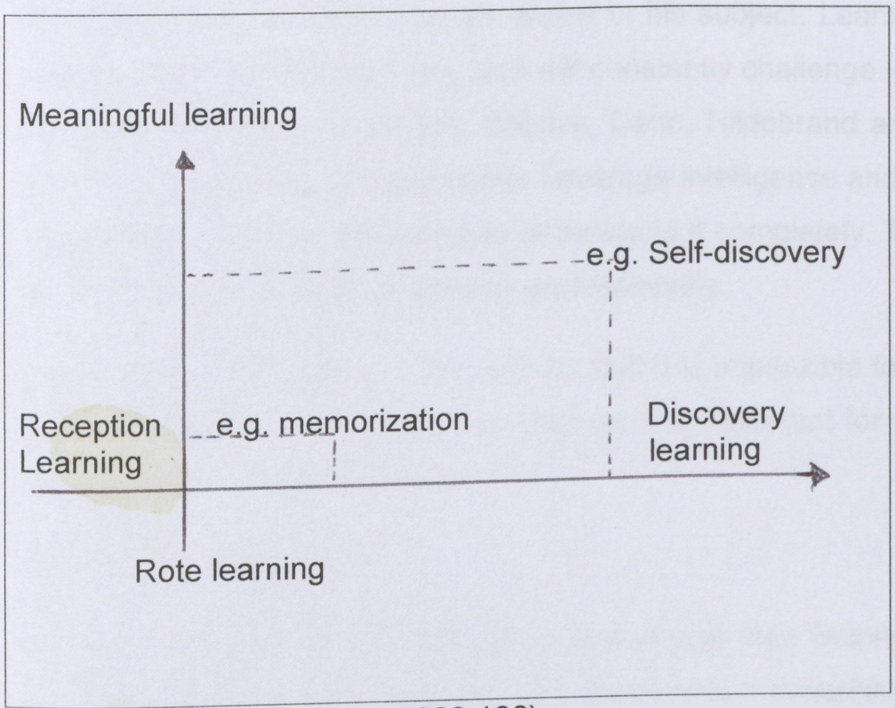
Group assignment, simulations and role play, brainstorming, jigsaws, peer teaching, team presentations, fishbowls, peer assessment and train questions.

2.3.5 Reception learning and discovery learning

The other strategic decision that an educator must make is how to achieve a balance between learning through straightforward presentation of facts compared with learners learning by themselves through research, experimentation and discovery. Even though discovery learning strategies are more effective in Science teaching, they are time consuming and also have the additional risk that learners may not "discover" what the educator intended them to discover.

David Ausubel developed a model that could assist an educator in making the strategic decision (Kramer 1999:100). His model consists of two axes. The vertical continuum is between rote learning and meaningful learning. Rote learning is the act of memorizing something without understanding it, while meaningful learning implies that learners will have a deep comprehension of what they have learned.

Table: 2.1 Ausubel's model



(Ausubel's model: Kramer 1999:100)

2.4 CHARACTERISTICS OF AN EFFECTIVE SCIENCE EDUCATOR

Effective Science teachers have certain characteristics they share. A perfect teacher does not exist, as much as a perfect human being does not exist. However, there are teachers who have qualities for effective teaching (Cullingford, 1995:120).

2.4.1 Model figure

Learners look upon teachers and emulate what they do. During school going age children spend most of their time at school with educators. Teachers have a very important role in moulding the children. Shipley, Cann, Hildebrand and Mitchell (1968:5) support the idea of teachers being model figures when they say; the courteous teacher finds his or her courtesy reflected in her learners who look to her or him as a model. Teachers' interaction with learners, determines their behavior and vice versa (Mutshaeni 2008:24)

2.4.2 The ability to master the subject

A Science teacher should be an expert in his subject. Learners are very quick to spot inadequacies in their teachers, and will constantly challenge levels of knowledge in their teachers (Mutshaeni 2008:24). Shipley, Cann, Hildebrand and Mitchell (1968:2) argue that the teacher should have above –average intelligence and be able to convey subject knowledge to her/his learners and understand it completely. This teacher should always be furthering studies as to develop professionally.

Cullingford (1995:124) is of the opinion that it is impossible to teach without knowledge. Science is changing almost every day, so it is important for an educator to be abreast with developments taking place.

2.4.3 Show enthusiasm

It is very difficult for many educators to motivate their Science learners and to arouse their interest in the subject matter. It is of paramount importance for an effective Science educator to be enthusiastic about the subject. Lack of enthusiasm and interest can be deterrent for those who are hungry to learn (Gower and Smith1982:43). According to Dekker, Papenfus, De Beer,and Mtombeni (1993:17) there is a problem that teachers themselves are not enthusiastic enough about their subject. According to them enthusiasm is shown by organizing field trips for learners to be able to discover things on their own. This will enable the teacher to develop Science interest in learners.

2.4.4 Maintain discipline without tears

Classroom management includes maintaining discipline. Good discipline means that an effective method of managing learners should be found (Dekker et al, 1993:15). Many educators vacate the teaching profession due to problems in maintaining discipline in the classroom.

There are principles for effective discipline; the first principle is that learners must trust the teacher, so that they have confidence to approach him or her. If discipline is well maintained, this will promote effective science teaching and learning as there will be trust between the teacher and the learners.

The second principle is that a teacher must be consistence in dealing with discipline issues, he or she should not punish certain behavior today, and laugh it away tomorrow (Dekker et al, 1993:16). This means that deviant behavior may occur if the teachers treat learners unfairly.

2.4.5 The ability to demonstrate

Farrant (1980) says demonstration may be more trouble if poorly and wrongly done, the learner may learn wrong concepts. This means an effective Science educator should be a good demonstrator. For demonstration to be effective, the teacher should give learners chance to demonstrate (Wessels, 1983:66). This allows learners to master and understand concepts well.

2.5 BARRIERS TO EFFECTIVE SCIENCE TEACHING

According to Masemola in Limpopo Mirror (11June 2010 Volume 39), "For the past four years, the results in Limpopo province had been on a downward slide from 70% to 48.9% in 2009". The most affected subjects being Science and Mathematics. The barriers to effective Science teaching need to be explored as to cause improvement in Science results. This chapter explored literature on barriers to Science teaching and learning in schools.

2.5.1 The concept of educational barriers

Educational barriers in schools are promoting ineffectiveness in Science teaching and learning. Without these barriers schools are likely to be more effective and efficient in Science education.

I view barriers as obstacles that hinder the achievement of good Science results in schools.

The existence of economic, physical, emotional, social, cultural, political and emotional barriers has detrimental effect on the success of learners in Science education in schools.

2.5.2 The nature of educational barriers

Schools cannot achieve optimum results in Science in the presence of Science education barriers. These barriers play a major role in retarding Science teaching and learning processes in schools.

The Mpumalanga Education News (1998:2) highlight how the Department of Education in Mpumalanga assist to transform apartheid education, which was characterized by inequalities and at times attained less than satisfactory standards especially in Science, to a more acceptable, internationally recognized system , cable of being responsive to socio-economic needs.

The statement implies that good science results make the school more effective. For a school to produce good science results must have the following qualities:

- Provide educational resources efficiently, economically and effectively;
- Responsive to people's needs;
- Redirect resources to aspects of the greatest need;
- Put citizens first in line with the principal of "Batho Pele", on the issue of effective Science teaching and learning in schools, all barriers must be dealt with by reducing or removing them.

2.5.3 Economic barriers

I view these barriers as barriers that occur as a result of how finances are managed in a country in relation to education, specifically in Science teaching and learning.

Heinemann and Loxley (1983) studied Science archived in 16 developing and 13 industrialized countries and found out that children who attended primary schools in countries with low per capita incomes had learners who perform substantially less after similar amounts of time in school than pupils in high income countries. At the same time, lower income countries affect teacher quality and academic achievement in schools. Financial resources' are of paramount importance regarding effective Science teaching.

2.5.3.1 Financial resources

Section 34(1) of South African School Act number 84 0f 1996 says the state must fund public schools from public revenue on an equitable basis in order to ensure the proper exercise of the rights of learners to education and to redress or past inequalities in education provision.

Section 39(1) of South African schools Act 84 of 1996 says subject to this Act , school fees may be determined and charged at a public school only if a resolution to do so has been adopted by a majority of parents attending the meeting referred to in section38(2). This section implies that school fees is determined only if parents sees it necessary according to the budget for the year presented to them by the school's governing body.

The National Norms and Standard for Schools Funding, which became national policy in 1999, aimed at achieving equality and poverty redress at schools in terms of non-personnel expenditure within a province. The Norms are clearly progressive, with 60% of a province's non personnel expenditure going to poorest 40% of learners in public schools. The poorest 20% of learners receive 35% of non personnel resources, while the riches 20% receive 5% (South African Yearbook, 2003/2004:213)

To address this basic principle the, Limpopo Education Department came up with its mission statement thus: "Limpopo Education Department, working in partnership with all stakeholders, is committed to render learner centered quality education through capacity building and maximum utilisation of existing resources". The Department's annual report of 1997/1998 (1998:34) on provision of physical facilities indicates that for the past four years the Department of Education has been unable to address all the needs of physical facilities in all the districts because of the budgetary constraints.

Miles (2000:5) asserts that schools which are successful in educational resources are effective in improving learner's performance, and need more funding to take care of their needs. Lekota and Dube (1998:2) indicated that the government provided each province with R200 million for textbooks but surprisingly such textbooks were rarely available at most of the rural schools, and those that were available could have been the minimum requirement.

2.5.3.2 School budgets

A "budget" is a plan and control mechanism expressed in financial terms. At the same time, it sets standards which have to be met to achieve certain objectives (Weston and Bringharm, 1982:01). I view a school budget as a system used in order to control finance in a school. According to my investigation 10 out of the 11 secondary schools in Sibasa circuit are no fee schools and usually the government considers the school enrolment when they allocate the funds, they don't look at the school's needs. The finances in most cases reach schools in June of which it will be too late for schools to plan as it will be almost year end. When the fund is allocated it will be having some specific issues to cover. Schools cannot use this money according to their own wish which is a barrier to science teaching and learning.

2.5.4 Physical barriers

I view these barriers as barriers that exist as a contribution of the physical appearance of the school in relation to science teaching.

Physical facilities of the school are very critical in facilitating effective science teaching and learning and some of these are infrastructure, materials and equipments. A lack of these facilities constitutes barriers to Science teaching and learning.

2.5.4.1 Infrastructure

A school that has a high learner enrolment without sufficient classes can easily experience disciplinary problems. It is easier to exercise control over pupils accommodated in classes than when they are outside.

Without facilities such as laboratories, Science teachers will find it difficult to conduct experiments. This lead to many lessons being done theoretically. The disadvantage of theoretical lessons in science is that learners become demotivated in the subject. It also demotivates and demoralizes teachers. The school without a library on the other hand limits learner's knowledge to the prescribed book because learners cannot go beyond the classroom situation to find relevant information elsewhere.

2.5.4.2 Materials and equipment

The current scenario of Science teaching and learning in the entire country of South Africa, but with special reference to Limpopo Province leaves much to be desired (Rathando 2010:4). According to Howie (2001) in Rathando (2010:4), half of the 225 schools tested in South Africa indicated that instruction in Science and Mathematics was seriously hampered by a shortage of materials, equipment and facilities. The results further highlight this shortage of materials, equipment and facilities as one of the reasons for this poor achievement. The report also mentioned the fact that the South African results for Science are significantly below the mean scores of all other participating countries (Howie 2001). Out of all nine provinces of South Africa, Limpopo obtained the lowest average score (169) in Science, which was approximately half the score achieved by the learners from Western Cape (393) (Rathando 2010:4).

According to Fuller and Heyneman (1989), teaching materials and related material inputs that are linked directly to teaching are related consistently to higher pupil academic achievement in Science education. Lockheed and Verspoor (1991) report that the availability of textbooks and other instructional materials has a consistently positive effect on student achievement in developing countries. They recommend the provision of good textbooks and teachers' guides as a "promising avenue" for policy -makers.

Levin and Lockheed (1991), in a study including case studies of effective schools in eight countries argue that flexibility appears to be the key to effectiveness, and points out the importance of material inputs on achievement in economically impoverished countries.

The necessary inputs are:

- A well developed curriculum, in terms of both scope and sequence.
- Sufficient instructional materials for students.
- Adequate time for teaching and learning.
- Teaching practices that encourage active student learning.

2.5.5 Emotional barriers

According to my understanding these barriers occurs as a result of education stakeholders' feelings depending on circumstances that may occur during the Science teaching and learning processes.

Teachers, parents and learners as stakeholders in Science teaching and learning can be barriers to effective Science teaching due to their emotional state that may occur in the educational processes. On 11 June 2010 the MEC for Education, Mr Namane Dickson Masemora addressed 3500 education stakeholders in Vhembe District. He urged them to strive to reclaim the title of the district in the province with the best Grade 12 results (Tshikhudo, in Limpopo Mirror 2010:14).Mr Masemora said for the past four years, the grade 12 results in Limpopo have been on downward slide from 78% to 48,9% in 2009. He set a target of 60% for 2010, definitely this will exert more pressure on the District Managers, Circuit Managers, School Managers and worse on the Teachers, this may lead to stress thereby affecting effective Science teaching. Ronold Nyati in Daily Sun 25 May (2010:9) says at a certain school "the principal armed herself to make the staff do what she said. She beat up a staff member". The principal was given leave because of her mental condition; this emotional condition might have been caused by the pressure from those above.

2.5.5.1 Teacher involvement

Teachers as supervisors in the learning environment can also be barriers to effective Science teaching and learning in the following ways:

2.5.5.1.1 Failure to create a conducive science teaching and learning environment

The teaching and learning environment created by a teacher is of paramount importance in promoting effective Science teaching and learning. Two types of environments that can be barriers to effective Science teaching and learning are paternalistic environment and the closed environment.

2.5.5.1.1.1 Paternalistic environment

According to Kruger and Van Schalkwyk (1993:110) the paternalistic environment is a classroom environment characterized by a teacher who is always not serious about teaching. The teacher is totally uninvolved and often leaves learners to their own devices. Learners are there prepared to learn but the teacher does very little about his/her educative teaching task. In this situation learners easily get discouraged and dodge lessons. This could further promote hatred for Science subjects and the teacher in particular.

2.5.5.1.1.2 The closed environment

This environment according to Kruger and Van Schalkwyk (1993:10) is characterised by uninvolvement of both teachers and learners. In this type of situation the teacher and learners waste teaching and learning time discussing completely irrelevant issues, as a result very little teaching and learning occurs. Teachers who involve themselves in the above discussed environments will always find it very difficult to create an atmosphere which is conducive to effective Science teaching and learning.

2.5.5.2 Demotivation

I view demotivation as a condition which occurs when one looses interest in carrying out a certain activity or task. In the teaching–learning process a teacher can become demotivated due to aspects such as threats to non- renewal of contracts, low or poor salaries and poor conditions of service. These factors are very critical as they impact negatively on the effectiveness of Science teaching and learning.

Khumalo in Daily Sun of (July 19 2010:8) said he heard a teacher and a union leader announcing that they would "go on strike even if it means till the end of the year". Definatly this teacher is demotivated and became a barrier to effective Science teaching.

Teachers who have served the education department for many years without rewards in the form of promotion or appraisal can also become demotivated and demoralized. Demoralized and demotivated teachers cannot perform to the maximum and this would affect the effectiveness of Science teaching and learning process.

2.5.5.3 Parental involvement

According to Oosthuizen (1997:02), parents can make a meaningful contribution to school activities that fall outside the expertise of educators but in which the parent is an expert as a result of his particular professional background and /or is interest. He goes on to say a research conducted in the USA has proved that a high degree of communication between home and school leads to an increase in the effectiveness of the educational programme.

Cookson and Scheider (1995) say parental involvement is conceptually attractive for several reasons. From the academic point of view, it is interesting because it explains some of the mechanisms by which family background has its well –known influence on the child's achievement. It is important because there will be good communication with parents about current school experience.

Oosthuizen (1997) indicate that there is a research undertaken in the New Haven public schools in United States of America which proved that an increase in parental participation in education process at school leads to a huge improvement in school's climate and learner's academic achievement.

Wagner (1989) asserts that, parents and other citizens will become more knowledgeable about school affairs, and as a result they will become,

- Better informed about what children learn or are learning at school.
- More supportive of efforts by the school to improve the Science education system.
- More understanding of the problems that the school faces.

He further indicated that lack of incentives and rewards is another hurdle to increasing community involvement and improving other aspects of the school community relations. Parents are not sure if they have the required skills and knowledge to get involved in school activities because they are untrained.

Kogan (1986) further indicated that parents have no clear legitimacy conferred by known and accepted electoral practice. The notion of constituency seems remote to many of them. He goes on to say their powers are limited because the agenda of the meetings is not set by governors themselves, their lead is taken by the principal and other teachers.

According to Lockheed and Levin (1993) there is a recent statistical research of schools in a metropolitan area of the United States which found that effective Science school's characteristics, particularly teacher involvement in decision and parental involvement in school, were modestly associated with high student achievement.

2.5.5.4 Learner involvement

Most learners who are attending school might not be doing so out of their own free will but are being forced by parents who attach more value to education as they themselves have derived some benefits from schooling. Learners who attend school against their will may instead of learning make learning difficult for other learners. The learner being the immediate beneficially of the educational setting has to accept and render herself/himself willingly to the assistance of the teacher. Once the learner resists the intervention, effective science teaching and learning cannot occur.

I believe that the tendencies of teacher intervention resistance manifest in learners who go to school only to please their parents without the real sense of purpose. Tshabalala (1991:5) concerning these learners say "when teachers at school force their will on unwilling students, who are just pressurised by parents to go to school, tension often result which further leads to unequal balance of power in the school and the classroom in particular".

One cannot hope to create a conducive environment for science teaching and learning in a school where disobedient tendencies and rejection of authority by learners who go to school because of parental pressures dominate the school.

Peer group pressure in learners can also be a great source or behavioral problems in youths, which in turn impacts very negatively on Science teaching and learning (Mwamwenda, 1995:489).

2.5.6 Social barriers

I understand these barriers as barriers that occur as a result of learner's social background in relation to science teaching and learning.

Berreman (1982:515) explained that, membership of a social class is governed by aspects such as behavior, income, occupation, education and lifestyle. Social class is defined by economic factors, power, status and social position.

Currently in South Africa , belonging to a certain social class determines to a large extent what kind of schooling learners will be exposed to in terms of the acquisition of knowledge, their expectations, what they experience and how long they can afford to stay in school (Lemmer and Badenhorst 1995:249). In other words Science education barriers may exist depending on the status of the school that is schools of Science excellence and merely schools.

2.5.7 Cultural barriers

Taylor and Mulhall (1871:1) defines culture as a complex whole to include knowledge, beliefs, art, morals, laws, customs and any other capabilities acquired by man as a member of society. Reuter (1952) says, "culture is a sum of human creation". That is it determines how members of a society think, feel, or whatever they do. Kluckhohn (1950:5) defines culture as "a design for living" from the above definitions I can say culture is the accepted ways of behavior that are shared by members of a society, about how they should live in order to avoid evil and promote what is good and art, literate and Science are included.

Culture is not genetically transmitted but acquired through the process of enculturation within a social context (Kottat 1987:22). This process includes formal and informal learning and continues throughout an individual's life.

The whole process of Science education is influenced and shaped by culture, and on the other hand culture is transmitted by education. According to Lemmer and Squelch (1993:12), there is a mutual relationship between culture and education.

Various cultural factors impact on the Science teaching and learning processes. Some of these factors include:

- Enculturation, the process in which a person acquire knowledge, values, language, social skills and roles to function well as a member of society. it is important to the Science teacher as he translates the way in which a child is brought up in a certain cultural context.
- Communication, Science teachers should know that learners have different languages and different socio-cultural framework linked to these languages. Science education is taught in English as a medium of instruction yet all the schools in Sibasa circuit use English as the first additional language. Most of the

teachers who are teaching science and mathematics in Sibasa circuit are foreigners making it even worse as they are uninformed concerning local cultural values.

- Learning styles, learners from different cultures will have different learning styles; hence science teachers should consider individual differences.

- Social values, there may be ineffective Science teaching due to conflicts which may occur as result of ignorance and disregard of other people's values.

How a person perceives the world, is associated with his/her culture. In a multicultural Science class different views of reality are at work. If the teacher fail to consider these views it may lead to communication breakdown result in ineffective teaching and learning (Lemmer and Squelch 1993:12).

It is important to consider individual's cultures when operating in a multicultural setting. Science teachers should not regard other cultures as superior and should evaluate all cultures accordingly. They should also not try to understand and interpret phenomena of other cultures in terms of their own situations.

2.5.8 Intellectual barriers

According to my perspective, intellectual barriers are aspects to do with the learner's maturity level that is their mental age versus chronological age and class level as well as educator's knowledge level in Science teaching and learning.

Gilberth cited in the Teacher July edition (2010:22) say a recent survey suggested that 10% of learners across all grades are three or more years outside the age-grade norm. Piaget valuably contributed to the theory of child development; he believed that the child's thinking passed through clearly defined stages that occur with age. Bruner cited in the Education Facilitators (1998:5) asserts that learners at different levels of development deal with information in different ways. Ausubel (1989) believed that learning is a psychological function. Ausubel may mean that learning depends on the learner's ability to process information in his or her brains.

From the above paragraph, if the intellect (mental age), chronological age and grade level of a learner is not taken into cognizance, it may be a barrier to science teaching and learning in schools. This may be the cause of high failure rate in Science in Sibasa Circuit schools. At one of the schools in Sibasa circuit there were more than 20 learners who were above 22 years of age in 2010 Grade 12 classes only.

2.5.8.1 Human resources

Human resources refer to a group of people in an organization working together for the purpose of attaining the organization's goals. In this research study human resources refers to educators as they assist learners to learn Science in schools.

The minister of basic education cited by Themba Khumalo in Daily Sun (19 July 2010:8) saying there is dire shortage of trained Science teachers, and that South Africa has reached a crisis. Mutshekwane and Munobe (1997:20) show that the department of education does not emphasize in-service training of educators. Educators need to be trained in various ways as to promote effective Science teaching and learning in schools. This was supported by Glaser (1970:3) who says" training is directly concerned with improving people's performance with regard to economic activities…"

2.5.8.1.1 Staff development

Nathan (1991:153) defines staff development as a deliberate and continuing process which supports the growth of both the individual and the institution in which they work. The department of education lacks human resource development for educators. There are no technicians, electricians and laboratory assistants which the department can provide.

Mutshekwane and Munobe (1997:220) further indicated that this has reached a crisis proportion in that some teachers have never received any pre-service or classroom guidance ever since they left a college or university as teacher trainees. There are no effective in-service training (INSET) programmes to upgrade Science skills of educators.

2.5.8.1.2 Professional development of educators

Professional development is of paramount importance in facilitating attainment of organizational goals. School managers should create conditions, which focus on achieving excellence. Tickle (1994:163) cited in Mutshaeni (2008:25) supported the need for staff development when he say:

> *teacher development does not only take place in colleges, but also as a result of teaching experience, which is often most valuable because it the most relevant.. Teacher development may be in the hands of a school principal or some other supervising professional acting as a counselor or broker.*

Fullan and Hargreaves (1991:344) states that as long as there is the need for improvement there will always be a need for professional development.

According to Stoll and Fink (1996:152), when educators are professionally fulfilled and demonstrate job satisfaction in skills and knowledge they are more likely to motivate the learners to learn and this will result in effective science teaching in schools. Mutshaeni (2008:30) says "... a teacher lacking in motivation will, in turn, fail to motivate learners, to the detriment of their learning".

2.5.9 Political barriers

These barriers occur as a result of politics and government policies on Science teaching in schools.

The South African Democratic Government is well aware of the needs for Science and Technology education and training as crucial components of any economic strategy (Manuel, 1993:3). Thus the introduction of curriculum 2005 which put more emphasis on outcome based learning. Outcome based learning is learner- centered, results-oriented and based on individual differences. Joseph (1997:195) says outcomes are what the learner must be able to demonstrate. This system is a barrier to Science teaching and learning as it is difficult to implement its principles in schools due to lack of resources and knowledge on teachers on how to implement it.

The education policies are usually drawn by people who are in higher offices and sometimes they do not even consult the implementers who are at grassroots level. Sometimes they do not consider the school locations or needs because the needs for schools in towns are different from the needs for schools in rural areas.

2.6 Effective science teaching and learning

I view effective Science teaching and learning as a process whereby learners acquire Science information, skills and knowledge from being assisted by teachers as to produce desired results. It is important to note that the tug-of-war between community and schools needs will have a dare effect on the effectiveness of Science teaching and learning. As asserted by Taylor and Mulhall (1997:70), if authority at school is with the educators and at home is with parents, the learners find themselves in the middle. It is of paramount importance for teachers and parents to join hands and closely work together as to promote any effective teaching and learning environment.

2.6.1 Implications for contextualising science teaching and learning

The Science teaching and learning environment in schools in Sibasa circuit still have a lot to be desired with a lot of problems identified and some of which follows below:

2.6.2 The school setting

Morrish (1981:30) defines a school as "an official institution set up for the purpose of socialization ..." Therefore a school is an agent which operates alongside the family, community, religion, peer group to impart particular skills, values and knowledge. The disparities in the education system, especially between urban and rural schools, affect Science teaching and learning. Taylor and Mulhall (1997:99) assert that inequitable distribution of both human and physical resources in rural schools has an effect on Science teaching and learning. Henry, Leven, Maraine and Lockheed (1993) indicates that developing countries face a host of common problems in providing sufficient education of high quality to their youth. Generally these challenges include participation, effectiveness and resources.

2.6.3 The need for effective science teaching in schools

According to Haddad (1990), empirical evidence suggest that in both developed and developing countries Science education investment has been one of the most important factors contributing to economic growth, that expenditure on Science education contribute positively to labour productivity.

Recent research on the effect of barriers on Science learning provides clear evidence that variations in characteristics of schools are associated with variation in student outcomes. [(Creamers, Peters and Reynolds (1989); Raudenbush and Willms (1991) and Lockheed and Verspoor (1991)]. They argue that to increase the pace of economic and social development in developing countries, schools must teach most school age children the essential skills targeted by the curriculum (sciences), which include Science, literacy, numeracy communications and problem solving skills.

2.6.4 Problems within the schools

There are vast problems which contribute to learner's Science poor performance in schools of which include physical problems, social problems, economic problems, and pedagogical problems.

2.6.4.1 Physical problems

According to Rossman and Morley (1996) there are many obstacles that contribute to ineffective science teaching and learning in schools some of which are overcrowding, high student teacher ratio, insufficient curricular and course relevance combined with, low student moral which give rise to disruption, poor facilities designed and portable building that both increase isolation and hamper internal communication.

2.6.4.2 Social problems

According to Patterson (1992), children are socialized from a very young age and most of their first socialization occurs at home and in the family. In other words the family environment plays a major role in the child's development including attitude towards school work.

2.6.4.3 Economic problems

Poverty also contributes to ineffective Science teaching and learning in various ways. Garman (1996:158-160) have this to say people who are always in financial problems are always in financial crises which impact negatively on themselves and the family.

Poverty may lead to truancy and deviant behavior among the affected learners as a result may end up indulging in drug abuse, alcohol abuse, sexual abuse and child pregnancy hereby promoting ineffectiveness in science teaching.

The survey pointed out that those learners in poorly performing schools, poor black South Africans struggle in their education for years, sometimes up to the age of 5 years, in a study conducted by UNESCO.

> *Pupils in rural schools have received lower scores on achievement tests. This can be can be explained by a number of factors, including lower parental income and educational levels, poor school infrastructure and facilities, poorly trained and less experienced teachers and lower expectations on the part of teachers and parents (Chinapah 1997:75; Mutshaeni 2008:19).*

Rural schools are affected mainly by economic problems may be is because they are attended by learners who are from poor backgrounds, who can only pay very little school fees.

2.6.4.4 Pedagogical problems

Educators' lack of knowledge and skills in terms of content, method of teaching and teaching and learning aids development affect effective Science teaching and learning in schools. Educators are facing problems in classroom management and organization due to lack of in-service training and professional development. The history of teacher shortages over the years, whatever the cause, has resulted in policies of hiring teachers without proper qualification for their task (Mutshaeni 2008:24). Steyn and Van Wyk (1999:41) argue that the training the educator receives may not always be relevant to the school or classroom situation. An educator trained to teach Afrikaans may be found teaching Science. This will pose a barrier to effective Science teaching as the educator may not be having Science pedagogies.

2.6.4.5 The home setting

According to Oosthuizen (1997), research in the United States of America (USA) has shown that a high degree of communication between home and school leads to an increase in the effectiveness of the educational programme. The research has further state that direct personal contact is the most effective form of communication between parent and educator. Oosthuizen (1997) goes on to say the family is regarded as basic societal relationship and is therefore primarily responsible for educational training of the learner. The caring function of the family plays a vital role in this "educative" role and should be fulfilled in educational training.

2.6.4.6 The community setting

Taylor and Mulhall (1997:105) states that the lack of co-operation from the community in aiding the school, poor infrastructure , occasional desire by community members to control school activities, unreliable water supply or absence of clean water locally and vandalism at school affect Science teaching and learning in schools.

Section 4 (M) of the National Education Policy Act (Department of Education SA 1996:6) Stipulates that community participation in development of an education policy should be realized as one of the guiding principal in education and that all interested partnerships in educational situations is of particular importance in the inter relationship between the family, the church and the school as societal relationships.

2.7 School location

Schools in Sibasa circuit are rural schools with most of their learners coming from the surrounding villages. Rural schools in developing countries suffer even more than urban counterparts from the major afflictions of low completion rates and under-education of completers. This in turn results in an under-educated adult workforce; the rural urban divide is not merely maintained, but increased (Lockheed 1993:20).

According to UNESCO (1992:105) parents in rural areas may be very suspicious of their children receiving an education packaged as "rural" which they perceive to be inferior to other aspects of national education system, especially if it is thought to limit chances for future employment and educational progression. Rural schools, almost by definition, have access to fewer resources (Madolo 1995:2; Mutshaeni 2008:19).

According to Mutshaeni (2008:19) rural schools are a burden to educators, with limited transport and accommodation. Rural schools are not attractive to qualified science educators, to them it means a no go area, it is like war zone. Since they are on high demand in schools they prefer urban or peri-urban schools.

2.7.1 School influence

Data (1984) says the school is regarded as a buffer zone between the highly personal zone world of the family and the impersonality of the work place. At school the child learns skills which facilitate his/her induction into the adult world. Schools are failing to equip learners with desirable skills due to barriers in Science teaching and learning.

Taylor and Mulhall (1997:102) indicate that the lack of materials available to learners such as textbooks with many schools having no Science laboratories and insufficient technological facilities such as computers, television and radios affect Science teaching and learning in schools.

2.7.2 Community influence

Morrish (1982:8) defines a school as a formal social organization. The school exists as a community with its own geographical location within the large community. It is this large community that I am going to discuss its influence to effective science teaching in schools.

Longman dictionary (1987:202) defines a community as "a group of people living together and or united by shared interest, religion, nationality..." The community, school, family and the peer group share in influencing the child's development by training and encouraging him/her in the complicated process of becoming an adult member of the society.

Section 4 (M) of the National Education Policy Act (Department of Education SA 1996:6) stipulates that community participation in the development of an education policy should be realised as one of the guiding principles in education and that all interested partnerships in educational situations is of particular importance in the inter relationship between the family, the church and the school as societal relationships. In practice educational training is influenced by differentiated input of multiple stakeholders although it should be regarded as unitary action.

2.8 CONCLUSION

The theoretical bases for the barriers to Science teaching and learning have been]discussed so as to give the understanding of how learners learn and how teachers should teach Science. For efficiency in Science teaching, it is of paramount importance to understand the didactic principles. The barriers that may retard effective Science teaching have been explored.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In the previous chapter, literature review on barriers to Science teaching and learning in schools was discussed. This chapter focuses on research design and methodology. This covers strategies for data collection, data analysis and interpretation of findings and the processes in which the whole research progressed. As reflected in item 1.6 chapter one, both qualitative and quantitative approaches were employed in this research study in order to triangulate data.

3.2 THE NATURE OF QUALITATIVE RESEARCH METHOD

According to McMillan and Schumacher (1993:372), qualitative research is naturalistic inquiry, where non- interfering data collection strategies are used to discover the natural flow of events, for this reason it was an appropriate method for data collection in this study. As pointed out by Gay (1996:11) this approach is more holistic and process-oriented in that many variables could be studied over an extended period of time in order to discover the origin, nature and functions of an event and what it entails. According to Gay (1996:13) the rationale for employing qualitative methods is to gain a complete understanding of a context and the situation in which this method occurs. Through this method I questioned the existence of the conditions that affected participants as well as insights into how participants felt about these conditions and what meaning they attach to such conditions.

McMillan and Schumacher (1993:373) explain that qualitative research describes and analyses people's individual and collective social actions, beliefs, thoughts and perceptions. Thus qualitative method concerns people and how they relate to their environment.

3.3 CHARACTERISTICS OF QUALITATIVE RESEARCH

Qualitative research is concerned with understanding the social phenomenon from the participants' perspective. Understanding is acquired by analyzing the many contexts of participants and by exploring meanings for these situations and events. Participants' meanings include their feelings, beliefs, thoughts and actions (McMillan and Schumacher, 1993:373)

The characteristics of these methods are summarized as follows:

- Multiple realities, e.g. interviews of principals, teachers and students about barriers to science teaching and learning.
- Understanding a social situation from participants' perspectives.
- Flexible, changing strategies; design emerges as data are collected.
- Ethnography, using "disciplined subjectivity".
- Prepared person becomes emerged in social situation.
- Goal of detailed context-bound generalizations.
- In qualitative research, most analysis is done with words.

3.4 THE NATURE OF QUANTITATIVE RESEARCH

According to Strydom et al (1998:11), quantitative approach is that approach to research in the social sciences that is more highly formalized as well as more explicitly controlled and which is relatively close to physical sciences.

3.5 CHARACTERISTICS OF QUANTITATIVE RESEARCH

Quantitative research aims to objectively measure the social world, to test hypothesis, and to predict and control human behavior.

Quantitative research has the following characteristics according to McMillan and Schumacher (1997:17):

- It has a single objective reality, that is measured by an instrument
- It establishes relationships between measured variables.
- There are procedures to be followed when conducting the research; these sequential steps are established before the study begins.
- Experimental design can be employed to reduce error and bias; detached with use of instrument
- It has a goal of universal context-free generalizations.

3.6 RESEARCH DESIGN: SURVEY METHOD

According to Nicholas (1991:19), survey is a method of obtaining large amount of data, usually in a statistical form, from a large number of people in relatively short time. It may be explanatory or descriptive.

Questionnaires and interviews were used to collect data from principals, teachers and learners in the survey.

3.7 POPULATION

Roscoe cited in Mouton (1996:134) says population is a collection of objects, events or individual having some common characteristics that the researcher is interested in studying. In this study the population consisted of all school principals, science educators, and grade twelve science learners from schools in Sibasa circuit.

3.8 SAMPLING

Sampling is the process of selecting a number of individuals for a study in such a way that the individual represents the larger group from which they were selected. It means taking any portion of a population as representative of the population. As pointed out by Neuman (1997:201), sampling should be viewed as the process of selecting a number of individuals for a study in such a way that the individual represent the larger group from which they were selected. The key concept of sampling is representativeness. Smith (1981:170) states that the major reason for sampling is feasibility. To determine the population, I used purposive or judgmental sampling as it was the most suitable for this study. Singleton, et al (1993) says in purposive sampling "... the sample will be composed of elements which contain the most characteristic, representative or typical attributes of the population". On the basis of my knowledge of the population, I made a judgment on which subjects to be selected to provide the best information to address the purpose of this study. Cohen, Manion and Morrison (2003:103) say in purposive sampling, researchers handpick the cases to be included in the sample on the basis of judgment of their typical.

3.9 SAMPLE

McMillan and Schumacher (1993:382) say a sample is a subset of the population to which the researcher intends generalizing the results. In this study a sample is a group of subjects selected from a larger population. The sample for this study constituted of ten school principals, eighteen Science educators and thirty nine Science learners who were selected based on the researcher's knowledge of the total population of Sibasa Circuit secondary schools.

3.10 RESEARCH INSTRUMENTS

Questionnaires were used as instruments to collect quantitative data. Interview schedules were used to collect qualitative data. Data was collected from school principals, Science educators and grade twelve Science learners in relation to barriers to effective Science teaching and learning in schools.

3.10.1 Pilot Study

The questionnaire was piloted to establish suitability as well as to correct errors. The questionnaires were well designed to avoid the following Babbie (1992) in Mutshaeni (2008:73)

- Lack of clarity
- Double- barreled questions
- Irrelevant questions
- Long items
- Negative items
- Biased items and terms

Five questionnaires were hand delivered to educators who completed them and commented on the appropriateness of the question structure before the final questionnaires were handed out.

3.11 DATA COLLECTION

3.11.1 Qualitative approach

From the qualitative (interactive) perspective, which could be described as a phenomenological approach, I examined the experiences and perceptions of school principals in the study by means of interviews (MacMillan and Schumacher 2001:36 in Mutshaeni 2008: 74).

Through this method, I got closer to data and acquired first hand information about experiences, knowledge, values, attitudes and beliefs of school principals.

3.11.1.1 Advantages of individual interviews

Rubin and Rubin (1985:135) state the following advantages of an individual interview:

- It enables an interviewee to have confidence without intimidation by others.
- The researcher obtains more intense or in-depth details of information from individuals.
- It takes a shorter space of time to interview an individual than is the case with a group.

3.11.1.2 Disadvantages of individual interviews

Rubin and Rubin (1985:140) indicate the following disadvantages of individual interviews

- Interviewer can lose focus easily if the interviewee delays answering the question.
- Interviewee can hide some important information due to personal reasons.
- If too many questions are asked, the interviewee can easily get bored and derail the information.

3.11.2 Quantitative part of the study

From the quantitative (non-experimental) perspective, the mode was descriptive and comparative because it allowed the assessment of the nature of existing conditions in order to categorise and compare factors (McMillan and Schumacher 2001:3 in Mutshaeni 2008: 72)

When collecting quantitative data I used questionnaires to obtain data from school educators and learners. A questionnaire is economical, can ensure anonymity, and contains the same questions written for a specific purpose for all subjects. I personally administered the questionnaire. The questionnaire contained closed-ended questions and open- ended questions.

3.11.2.1 Closed-ended questions

The questions allow only certain specific responses. Quantification and analysis of results may be carried out easily and effectively.

(a) Advantages of closed-ended questions

- The answers are standard and can be compared from person to person.
- The answers are much easier to code and to analyze.

- The respondent is often clearer about the meaning of the question.
- The chances of irrelevant answers are limited to the minimum, because appropriate answer categories are provided.
- It is easier for a respondent to answer, because he only has to choose a category.

(b) Disadvantages of closed-ended questions

- It is easy for a respondent who doesn't know the answer to choose the don't know categories or even to answer randomly.
- The respondent may feel frustrated because the appropriate category for his answer is not provided.
- There are greater chances for clerical error as the respondent may circle a three when he/she meant to circle a two.

3.11.2.2 Open-ended questions

The questions allow the respondent to make any response he/she wishes in his/her own words. Open-ended questions are used for more complex questions that cannot be answered in a few simple categories that require more detail and discussion.

(a) Advantages of open-ended questions

- It can be used when the researcher would like to see what the respondent views as appropriate answer category.
- They allow respondent to answer adequately, in all detail he likes, and to qualify and clarify his answer.
- They are preferable for complex issues that cannot be condensed into a few small categories
- They allow more opportunity for creativity or self expression by the respondent.

(b) **Disadvantages of open-ended questions**

- It may lead to the collection of worthless and irrelevant information.
- Data is not standardized from person to person, making comparison or statistical analysis difficult.
- Open-ended questions require good writing skills, better ability to express one's feelings verbally, and generally a higher educational level than do closed- ended questions.
- Open-ended question generally require much more of a respondent's time.
- It requires more paper and let the questionnaire look longer, possibly discouraging respondents who do not wish to answer a lengthy questionnaire.

3.12 DATA ANALYSIS

According to McMillan and Schumacher (1997:500-503) data analysis entails the following cyclical phases:

- Continuous discovery, especially in the field but also throughout the entire study, to identify tentative patterns:
- Categorizing and ordering of data typically after data collection;
- Qualitatively assessing the trustworthiness of data, to refine patterns;
- Writing synthesis of themes and/or concepts.

3.12.1 PREPARING DATA FOR ANALYSIS

In this research the following procedures were followed.

3.12.1.1 Transcribing interview data

Transcriptions are the subsequent steps following recording with individual persons. The interviews were transcribed from oral to written texts so much that the main sense of what was said was rephrased in fewer words. I transcribed and translated the interviews from oral language, with its set of rules, to a written language with another set of rules.

As transcriptions involve ethical issues, I protected the confidentiality of participants in interviews by using alphabetical codes for informants. Recorded tapes and transcriptions were stored in a safe place for future reference.

3.12.2 QUANTITATIVE DATA ANALYSIS

Quantitative data were analyzed using the computer statistical package for Social Sciences (SPSS) version 17. I broke down quantitative data into constituent parts to obtain answers to research questions.

3.12.3 QUALITATIVE DATA ANALYSIS

Creswell (1994:153) asserts that qualitative data analysis involves sorting the information into categories forming the information into a picture and actually writing qualitative text. This means that the researcher establishes a broad outline of the phenomenon being studied assembles pieces of data and then fits those pieces into a complete whole.

There are varieties of approaches to qualitative data analysis; however it is a process of selecting, categorizing, comparing, synthesizing and interpreting to provide explanation of the single phenomenon of interest (McMillan and Schumacher, 1993:480).

This research study focuses on the study of learning in a natural setting; therefore I approached data analysis with the mode that was consistent with the objectives of the research.

3.13 Quality Assuarance Techniques

3.13.1 Qualitative techniques

3.13.1.1 Trustworthiness of qualitative data

Lincoln and Guba (1985) suggest the following in order to increase trustworthiness in qualitative study:

- Credibility
- Transferability
- Dependability
- Confirmability

In this study, I implemented member checking and participant review as to increase the credibility of the interview. Krefting (1991) cited in Mutshaeni (2008:80) suggest that member checking, is where the interviewee plays an active role in being part of the process, in bringing in his/ her own meaning or interpretation of the data, is a form of triangulation and thus minimises researcher bias (Creswell 2003).

3.13.2 Quantitative techniques

3.13.2.1 Validity

According to Education Facilitators (1998:19) validity means that the researcher's conclusion is true or correct. This means the research conclusion corresponds to the actual state in reality. This study depends on valid, authentic and trustworthy methods of collecting information and interpretations as stated by Hammersley and Atkinson (1983:33) in Mutshaeni (2008:80). To reduce by some degree the limitations of the research, certain measures may be taken to enhance design validity (McMillan and Schumacher, 1993:389). The table below highlights the steps I followed to ensure validity of the research design in this research according to the criteria set by McMillan and Schumacher (1997:405).

Table 3.1 Strategies to ensure validity

Strategy	Description of Action
Verbatim accounts	Interviews were conducted in a fully verbatim form.
Mechanically recorded data	I used an audio cassette recorder during interviews with school principals.
Participants review	I asked the participants to review my synthesis of all the interviews for accuracy of representation.
Consistency of application	I used a single questionnaire with the same set of questions for every respondent, and a single interview schedule used for all interviews I conducted.
Multi-method approach	I conducted interviews to aid the interpretation of quantitative data from the questionnaire.
Member checking	During data collection, I informally checked with participants for accuracy.

(McMillan and Schumacher, 1997:405)

In this study I employed the following approaches to validity: Face validity and Content validity.

- **Face validity**

This is the idea that a test should appear to any person to be a test of what it is supposed to test. To insure validity certain procedures were followed to facilitate validity of the questionnaire. Specialists in the field gave their opinions as to whether the questionnaire was valid to address the issue of barriers to effective Science teaching and learning in schools.

- **Content validity**

According to Education Facilitators (1987:23), a test with content validity should sample the range of the behaviour that is represented by the theoretical concept being measured. To demonstrate this form of validity, the instrument must show the appropriateness of the items to reviewers who have some knowledge of the subject matter (Litwin and Guba 1995:35 in Mutshaeni, 2008:81). The items must as well be validated by means of literature review.

In this study, the literature review which validates the items was also used to determine the selection of factors to be tested as barriers to effective Science teaching.

- **Reliability**

Hudson (1981:113) in De Vos (2000:85) defines reliability as the accuracy or precision of an instrument. Reliability thus the degree of consistency or agreement between two independently derived sets of scores; and as the extent to which independent administrations of the same instrument yield the same or similar results under comparable conditions (Education Facilitators, 1987:25).

In this study reliability was checked by means of a computer analysis as discussed in section 4.2, Quantitative data analysis.

- **Triangulation**

Triangulation can be seen as an aspect that combines qualitative and quantitative approaches in research (Education Facilitators 1987:17). The inclusion of multiple sources of data collection in a research project is likely to increase the reliability of the observations (Mouton, 1998:156). Triangulation is critical in establishing data trustworthiness (McMillan and Schumacher, 1993:418). Triangulation was utilized to determine whether multiple sources of data agree and thus make it possible to arrive at better, cross-checked insights. Frequencies were compared by means of contingency tables and also tested for independence by the second test when data was analysed. This gave strength to the interpretations hence increase confidence to in the study findings.

3.14 ETHICAL CONSIDERATIONS

Strydom (2000:24) provides the following definition for ethics:

> *Ethics is a set of moral principles which is suggested by an individual or group, is subsequently widely accepted, and which offers rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, employers, sponsors, other researchers, assistants and students.*

In this study ethics generally deals with beliefs about what is right or wrong, proper or improper, good or bad. Dane (1990:44) cited in Education Facilitators (2008:84) claims that an ethical obligation rests with the researcher to protect subjects against any form of physical discomfort which may emerge, within reasonable limits, from the research project.

I wrote a letter to the Department of education Vhembe District Senior Manager, Circuit Managers and School Principals to seek for permission to conduct research in their schools. I designed a consent form for all participants stating how information was to be collected, procedures followed during the investigation, how the data was to be stored, the possible advantages, disadvantages and dangers to which respondents may be exposed. I treated all participants with respect and due considerations. Miller and Bell (2002:67) suggest that "keeping a constant record of decisions made is a good safeguard against sloppy thinking and inadvertent overlooking of ethical issues". I used a research diary to document decisions made throughout the research process. Strydom et al (1998:330) indicate that strategies to maintain confidentiality are critical in reducing the risk of harm related to embarrassment and administrative or legal punishment to those studied.

3.14.1 Privacy

Sieber (1982:154) defines privacy as "that which normally is not intended for others to observe or analyze". Singleton et al (1988:454) further explain that "the right to privacy is the individual's right to decide when, where, to whom, and to what extent his or her attitudes, beliefs and behavior will be revealed".

In this study, I was very sensitive not to violate the participants' rights to privacy. I protected the data collected from informants from public disclosure. All information gathered was subjected to privacy until the actual publication of this report.

3.14.2 Anonymity

Anonymity in this research implies safeguarding the participants, their identity remained undisclosed. Instead of using their real names, places or schools, codes were used.

3.14.3 Confidentiality

In this study confidentiality is indicated by handling of information in a confidential manner. Neuman (1997:453) asserts that confidentiality means that information may have names attached to it, but the researcher holds it in confidence or keeps it secret from the public. In this study I protected respondents from psychological harm by withholding their names.

3.15 CONCLUSION

I followed the procedures as stipulated in the preceding paragraphs. The methodology for data collection described in this chapter supplied a procedure that enabled me to gather valid data that could facilitate in improving the effectiveness of Science teaching in schools in Limpopo province. The following chapter focuses on data analysis and interpretation of results.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION OF RESULTS

4. INTRODUCTION

Chapter three concentrated on the design and the methodology of the research study. In this chapter, attention is on analysis and interpretation of qualitative and quantitative data obtained through interviews with school principals and educator, learner questionnaires. The presentation would begin with results obtained from interviews with school principals who manage the schools, followed by questionnaires completed by Science educators who teach grade twelve and lastly questionnaires completed by grade twelve learners.

4.1 ANALYSIS OF QUALITATIVE DATA: INTERVIEWS WITH SCHOOL PRINCIPALS

I am going to discuss the following topics: data coding and discussion on themes and categories. I considered the following themes when analyzing data collected from interviewing school principals:

- Economic barriers
- Physical barriers
- Emotional barriers
- Social barriers
- Intellectual barriers.

4.1.1 DATA CODING

McMillan and Schumacher (1993:486), views data coding as the process of dividing data into parts by a classification system. The way in which data was coded is shown in Table 4.1.

Table 4.1 Themes and Categories

	THEMES	CATEGORIES
1	Economic barriers	• Financial resource
2	Physical barriers	• Infrastructure • Materials and equipment
3	Emotional barriers	• Teacher involvement • Parental involvement • Learner involvement
4	Social barriers	• School locality • language
5	Intellectual barriers	• Teacher qualification • staff-development • Effective science teaching and learning.

4.1.2 ANALYSIS OF THEMES AND CATEGORIES

4.1.2.1 THEME ONE: Economic Barriers

The individual interviews conducted with secondary school principals in this research reveals that all ten secondary schools in Sibasa circuit of Vhembe district of Limpopo Province have similar barriers to Science teaching and learning. The study also reveals that the said barriers result in ineffectiveness in Science teaching and learning. I identified one category on this theme and the category is discussed.

4.1.2.1.1 Financial resources

All interviewed participants in this study clearly state that resources are a major barrier as they are inadequate. All ten secondary schools are not satisfied by the resources in their schools especially financial resources. They indicated that they need more resources for effective Science teaching at grade twelve level. One school principal has this to say :

"... effective Science teaching and learning can only take place where there are adequate financial resources".

Another principal has this to say:

"... no resources no meaningful learning..."

4.1.2.2 THEME TWO: Physical barriers

In this research, Interview responses revealed that the existence of physical barriers in grade twelve is resulting in ineffectiveness in Science teaching.

4.1.2.2.1 Infrastructure

The majority of the participants showed that there are no Science laboratories, libraries and adequate Science classrooms in secondary school in Sibasa circuit.

4.1.2.2.2 Materials and equipment

The investigation revealed that, lack of laboratories is a huge barrier to Science teaching and learning in all ten sampled secondary schools in Sibasa circuit. When it comes to Science equipment and materials all respondents said they did not have anything.

4.1.2.3 THEME THREE: Emotional barriers

In this study, it was realised that emotional barriers contribute to ineffectiveness in Science teaching and learning. I identified three categories of factors that are involved.

4.1.2.3.1 Teacher involvement

The participants showed that educators do not involve themselves seriously in learners' social problems.

One participant has this to say:

"... that's time wasting because the education department is only concerned with exam results, not learners' well being".

One of the participants said:

"I blame the education system because it only focuses on exams, so we don't have time to discuss learners' social problems. Our duty is to prepare them for exams"

This is promoting ineffective Science learning because learners cannot concentrate when they have problems.

4.1.2.3.2 Parent involvement

In this study, all participants revealed that parents are not actively involved in school activities due to poor communication and ignorance. Parents are not regularly consulting with school authorities concerning their children's performance. This is hindering effective Science teaching thereby resulting in poor results.

One participant said: "*… parents are not willing to come to school unless when there is a meeting of which in most cases the turn up will be very poor*"

He further said that "*… parents are not involving themselves in their children's education; they don't even monitor their children's school work*"

According to Oosthuizen (1997), an increase in parental participation in education process at school leads to a huge improvement in school's climate and learner's academic achievement. Concern of parents over the well being of their children at school should be emphasized.

4.1.2.3.3 Learner involvement

Some of the participants showed that learners are not involving themselves in Science teaching and learning processes instead they are involving themselves in drugs and sexual activities.

Tshabalala (1991:5) has this to say, concerning learners who are not willing to learn "when teachers at school force their will on unwilling students, who are just pressurised by parents to go to school, tension often result which further leads to unequal balance of power in the school and the classroom in particular".

4.1.2.4 THEME FOUR: Social barriers

My study shows that social barriers contribute to ineffectiveness in Science teaching and learning in Sibasa circuit secondary schools especially in grade twelve.

4.1.2.4.1 School locality

In this study, participants revealed that secondary schools in Sibasa Circuit are rural. This is having an impact especially when it comes to resource allocation as well as resource allocation by the government. Most of the learners who attend school in Sibasa circuit secondary schools travel long distances to and from school. Learners wake up very early around half past three to be in school on time, they also reach home late after school. This affect effective Science teaching and learning as learners will be tired and feel like sleeping during learning time. Mutshaeni (2008:33) has this to say "… rural population being so scattered would mean that a greater number of learners would travel long distances"

As is revealed in this study, most of the learners come from disadvantaged backgrounds meaning that their status and social position is low, this means they may not be able to afford things required to aid Science teaching and learning.

4.1.2.4.2 Language

Teachers may be handicapped by their own language or at least inadequate range of vocabulary when their own language is not English, given that the medium of instruction usually needs to be English (Mostert 1998:127). Interviewed participants in my study revealed that all secondary schools in Sibasa circuit use English as medium of instruction, this contribute to ineffective Science teaching and learning.

One of the participants said:

"… most of our learners are Venda speakers , I think they can pass if Science can be taught in mother tongue".

4.1.2.5 THEME FIVE: Intellectual barriers

4.1.2.5.1 Effective Science teaching and learning

Based on the findings in this study, all secondary schools in Sibasa circuit are negatively affected by the barriers to such an extent that effectiveness in Science teaching is very difficult to achieve. Some of the principals have this to say:

"... there is no effective Science teaching because there are many obstacles that are hindering good Science results"

"... since our Science results are poor, I cannot say there is effective Science teaching in my school. Effectiveness can only be seen with good results"

4.1.2.5.2 Teacher qualification

Mutshaeni (2008:24) says shortage of qualified Science educators has resulted in policies of hiring teachers without proper qualification for their task. In this investigation participants revealed that some of the Science educators (55,6 %) in Sibasa secondary schools are not qualified to teach Science.

One principal said:

"the educator who is teaching Science at my school is trained to teach languages"

4.1.2.5.3 Staff development

This study revealed that all Science educators need to be staff developed on new changes in as far as Science is concerned.

One principal said:

"...it has been long since our Science educators left college, they also need to be staff developed in the use of computers".

4.2 ANALYSIS OF QUANTITATIVE DATA: EDUCATOR RESPONDENTS

This section presents an analysis of the results obtained from the questionnaires completed by Science educators in grade twelve from the selected secondary schools in Sibasa circuit.

Table 4.2 Gender

	Frequency	Percentage
Male	11	61.1
Female	7	38.9
Total	18	100.0

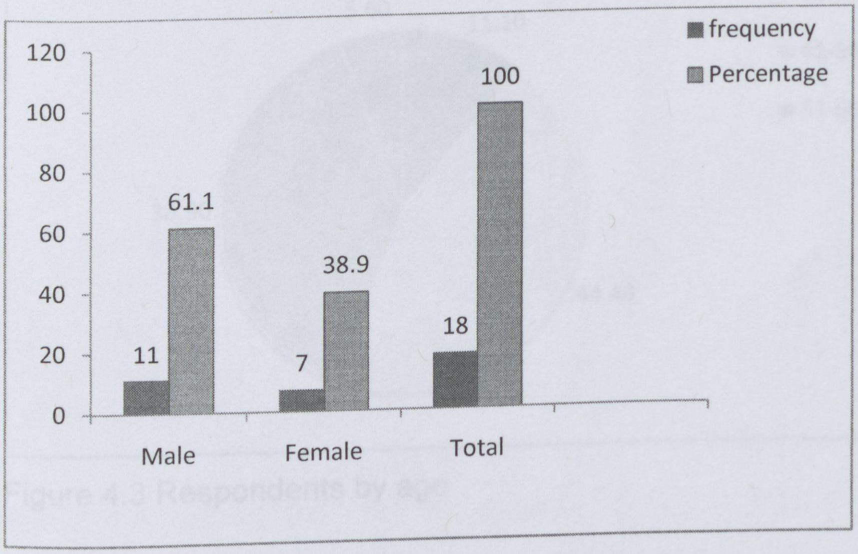


Figure 4.2 Gender

Table 4.2 shows that there were more male participants (61.1%) than females (38.9%). This suggests that there are more male teachers teaching Science than there are females in Sibasa Circuit Secondary Schools. The results further indicate that few female educators train as Science educators.

Table 4.3 Respondents by age

	Frequency	Percentage
21-30	2	11.1
31-40	8	44.4
41-50	7	38.9
51-60	1	5.6
Total	18	100.0

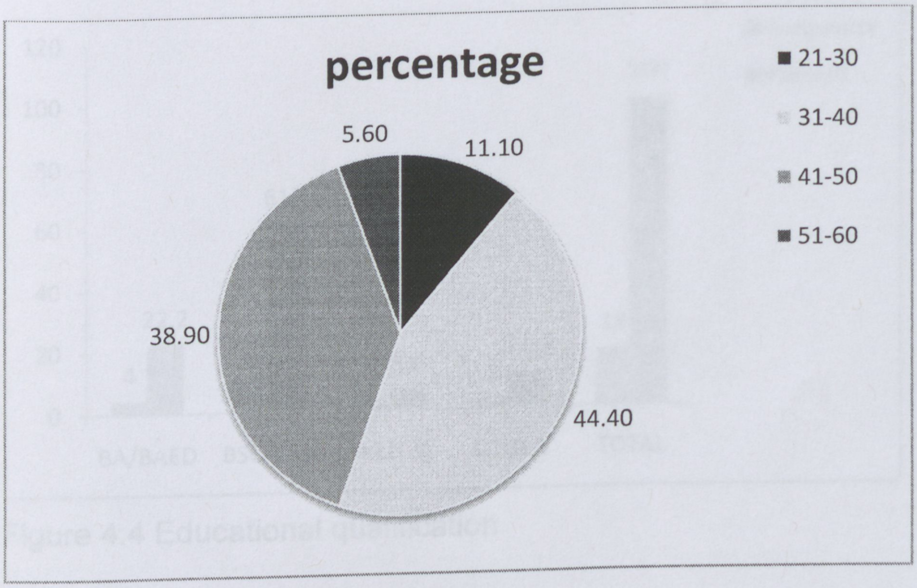


Figure 4.3 Respondents by age

Table 4.3 shows that the majority of Science educators are in the age group 31-40 which is (44. 4%). This may mean that science is being taught by educators who are still very active. The results also indicate that there are also quite a number of Science teachers (38.9%) in the category 41-50 years. This group (41-50 years) is well experienced in the teaching of the subject.

Table 4.4 Educational qualification

	Frequency	Percentage
BA/BAED	4	22.2
BSC	8	44.4
BED	3	16.7
M.ED SC	1	5.6
OTHER	2	11.1
Total	18	100.0

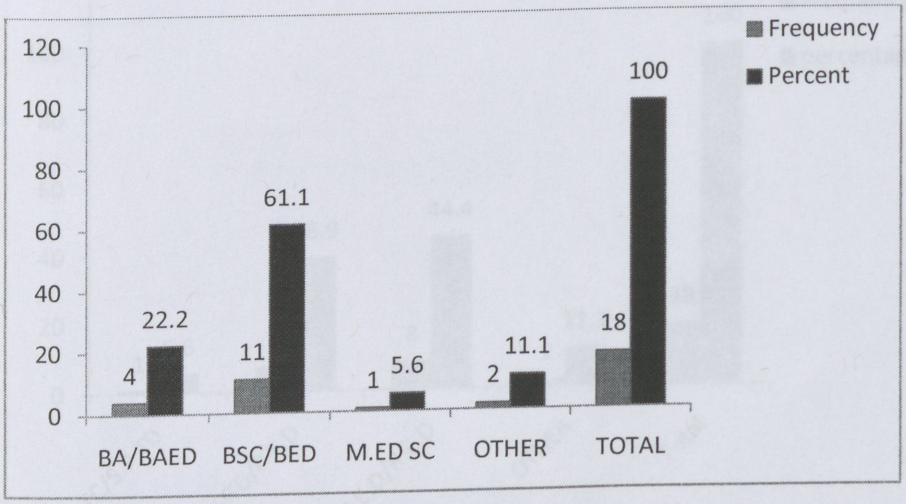


Figure 4.4 Educational qualification

Table 4.4 shows that the majority of Science educators (66.7%) have relevant qualifications (That is BSC Science 44.4%, BED science 16.7% and M.ED Science 5.6%). The table also shows that there are teachers (33.3%) with irrelevant qualifications (BA/BAED and OTHER) to teach Science.

Table 4.5 Professional qualification

	Frequency	Percentage
J.S.T.C./S.P.T.D	1	5.6
S.T.D./P.T.D.	7	38.9
U.E.D/H.E.D	8	44.4
OTHER	2	11.1
Total	18	100.0

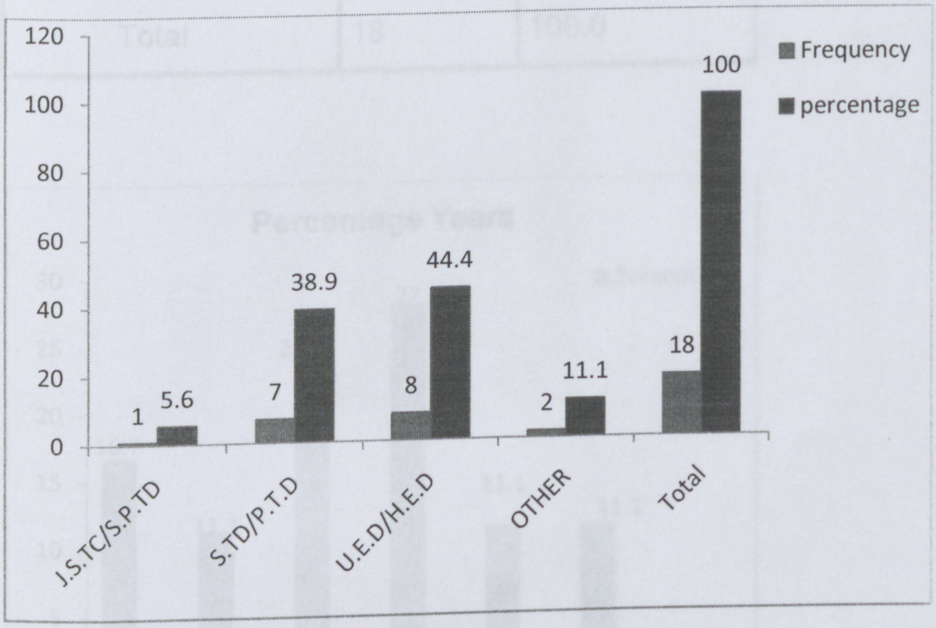


Figure 4.5 Professional qualification

Table 4.5 shows that most of the respondents (44.4%) are professionally qualified educators. The results may suggest that the educators should be able to deliver Science concepts as they are qualified educators.

Table 4.6 Teaching experience.

Years of Teaching	Frequency	Percentage
1-5	3	16.7
6-10	2	11.1
11-15	4	22.2
16-20	5	27.8
21-25	2	11.1
26-30	2	11.1
Total	18	100.0

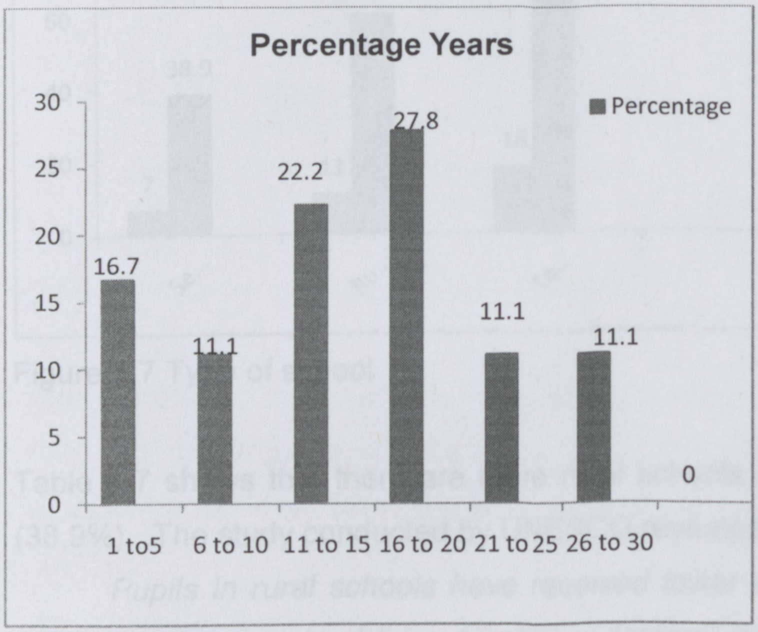


Figure 4.6 Teaching experience

Table 4.6 shows that most of the respondents (62.2%) have teaching experience ranging from 11 to 30 years. While a few (37.8%) have experience lower than ten years of teaching experience. Most Science teachers in the circuit through their experience are expected to have relevant content and appropriate teaching methods and skills.

Table 4.7 Type of school

	Frequency	Percentage
Rural	7	38.9
Semi-rural	5	27.8
Total	18	100.0

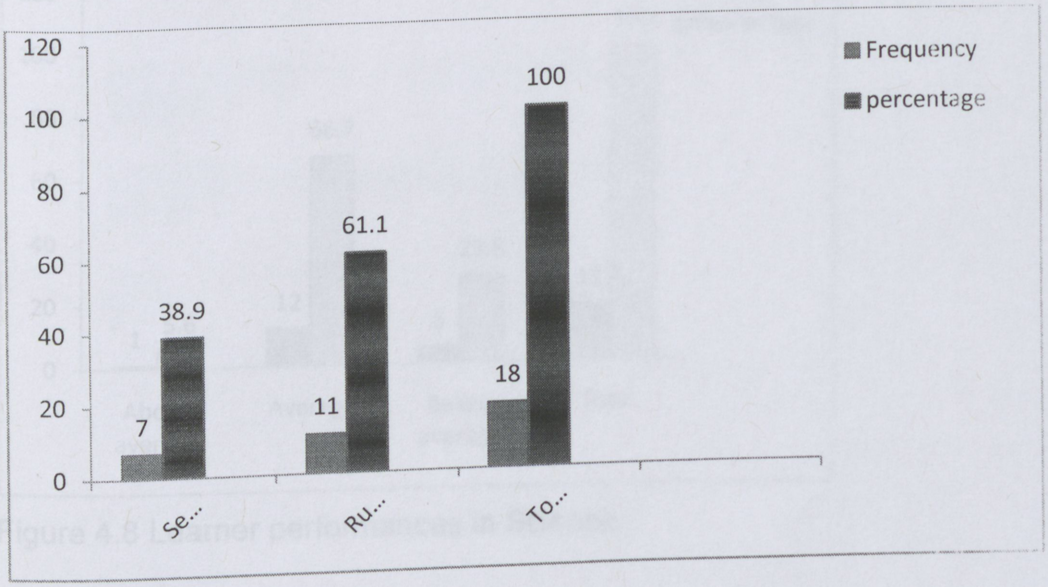


Figure 4.7 Type of school

Table 4.7 shows that there are more rural schools (61,1%) than those in semi- rural (38,9%). The study conducted by UNESCO revealed that:

> *Pupils in rural schools have received lower scores on achievement tests. This can be explained by a number of factors, including lower parental income and educational levels, poorer school infrastructure and facilities, poorly-trained and less experienced teachers and lower expectations on the part of teachers and parents (Chinapah 1997:75).*

Table 4.8 Learner performance in Science

	Frequency	Percentage
Above average	1	5.6
Average	12	66.7
Below average	5	27.8
Total	18	100.0

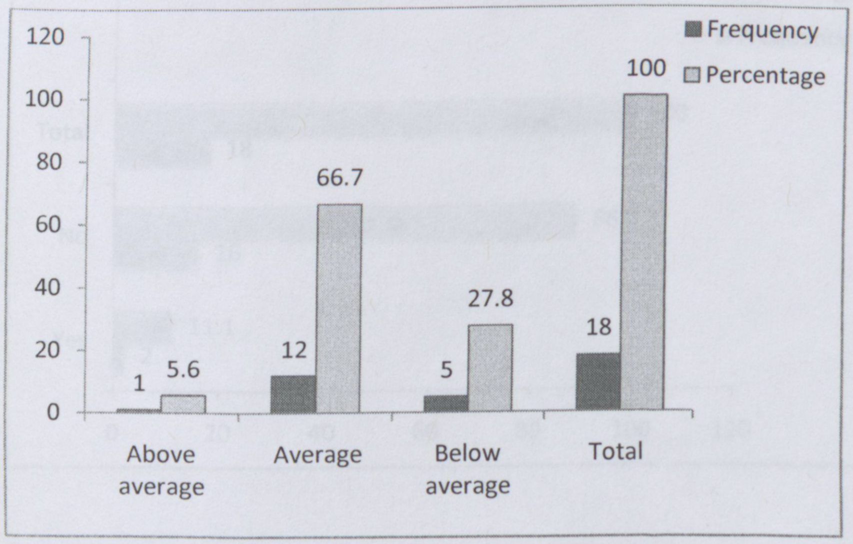


Figure 4.8 Learner performances in Science

Table 4.8 shows that most learners are average performers (66.7%) although those performing below average (27.8%) are fewer than those who are average and above, the performance is not pleasing because there are too many failing students.

Table 4.9 Availability of educational resources

	Frequency	Percentage
Yes	2	11.1
No	16	88.9
Total	18	100.0

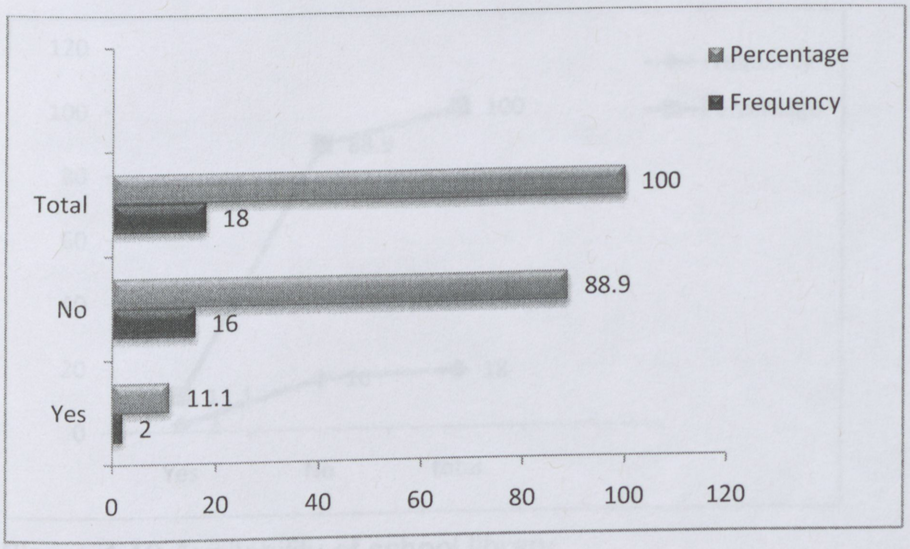


Figure 4.9 Availability of educational resources.

Table 4.9 shows that the majority of Science teachers (88.9%) reported that they have inadequate Science teaching resources while only a few (11.1%) indicated that they have sufficient resources. The results may suggest that the majority of the respondents (88.9%) may not deliver well Science concepts.

Table 4.10 Availability of school library

	Frequency	Percentage
Yes	2	11.1
No	16	88.9
Total	18	100.0

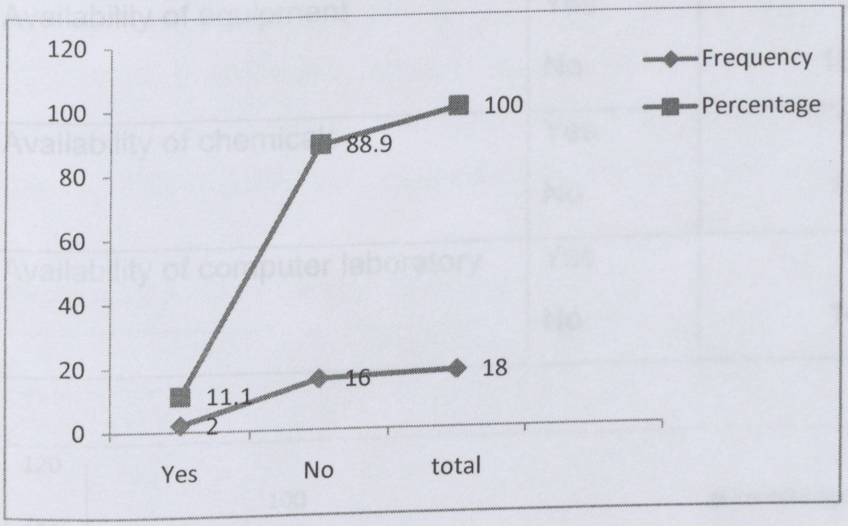


Figure 4.10 Availability of school library

Table 4.10 shows that the majority of respondents (88.9%) reported that they do not have libraries, while only a few (11.1%) indicated that they have school libraries. The results may suggest that the majority (88.9) of the respondents have limited sources for referencing. According to Howie (2001) in Rathando (2010:4), half of the 225 schools tested in South Africa indicated that instruction in Science and Mathematics was seriously hampered by shortage of materials, equipment and facilities.

Table 4.11 Availability of Science Laboratories, Chemicals, Equipment and Computer Laboratories.

	Response	Frequency	Percentage
Availability of Science Laboratory	Yes	2	11.1
	No	16	88.9
Availability of equipment	Yes	0	0
	No	18	100.0
Availability of chemicals	Yes	3	16.7
	No	15	83.3
Availability of computer laboratory	Yes	4	22.2
	No	14	77.8

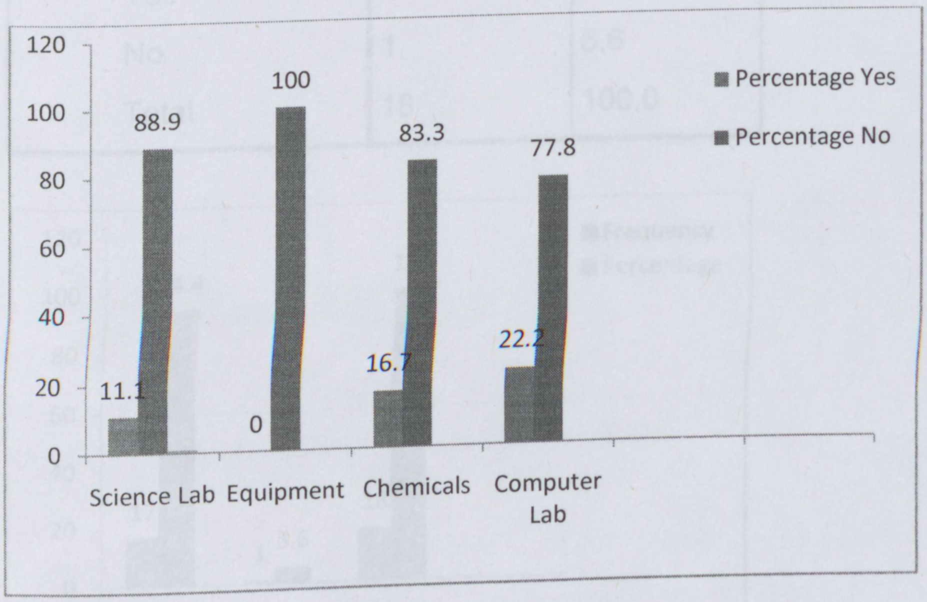


Figure 4 .11 Availability of Science Laboratory, Chemicals, Equipment and Computer Laboratory

Table 4.11 shows that the majority of respondents (88.9%) indicated that they do not have Science laboratories, while a few (11.1%) reported that they have Science laboratories. 100% of the respondents indicated that they do not have equipment for

Science teaching, this suggest that 11.1% of the respondents who have laboratories do not have chemicals for experiments (practical). 83.3% of respondents further indicated that they do not have chemicals in their Science laboratoriess. This suggests that all respondents do not do Science experiments. 77.8% of respondents indicated that they do not have computer laboratories. The results may suggest that respondents are not exposed to other Science teaching resources. They only rely on textbook knowledge and do their work manually. According to NEIMS (2009, Nov 02), Limpopo had only 10% of the Science laboratories whereas other provinces had much more, for example Gauteng had 78%. In the current study, results revealed that the majority of respondents (88.9%) indicated that there are no Science laboratories in schools.

Table 4.12 A need for staff-development

	Frequency	Percentage
Yes	17	94.4
No	1	5.6
Total	18	100.0

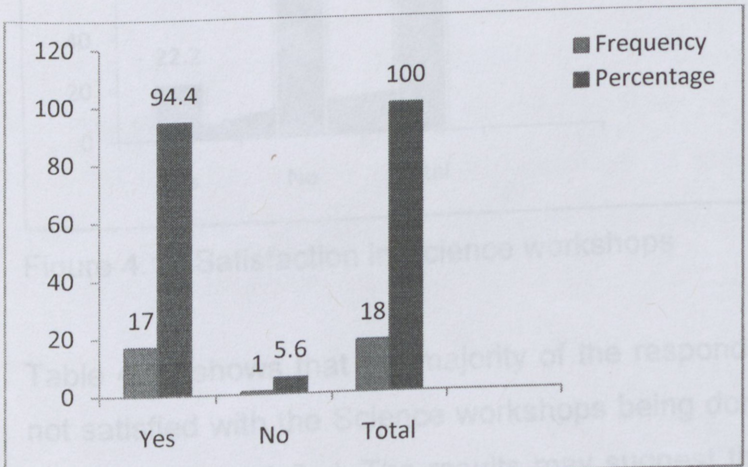


Figure 4.12 A need for staff- development

Table 4.12 shows that the majority of the respondents (94.4%) indicated that there is need for staff- development while only a few (5.6%) indicated that staff- development is not necessary. Tickle (1994:163) cited in Mutshaeni (2008:25) supported the need for staff development when he wrote:

> *teacher development does not only take place in colleges, but also as a result of teaching experience, which is often most valuable because it the most relevant.. Teacher development may be in the hands of a school principal or some other supervising professional acting as a counselor or broker.*

Table 4.13 Satisfaction in Science workshops

	Frequency	Percentage
Yes	4	22.2
No	14	77.8
Total	18	100.0

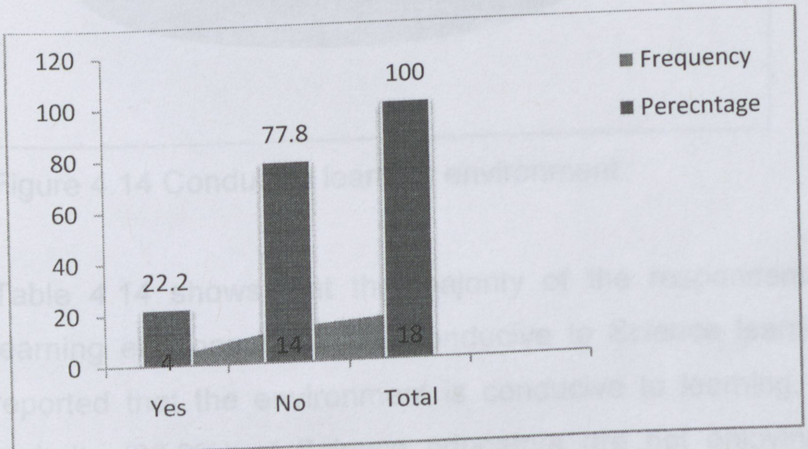


Figure 4.13 Satisfaction in Science workshops

Table 4.13 shows that the majority of the respondents (77.8%) indicated that they are not satisfied with the Science workshops being done while only a few (22.2%) reported that they are satisfied. The results may suggest that the workshop facilitators may not be knowledgeable enough as far as Science is concerned.

Table 4.14 Conducive learning environment

	Frequency	Percentage
Yes	2	11.1
No	16	88.9
Total	18	100.0

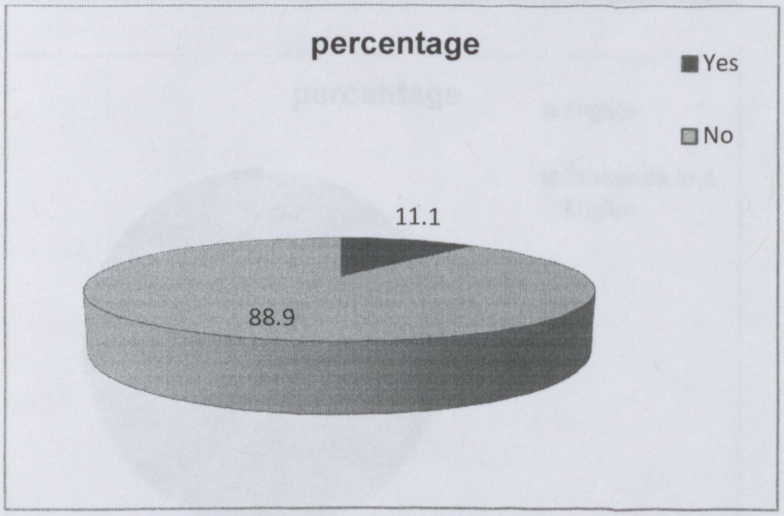


Figure 4.14 Conducive learning environment

Table 4.14 shows that the majority of the respondents (88.9%) indicated that the learning environment is not conducive to Science learning while only a few (11.1%) reported that the environment is conducive to learning. The results suggest that the majority (88.9%) of Science educators are not enjoying their work, teaching under unfavorable conditions.

Table 4.15 Language of instruction

	Frequency	Percentage
English	13	72.2
Tshivenda and English	5	27.8
Total	18	100.0

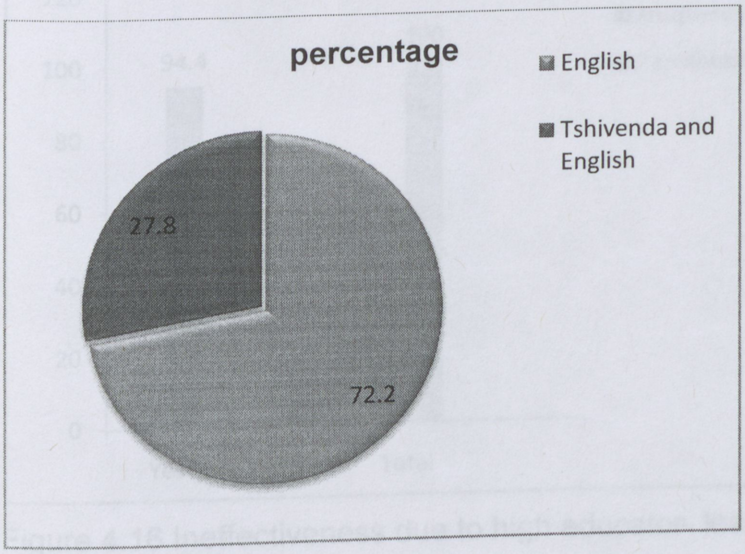


Figure 4.15 Language of instruction

Table 4.15 shows that the majority of the respondents (72.2%) indicated that they use English in teaching Science while only (27.8%) reported that they use Tshivenda and English. The results suggest that English as a medium of instruction is a barrier to effective Science teaching and learning. Learners may not understand concepts explained in English as it is not their mother tongue. 88.9% of the respondents indicated that the use of English as a medium of instruction may be result in ineffectiveness in Science teaching and learning while only a few (11.1%) reported that the medium of instruction does not affect Science teaching. The results may suggest that the use of English as a medium of instruction is retarding Science teaching and learning processes.

Table 4.16 Ineffectiveness due to high educator-learner ratio

	Frequency	Percentage
Yes	17	94.4
No	1	5.6
Total	18	100.0

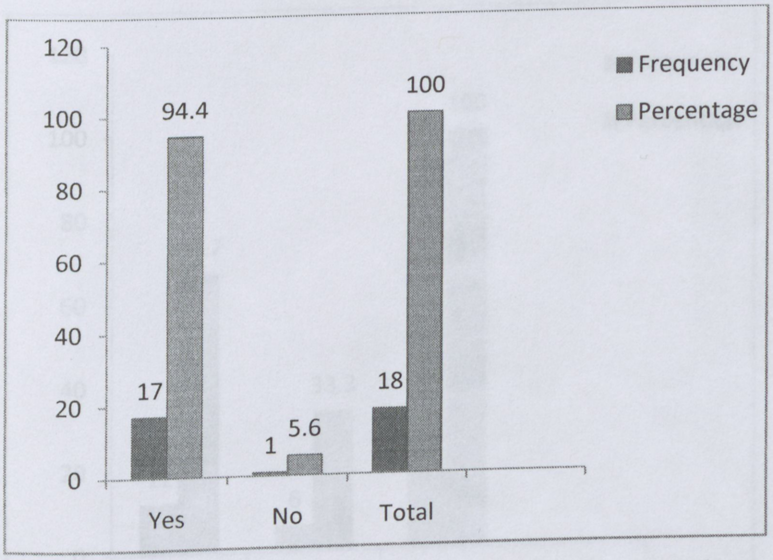


Figure 4.16 Ineffectiveness due to high educator- learner ratio

Table 4.16 shows that the majority of the respondents (94.4%) indicated that the high teacher-learner ratio is resulting in ineffective Science teaching and learning while only a few (5.6%) reported that the teacher-learner ratio is not affecting Science teaching. The results may suggest that, overcrowding have an effect to effective Science teaching and learning in schools.

Table 4.17 Teacher qualification and performance

	Frequency	Percentage
Yes	12	66.7
No	6	33.3
Total	18	100.0

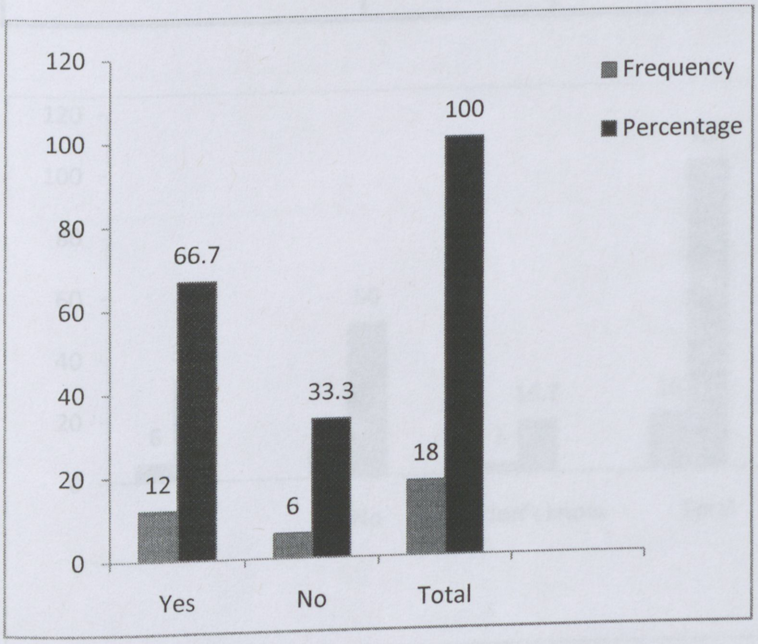


Figure 4.17 Teacher qualification and performance

Table 4.17 shows that the majority of the respondents (66.7%) indicated that educator qualification contributes to effective Science teaching and learning while only a few (33.3%) reported that educator qualification do not have any effect on effective Science teaching. The results suggest that poorly qualified educators do not deliver Science concepts well.

Table 4.18 Effects of Government policy in Science teaching and learning

	Frequency	Percentage
Yes	6	33.3
No	9	50.0
I don't know	3	16.7
Total	18	100.0

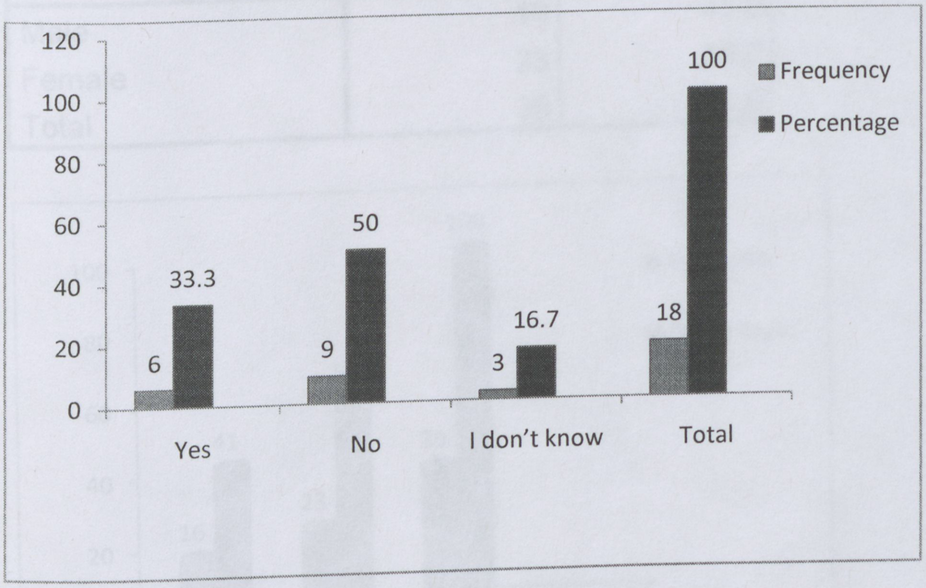


Figure 4.18 Effects of government policies in Science teaching and learning.

Table 4.18 shows that the majority of the respondents (50.0%) indicated that government policies are not promoting effective Science teaching and learning while (33.3%) reported that the government policies are not affecting Science teaching. The no fee school policy is negatively affecting schools as schools need money to utilize in Science teaching, the money schools get from the Department of Education is allocated having some specific issues to cover and in most cases the money is very little and it usually reach the schools midyear making it very difficult for schools to plan. Perhaps this explains why there is a high rate of failure in Science in Sibasa circuit.

4.3 LEARNER RESPONDENTS

In this section is presentation of an analysis of the results obtained from the questionnaires completed by Science learners in grade twelve from the selected secondary schools in Sibasa circuit.

Table 4.19 Gender

	Frequency	Percentage
Male	16	41.0
Female	23	59.0
Total	39	100.0

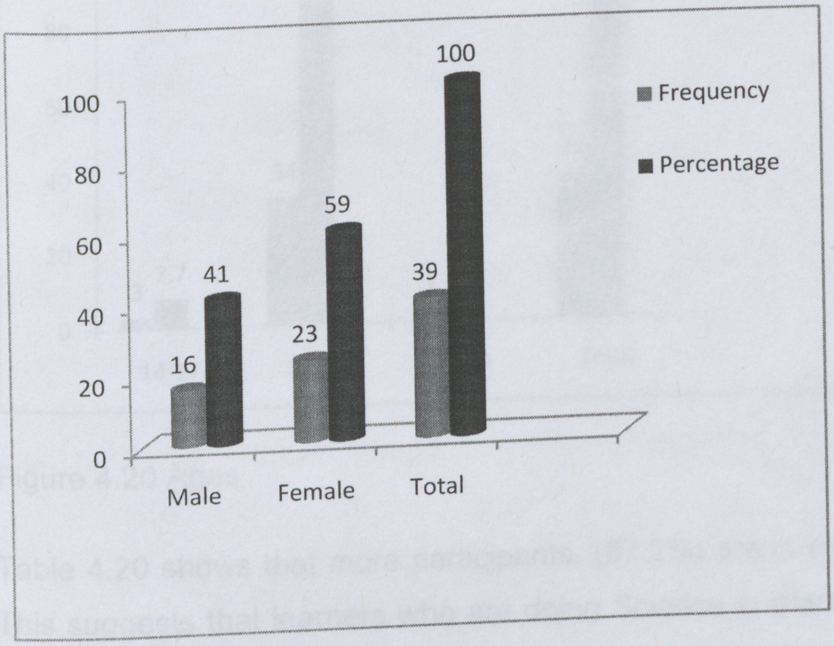


Figure 4.19 Gender

Table 4.19 shows that the majority of the respondents (59.0%) are female learners while (41.0%) are male learners. This might mean that there are more female learners than male learners who are doing Science in secondary schools of Sibasa circuit. This is an interesting result since it destroys the notion that Science is a male domain.

Table 4.20 Age

	Frequency	Percentage
14-17	3	7.7
17-20	34	87.2
21-24	2	5.1
Total	39	100.0

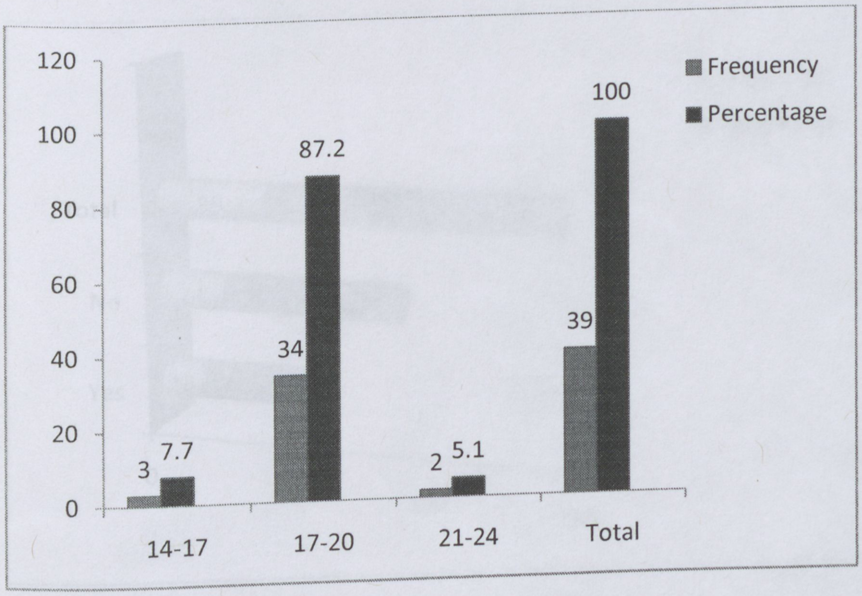


Figure 4.20 Ages

Table 4.20 shows that more participants, (87.2%) are in the age group 17 to 20 years. This suggests that learners who are doing Science in grade twelve are mature enough to handle difficult tasks in Science considering their mental age.

Table 4.21 Computer literacy in Science learning.

	Frequency	Percentage
Yes	15	38.5
No	24	61.5
Total	39	100.0

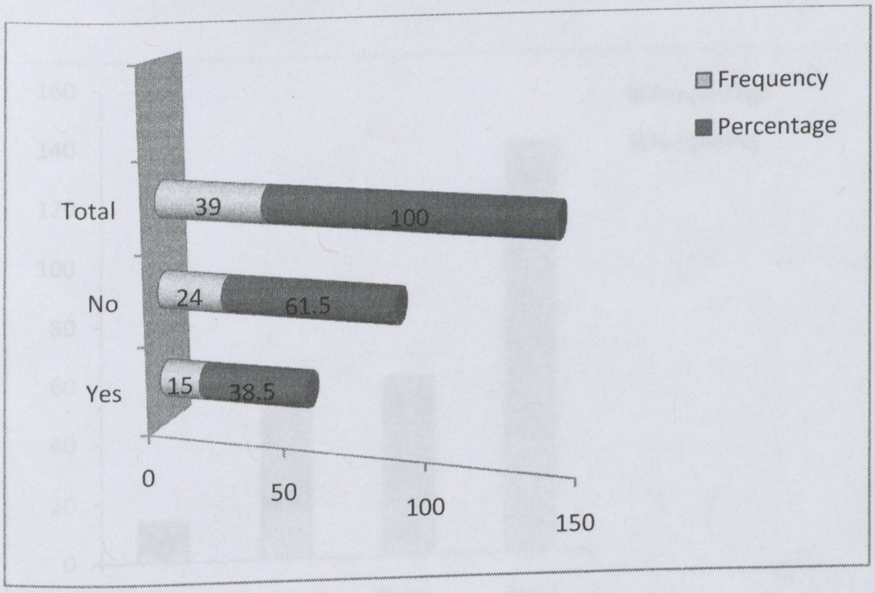


Figure 4.21 Computer literacy in Science learning.

Table 4.21 shows that the majority of the respondents (61.5%) indicated that they are not computer literate, while (38.5%) indicated that they are computer literate. The results may mean that most of the learners (61.5%) are inexperienced in the use of technological resources in Science learning. They may not be able to surf for Science information on the Internet

Table 4.22 Learner performance in Science

	Frequency	Percentage
Above average	4	10.3
Average	18	46.2
Below average	17	43.6
Total	39	100.0

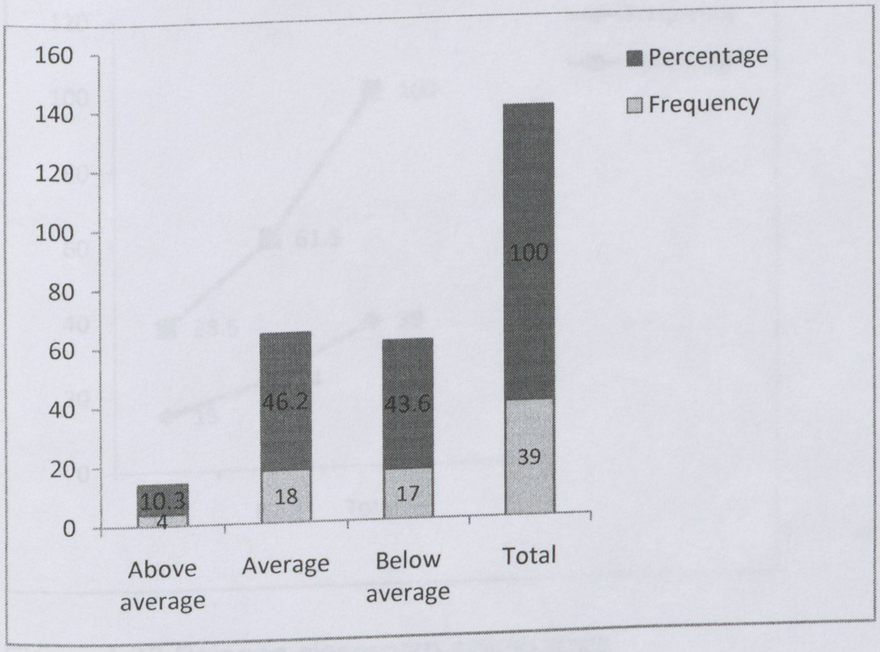


Figure 4.22 Learner performances in Science

Table 4.22 shows that most learners are average performers (46.2%) although those performing below average (43.6%) are fewer than those who are average and above average (10.3%), the performance are not pleasing because there are too many failing students. The results may suggest that respondents may be having various reasons for poor performance in Science.

Table 4.23 Adequate Science classrooms

	Frequency	Percentage
Yes	15	38.5
No	24	61.5
Total	39	100.0

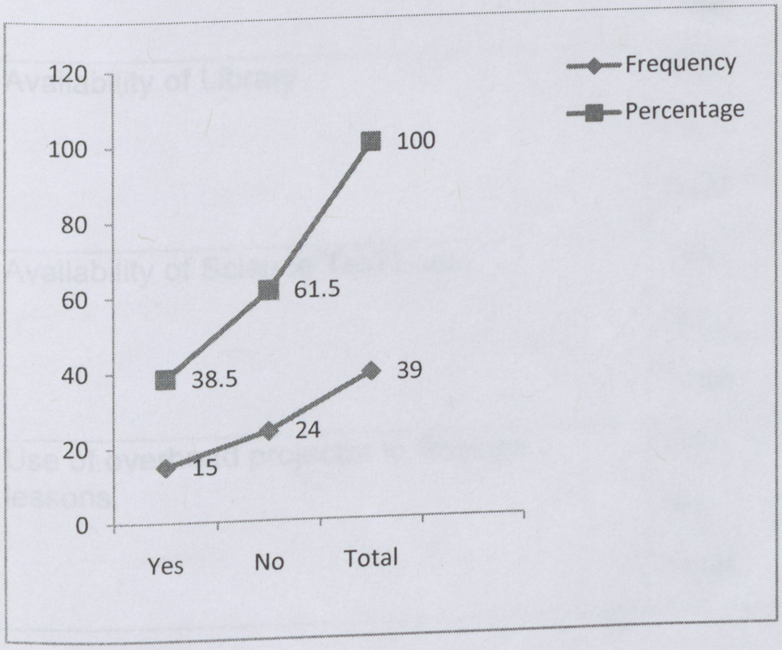


Figure 4.23 Science classroom adequacies

Table 4.23 shows that the majority of the respondents (61.5%) indicated that they do not have adequate Science classrooms while (38.5%) indicated that they have adequate Science classrooms. The results seem to suggest that respondents are overcrowded in class during Science learning. 94.4% of Science educators indicated that overcrowding in Science classes contribute to ineffective Science Teaching and Learning.

Table 4.24 Availability of Teaching/ Learning Aids, Library and Science Textbooks and use of overhead projector.

	Response	Frequency	Percentage
Availability of Teaching/ Learning Aids	Yes	3	7.7
	No	36	92.3
	Total	39	100.0
Availability of Library	Yes	13	33.3
	No	26	66.7
	Total	39	100.0
Availability of Science Text books	Yes	2	5.1
	No	37	94.9
	Total	39	100.0
Use of overhead projector in Science lessons.	Yes	6	15.4
	No	15	84.6
	Total	39	100

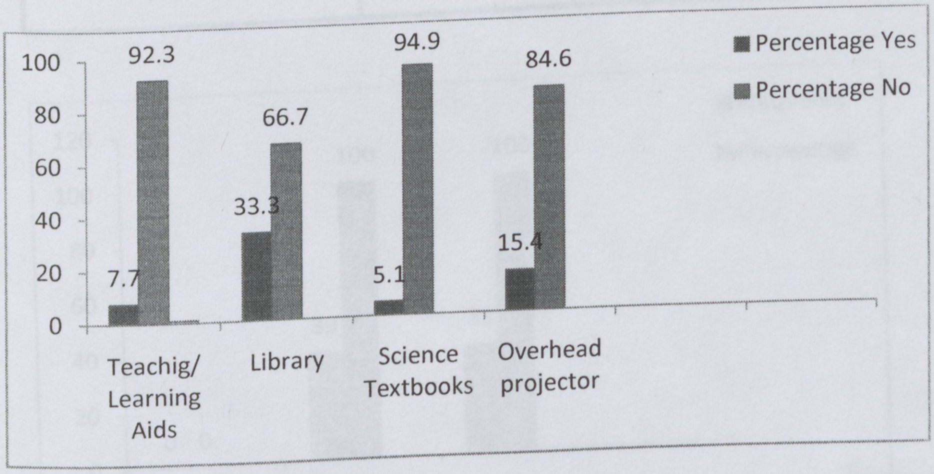


Figure 4.24 Availability of Teaching, Learning Aids, Library and Science Textbooks and use of overhead projector.

Table 4.24 shows that the majority of the respondents (92.3%) indicated that they do not have teaching and learning aids while (7.7%) indicated that they have teaching and learning aids. The results may mean that unavailability of teaching and learning aids promotes ineffectiveness in Science teaching and learning in secondary schools in Sibasa Circuit schools. 94.9% of the respondents indicated that there are no Science textbooks in schools while 66.7% indicated that they do not have school libraries. The results may suggest that, the majority of the respondents are not exposed to a variety on Science resources or information. This is supported by Lockheed and Verspoort (1991) who say that the availability of textbooks and other instructional materials has a consistently positive effect on student achievement in developing countries. On the use of overhead projectors, the majority of the respondents (84.6%) indicated that they do not use overhead projectors during Science lessons while (15.4%) indicated that they use overhead projectors during Science lessons. The results indicate that (84,6%) of the respondents depend on blackboards or lecture method to explain Science concepts which needs practical investigation.

Table 4.25 Use of computers during Science lessons

	Frequency	Percentage
No	39	100.0

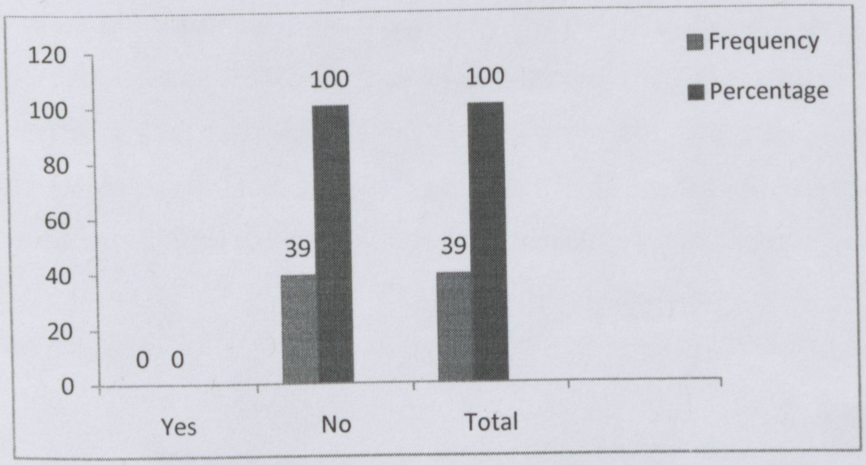


Figure 4.25 Use of computers during Science lessons

Table 4.25 shows that (100%) respondents indicated that they do not use computers in learning Science during their Science lessons. The results might mean that under or no utilization of computers is causing ineffectiveness in Science teaching and learning in Sibasa circuit secondary schools. Mbewane in Daily Sun (July 2010:25) says "technology helps us to work smart, we will benefit a lot from the laptop as we will get information to assist us in improving our teaching skills". Use of computers is of paramount importance in promoting effective Science teaching and learning.

Table 4.26 Availability of Science Laboratory, Chemicals and Equipment

	Response	Frequency	Percentage
Availability of Science Laboratory	Yes	8	20.5
	No	31	79.5
	Total	39	100.0
Availability of equipment and chemicals	Yes	5	12.8
	No	34	87.2
	Total	39	100.0

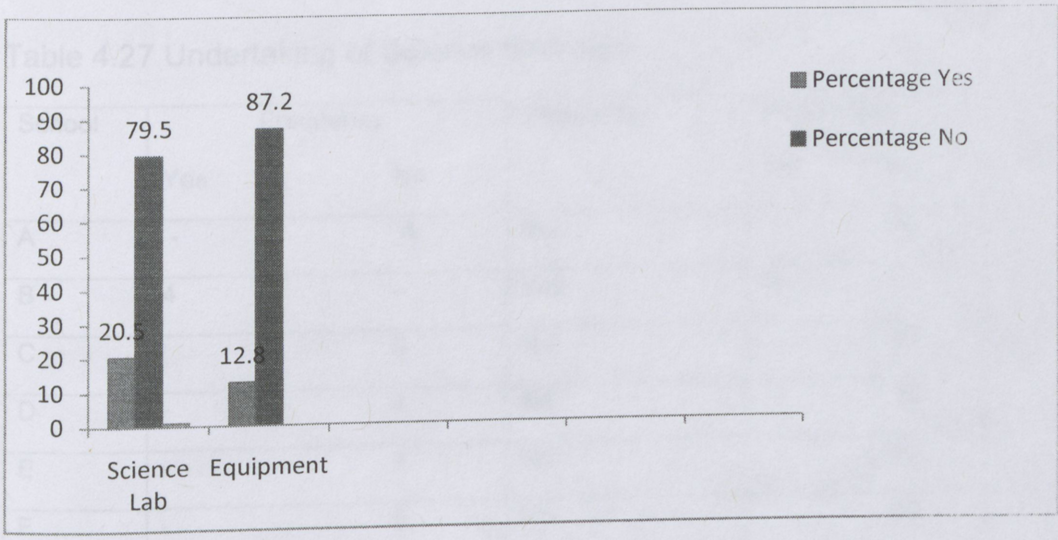


Figure 4 .26 Availability of Science Laboratory, Chemicals and Equipment

Table 4.26 shows that the majority of the respondents (79.5%) indicated that there are no Science laboratories in schools while (20.5%) indicated that Science laboratory are available in their school. 87.2% indicated that there are no Science chemicals and equipment in schools while a few (12.8%) indicated that Science equipment and chemicals are available in their school. The results may suggest that the majority of the respondents do not do Science experiments during Science teaching and learning. This may result in poor performance leading to poor achievement in the examinations. The result is similar to 88.9% of Science educators who indicated that they do not have Science laboratories in their schools. On the use of overhead projectors, the majority of the respondents (84.6%) indicated that they do not use overhead projectors during Science lessons while 15.4% indicated that they use overhead projectors during Science lessons. The results further indicate that respondents depend on blackboards or lecture method to explain Science concepts which needs practical investigation.

Table 4.27 Undertaking of Science field trips

School	Frequency Yes	No	Response	Percentage Yes	No
A	-	4	No		10
B	4	-	Yes	10	
C		5	No		10
D	-	4	No		10
E	-	4	No		10
F	-	5	No		10
G	3		Yes	10	
H	-	4	No		10
I	-	5	No		10
J	2	-	Yes	10	
Total	3	7	Yes 3 No 7	30	70

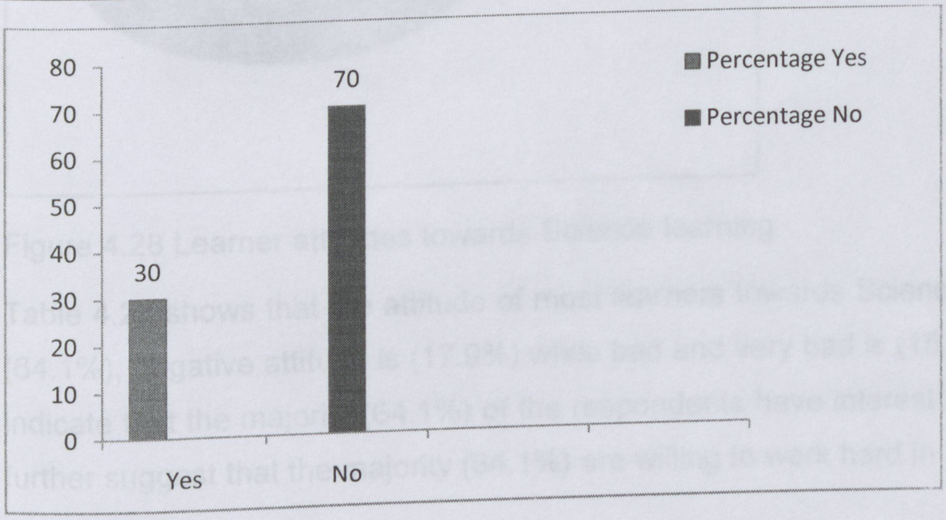


Figure 4.27 Undertaking of Science field trips

Table 4.27 shows that the majority of the respondents (70%) indicated that they do not undertake Science field trips while (30%) indicated that they undertake field trips. The results indicate that the majority of the respondents (70%) are not gaining real experiences in Science learning.

Table 4.28 Learners attitude towards Science learning

	Frequency	Percentage
Very positive	1	2.6
Positive	25	64.1
Negative	7	17.9
Very negative	6	15.4
Total	39	100

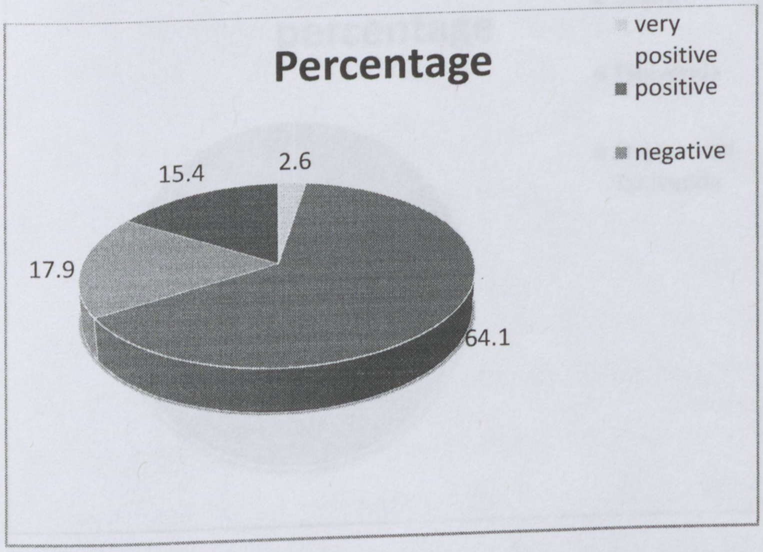


Figure 4.28 Learner attitudes towards Science learning

Table 4.28 shows that the attitude of most learners towards Science learning is positive (64.1%), negative attitude is (17.9%) while bad and very bad is (15,4%), the results may indicate that the majority (64.1%) of the respondents have interest in Science. This may further suggest that the majority (64.1%) are willing to work hard in Science.

Table 4.29 Language used during Science lesson

	Frequency	Percentage
English	24	61.5
Tshivenda	6	15.4
English and Tshivenda	9	23.1
Total	39	100

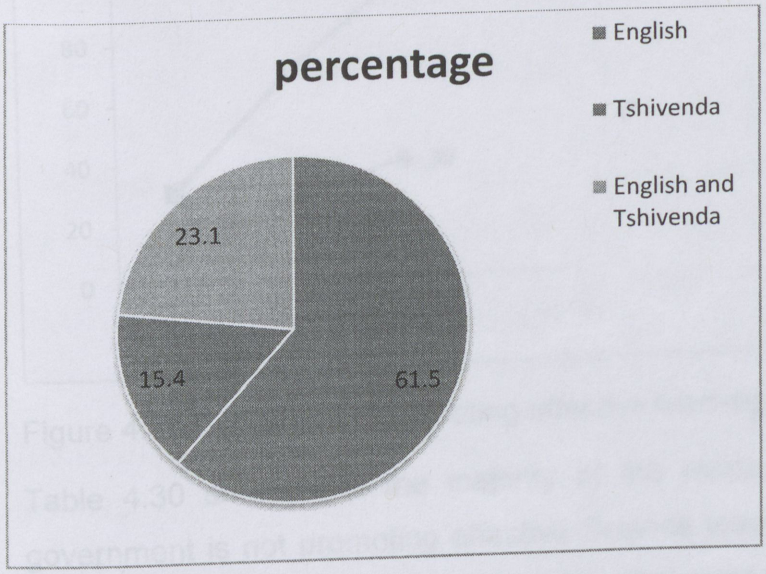


Figure 4.29 Language used during Science lessons

Table 4.29 shows that the majority of the respondents (61.5%) indicated that they use English as a medium of instruction in their Science learning. The results suggest that respondents should pass Science since they are tested in English during their Grade Twelve Examinations.

Table 4.30 Government promoting effective learning

	Frequency	Percentage
Yes	12	30.8
No	27	69.2
Total	39	100.0

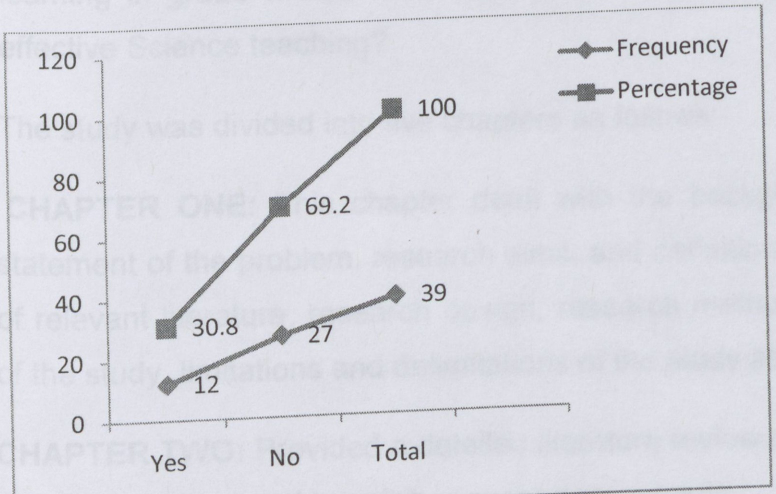


Figure 4.30 Government promoting effective learning

Table 4.30 shows that the majority of the respondents (69.2%) indicated that the government is not promoting effective Science teaching and learning. The results may mean that the respondents may not be getting appropriate required support from the government in terms of resources.

4.3 CONCLUSION

This chapter presented the analysis and interpretation of the collected data. The captured responses in this section is presentation of an analysis of the results obtained from the questionnaires completed by Science educators and learners in grade twelve and interviews with school principals from the selected secondary schools in Sibasa circuit. These responses lead to the recommendations to be made as to overcome the barriers to effective Science teaching and learning in secondary schools. The following chapter focuses on discussions, conclusions and recommendations.

CHAPTER FIVE

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 OVERVIEW OF THE STUDY

The aim of this study was to investigate barriers to effective Science teaching and learning in grade twelve. The main research question was: What are the barriers to effective Science teaching?

The study was divided into five chapters as follows:

CHAPTER ONE: This chapter dealt with the background of the research problem, statement of the problem, research aims, and definition of key terms, preliminary review of relevant literature, research design, research methods and procedures, significance of the study, limitations and delimitations of the study as well as outline of the chapters.

CHAPTER TWO: Provided a detailed literature review related to the barriers to effective Science teaching and learning in secondary schools.

CHAPTER THREE: This chapter dealt with research design and methodology used to gather data.

CHAPTER FOUR: This chapter dealt with presentation of data, statistical analysis and interpretation of the results.

CHAPTER FIVE: This chapter focused on the summary of the research, findings recommendations and conclusion.

5.2 MAJOR FINDINGS OF THE STUDY

The grade twelve learner's results in Science leave much to be desired. This luke warm performance is attributed to learning barriers.

5.2.1 Findings based on the interviews with secondary school principals (qualitative)

School principals' views on obstacles that hinder effective Science teaching and learning are similar to those of learners.

- Barriers to effective Science teaching and learning still exist at an alarming rate in Sibasa circuit secondary schools and are affecting the effectiveness of Science teaching and learning in grade twelve.

- The results of this study revealed that all secondary schools in Sibasa circuit have similar problems of lack of educational resources which in turn is causing ineffectiveness in Science teaching and learning thereby resulting in poor results achievement in grade twelve examinations.

- The provision of adequate educational resources, promotes effective Science teaching and learning in grade twelve.

5.2.2 Findings based on the questionnaires completed by Science educators (quantitative).

Barriers that hinder effective Science teaching and learning according to Science educators are similar to those of school principals.

- Sixty two percent (62.2%) of respondents reveal that they have more than ten (10) years of experience in Science teaching. One would expect such experienced teachers to produce desired results. They are still failing as a result of the existence of other barriers.

- The majority (94.4%) of respondents indicated that high educator -learner ratio is a major barrier to effective Science teaching and Learning in grade twelve.

- The results indicated that lack of resources is a major barrier to effective Science teaching and learning in Secondary Schools in grade twelve.

5.2.3 2 Findings based on the questionnaires completed by Science learners (quantitative).

Factors that hinder effective Science teaching and learning according to grade twelve Science learners are similar to those of Science educators.

- The majority (79.5%) respondents indicated that they do not have Science laboratories, (87.2%) indicated that they do not have Science equipment and chemicals this implies that they are not doing Science experiments (practical). This is definitely contributing to ineffectiveness in Science teaching and learning in schools.
- The results also indicated that Science experiments (practical) are not being done in Sibasa circuit secondary schools yet examiners include experiments in metric examination.

CONCLUSION

The findings revealed that a number of barriers to effective Science teaching and learning exist in schools. These barriers retard the process of effective Science teaching and learning in schools.

5.3 LIMITATIONS OF THE STUDY

Although the results of the current study are significant, these cannot be generalized to the whole nation because the sample was taken from a single circuit. However if one looks at the number of learners representing the population, it is quite big. The sample represented conditions affecting about 1500 grade twelve Science learners from the Sibasa circuit.

5.4 RECOMMENDATIONS

The major focus of this research was on barriers to effective Science teaching and learning in Sibasa Circuit Secondary Schools. I explored the physical, social, emotional, economic, intellectual and cultural barriers in secondary schools in grade twelve.

The following recommendations were made on the bases of the results of the current study:

- Science teaching requires teachers who are well qualified, with adequate subject content. The results of the current research show that the majority of the respondents (66.7%) indicated that educator qualification contributes to effective Science teaching and learning while only a few (33.3%) reported that educator qualification do not have any effect on effective science teaching. The results suggest that poorly qualified educators may not deliver Science concepts well as they do not have adequate subject content.
- Every school should have a well equipped laboratory. Science teaching needs a lot of materials such as chemicals. The results of this study revealed that all the respondents (100%) indicated that they do not have chemicals for science teaching. According to NEIMS (2009, Nov 02), Limpopo had only 10% of the Science laboratories whereas other provinces had much more, for example Gauteng had 78%. In the current study, results revealed that the majority (79.5%) indicated that there are no Science laboratories in schools.
- Educator-learner ratio should be reduced to a lower ratio possibly 1:15 which is appropriate for effective Science teaching. Results of the current study revealed that the majority (94.4%) indicated that high educator -learner ratio is promoting ineffective Science teaching and learning.
- Science is a practical subject hence students need to carry out experiments in order for them to understand Science subject matter. Laboratory assistants to assist Science educators in laboratories should be employed. I also recommend that Science workshops should be done regularly as to keep Science educators abreast with new development in the field of Science.

5.4.1 RECOMMENDATIONS FOR FURTHER RESEARCH

The study's findings cannot be generalized to all schools in South Africa because the sample was taken from a single circuit; however it is a good representative for Vhembe District. In terms of barriers to effective Science teaching and learning, it gives an insight into what other circuits should be like. I therefore recommend that a national study on barriers to effective Science teaching and learning should be carried out.

5.7 CONCLUSION

From the results in the current study I can conclude that, Sibasa circuit has adequately experienced and qualified educators, I can also conclude that despite there being qualified and experienced Science educators, the students' performance in Science is very low. It can be concluded that students' performance is disabled by educational barriers such as lack of equipment and lack of laboratories in schools. Lastly I conclude that if schools are well equipped with Science materials, students' performance in Science will improve.

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LIST OF APPENDICES

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APPENDIX A

Tsiga George

P.O. Box 4114

Louis Trichardt

0920

10 May 2010

The Circuit Manager

Sibasa C ircuit

Sibasa 0970

Dear Sir/ Madam

Ref: Permission to carry out an Educational Research in Sibasa Circuit Schools.

I am asking for permission to carry out a research on the barriers to effective science teaching and learning in Sibasa Circuit Secondary Schools.

I am an educator at one of the schools in Sibasa Circuit and currently studying for a Master of Education Degree at University of Venda.

Thank you for the support you are going to give me during the study. I hope the findings will be of paramount importance in facilitating effective science teaching and learning in schools.

Yours faithfully

Tsiga George

APPENDIX B

Tsiga George

P.O. Box 4114

Louis Trichardt

0920

15 May 2010

The District Senior Manager

Department of Education

Vhembe District

Dear Sir/ Madam

Ref: Permission to carry out an Educational Research in Vhembe District Schools.

I am asking for permission to carry out a research on the barriers to effective science teaching and learning in Sibasa Circuit Secondary Schools.

I am an educator at one of the schools in Sibasa Circuit and currently studying for a Master of Education Degree at University of Venda.

Thank you for the support you are going to give me during the study. I hope the findings will be of paramount importance in facilitating effective science teaching and learning in schools.

Yours faithfully

Tsiga George

APPENDIX C

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION
VHEMBE DISTRICT

Ref: 14/7/R
Enq: M.S Matibe
Tel: 0159621029

DEPARTMENT OF EDUCATION
VHEMBE DISTRICT
DSM'S OFFICE
2019 -06- 11
PRIVATE BAG X2250, SIBASA 0970
TEL: 015 962 1313
LIMPOPO PROVINCE

Mr. George Tsiga
P.O.Box 4114
Louis Trichardt
0920

Dear Sir

PERMISSION TO CONDUCT EDUCATIONAL RESEARCH IN SCHOOLS: SIBASA CIRCUIT.

1. The above matter bears reference.
2. Your request for permission to carry out an educational research on barriers to effective science teaching and learning in schools in the district has been granted.
3. This permission is subject to ensuring that your visits to schools do not disrupt teaching and learning activities.
4. Kindly inform the Circuit Manager and Principals of affected schools prior to your visits.
5. Wishing you the best in your academic pursuits.

DISTRICT SENIOR MANAGER

19/06/2019
DATE

Thohoyandou Government Building, Old Parliament, Block D, Private Bag X2250, SIBASA, 0970
Tel: (015) 962 1313 or (015) 962 1331, Fax: (015) 962 6039 or (015) 962 2288

The heartland of southern Africa - development is about people!

APPENDIX D

Limpopo
PROVINCIAL GOVERNMENT

Sibasa Circuit Office
P/Bag X2166
SIBASA 0970
Tel.No. 015 963 2062
Fax. 015 963 2931

Ref: 92842507
Enq: Mathalauga A.V.
Tel: 015 963 2062
Cell: 072 8921 567

11 September 2008

Mr. Tsiga George
P.O. Box 4114
Louis Trichardt
0920

RE: **REQUEST FOR PERMISSION TO CARRY OUT AN EDUCATIONAL RESEARCH IN OUR CIRCUIT.**

1. The above-stated matter has reference.

2. It would be appreciated and quite acceptable if you would approach the District Office for such permission. The Circuit Office would have no objection if permission had been granted by the District Office first.

3. Thank you.

Amatho
CIRCUIT MANAGER: SIBASA

24/05/2010
DATE

DEPARTMENT OF EDUCATION
SIBASA CIRCUIT OFFICE
2010 -05- 25
P/BAG X 2166 SIBASA 0970
LIMPOPO PROVINCE

APPENDIX E

TSIGA GEORGE

P.O. BOX 4114

LOUISTRICHADRT

0920

Cell :0834377168

Email: orgetsiga@yahoo.com

5 June 2010

The Principal

I am currently conducting a research on the barriers to effective science teaching and learning in secondary school in grade twelve. Permission has been granted by the District Senior Manager Vhembe District. Your school has been selected to take part in this worthwhile research.

1. An interview will be conducted at your school.

2. There are no known risks involved in this research.

3. There are no costs involved.

You are assured that your identity and responses to the interview will be regarded as confidential at all times and they will not be made available to any unauthorized user.

For any further clarification you are welcome to contact me.

TSIGA GEORGE

CONSENT

In terms of the ethical requirements of the University of Venda, you are required to complete the following section:

I --

Have read and understand this letter.

On condition that the information provided by me is treated as confidential at all times. I hereby (MARK the appropriate section)

☐	**give** consent
☐	do **Not** give consent that the results may be used for research purpose.

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

APPENDIX F

TSIGA GEORGE

P.O. BOX 4114

LOUISTRICHADRT

0920

Cell :0834377168

Email: orgetsiga@yahoo.com

5 June 2010

Dear Learner

I am currently conducting a research on the barriers to effective science teaching and learning in secondary school in grade twelve. Permission has been granted by the District Senior Manager Vhembe District. Your school has been selected to take part in this worthwhile research.

1. A questionnaire will be delivered to you.

2. There are no known risks involved in this research.

3. There are no costs involved.

You are assured that your identity and responses to the questionnaire will be regarded as confidential at all times and they will not be made available to any unauthorized user.

For any further clarification you are welcome to contact me.

TSIGA GEORGE

CONSENT

In terms of the ethical requirements of the University of Venda, you are required to complete the following section:

I ---

Have read and understand this letter.

On condition that the information provided by me is treated as confidential at all times. I hereby (MARK the appropriate section)

	give consent
	do **Not** give consent that the results may be used for research purpose.

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

APPENDIX G

TSIGA GEORGE

P.O. BOX 4114

LOUISTRICHADRT

0920

Cell :0834377168

Email: orgetsiga@yahoo.com

5 June 2010

Dear Science Educator

I am currently conducting a research on the barriers to effective science teaching and learning in secondary school in grade twelve. Permission has been granted by the District Senior Manager Vhembe District. Your school has been selected to take part in this worthwhile research.

1. A questionnaire will be delivered to you.

2. There are no known risks involved in this research.

3. There are no costs involved.

You are assured that your identity and responses to the questionnaire will be regarded as confidential at all times and they will not be made available to any unauthorized user.

For any further clarification you are welcome to contact me.

TSIGA GEORGE

CONSENT

In terms of the ethical requirements of the University of Venda, you are required to complete the following section:

I --

Have read and understand this letter.

On condition that the information provided by me is treated as confidential at all times. I hereby (MARK the appropriate section)

☐ give consent

☐ do **Not** give consent that the results may be used for research purpose.

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

APPENDIX H

INTERVIEW QUESTIONS

INTERVIEWS WITH SCHOOL PRINCIPALS

1. What is your work experience?

2. For how long have you been the principal at this school?

3. How is the learner performance in science?

4 .Is there effective science teaching and learning at your school? Why/ Why not?

5. What is your opinion on barriers to effective science teaching at your school?

6. Do you think educational barriers are facilitating poor performance in science at your school?

7. Do you think lack of resources is a barrier in teaching science? Why/ Why not?

8. Do you have a science laboratory at your school?

9. Is your science laboratory well equipped with equipment and chemicals?

10. Do you think your science educators need to be staff developed?

11. Are your educators fully participating in the school science programmes e.g. science expo?

12. Are you satisfied with the science teaching workshops being done?

13. What is the medium of instruction at your school?

14. Do you think the medium of instruction is a barrier to effective science teaching and learning at your school? How?

15. What is the teacher pupil ratio, how is it contributing to science pass rate?

16. How is the involvement of parents at your school? Are you satisfied with their involvement in your school?

17. What other barriers you think are causing ineffectiveness in science teaching in schools?

18. What do you think can be done to remove barriers to effective science teaching and learning in school?

QUESTIONNAIRE FOR EDUCATORS

George Tsiga is a student at university of Venda and is conducting a research in Sibasa circuit in Vhembe District of Limpopo Province on **Barriers to effective science teaching and learning.** The research is intended to assist educators, curriculum advisors, material developers, policy makers, when designing professional development activities and producing educational materials.

You are kindly requested to complete this questionnaire.

Contact number **0834377168/ 0788004707**

Instructions

(a) Please answer all questions

(b) Indicate your response by marking with a tick next to the appropriate answer, and where question needs personal views, please state your views.

(c) Do not mark two boxes per question.

1. Gender

Male	1
Female	2

2. Age

21-30	31-40	41-50	51-60	61-70	70+
1	2	3	4	5	6

3. What is your educational qualification?

Std 10	BA/BAED	BA HONS/B.ED.	M.A/ MED	Other
1	2	3	4	5

4. What is your professional qualification?

P.T.C	J.S.T.C/S.P.T.C	S.T.D/P.T.D	U.E.D/H.E.D	Other
1	2	3	4	5

5. How long have you been teaching science?

1-5	6-10	11-15	16-20	21-25	25-30	30+
1	2	3	4	5	6	6

6. Type of school: Rural [1] Urban [2] Semi-Urban/ Semi-Rural [3.]

7. How is learner performance in science at your school?

Above average	average	Below average
1	2	3

8. Do you have enough educational resources?

Yes	1	No	2

9. Do you have a library in your school?

Yes	1	No	2

10. Do you have a Science laboratory in your school?

Yes	1	No	2

11. Is your Science laboratory well equipped with chemicals?

Yes	1	No	2

12. Is your Science laboratory well equipped with equipment?

Yes	1	No	2

13. Do you have a computer laboratory in your school?

Yes	1	No	2

14. Do you use some technological resources in your lesson like computers?

Yes	1	No	2

15. Do you think you need to be staff- developed (in- service training) in Science?

Yes	1	No	2

16. Are you satisfied with the Science teaching workshops being done?

Yes	1	No	2

17. Is Science teaching and learning environment conducive for example teacher-pupil ratio?

Yes	1	No	2

18. Do high teacher-learner ratio affect the effectiveness of Science teaching and Learning?

Yes	1	No	2

19. What language of instruction do you use in teaching Science?

----

20. Do you think the medium of instruction is affecting the effectiveness of Science Teaching? and learning?

Yes	1	No	2

21. Do you think teacher qualification contributes to effective Science teaching and Learning?

Yes	1	No	2

22. Do you think the government policies promote effective Science teaching and learning in schools?

yes	No	I don't know
1	2	3

23 Do you think government policies are promoting effective science teaching?

Yes	1	No	2

APPENDIX J

QUESTIONNAIRE FOR LEARNERS

George Tsiga is a student at university of Venda and is conducting a research in Sibasa circuit in Vhembe District of Limpopo Province on **Barriers to effective science teaching and learning.** The research is intended to assist educators, curriculum advisors, material developers, policy makers, when designing professional development activities and producing educational materials.

You are kindly requested to complete this questionnaire. Contact number **0834377168/ 0788004707**

Instructions

(a) Please answer all questions

(b) Indicate your response by marking with a tick next to the appropriate answer, and where question needs personal views, please state your views.

(c) Do not mark two boxes per question.

1. Gender

Male	1
Female	2

2. Age

14-17	17-20	21-24	24-27	27-30	30
1	2	3	4	5	6

3. Is this your first year in grade 12?

Yes	1	No	2

4. Is this your first school since grade 8?

Yes	1	No	2

5. Are you computer literate?

Yes	1	No	2

6. How is learner performance in science in your class?

Above average	average	Below average
1	2	3

7. Do you have adequate chalkboard in your science classrooms

Yes	1	No	2

Yes	1	No	2

8. Do you have adequate science classrooms?

Yes	1	No	2

9. Do you have enough science text books?

Yes	1	No	2

10. Are there learning aids such as pictures, wall charts, maps, models in your class?

Yes	1	No	2

11. Do you use computers during science lessons?

Yes	1	No	2

12. Do you have a science laboratory at your school?

13. Does your science laboratory fully equipped with equipment and chemicals?

Yes	1	No	2

14. Is there electricity in your science class?

Yes	1	No	2

15. Do you use an overhead projector during science lessons?

Yes	1	No	2

Yes	1	No	2

16. Do you go for science field trips?

Yes	1	No	2

17. Does your school have a library?

Yes	1	No	2

18. Are there enough science reading books in your school library?

19. How do you rate learner's attitude towards science learning?

Very good	good	bad	Very bad
1	2	3	4

20. Do you have adequate qualified science teachers at your school?

Yes	1	No	2

21. How do you rate your science teachers' performance?

excellent	Very good	good	poor	Very poor
1	2	3	4	5

22. Which language do you use during science lessons? ---

23. Do you think the government is promoting effective science learning in schools?

Yes	1	No	2