The Impact of the Curriculum Change in the Teaching and Learning of Science: A Case Study in Under-resourced Schools in Vhembe District

by

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DECLARATION

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I, LITSHANI LIZER TSHIREDO, declare that “The Impact of the Curriculum Changes in the Teaching and Learning of Science: A Case Study in Under-resourced Schools in Vhembe District” is my work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Signed by ………………………. on the ………… day of …………………2013
ABSTRACT

The aim of the study was to investigate the impact of curriculum change in teaching and learning of science subjects at schools in Vhembe District. The research also meant to answer the following research objectives on the impact of new changes in curriculum. The first research objective was based on the effects of curriculum changes in the teaching and learning of science. The second research objective was based on the constraints or factors that might be affecting the effectiveness of new changes in teaching and learning of science. The third research objective was based on the monitoring and support on the new changes in science curriculum. Research objective four was addressed as a recommendation. It was about the suggestion for future planning of changes in curriculum. In this era of on-going new developments in curriculum, it was imperative to find out how new changes are affecting teaching and learning of science curriculum even in the most remote parts of the country. The continuous changes that are taking place in science curriculum demand the need for this research. Questionnaires, interviews and observation were used as data collection methods using the qualitative method. Schools which participated in the study were selected using purposive sampling. It is revealed in the findings that teachers feel that it is not necessary for them to change the way they teach, especially those who did not receive training on the new curriculum changes during their tertiary education. The findings also indicate that lack of resources impact negatively on the implementation of curriculum reform in teaching and learning of science in many under-resourced schools in rural areas. The findings also reveal that, it is not easy for subject advisors to give relevant support because of inadequate resources and lack of human capacity. According to the research findings, inadequate resources, skills and knowledge and lack of pre-planning on new curriculum development adversely affect the teaching and learning of science in schools. It is therefore recommended that the proposed curriculum development and reform be piloted before it is implemented as proposed in the model for the preparation of effective curriculum changes and development in science. Also, it is important to have functional curriculum support forums at school, circuit and district levels. The provisioning of science centres with well-equipped laboratories in each and every circuit will play a greater role in effective teaching and learning of science in schools.

Keywords: science curriculum, teaching, learning, curriculum change, resources.
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Above all, God Almighty for giving me the courage and strength to start and complete this research.
DEDICATION

This study is dedicated to my only son, Blessing Maluleke, for his love, support and understanding. I dedicate this work also to my husband, Brighton Maluleke, for his undying love, encouragement and support.
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CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION AND RATIONALE

Curriculum change in South Africa came as an idea for the purpose of addressing education system which was characterized by racism, discrimination and inequalities. However, failure to implement successful new curriculum still persists and it is argued that well designed curriculum reform with impressive goals have not been successful because too much attention has been focused on the desired educational change and neglects how the curriculum change should be implemented (Bantwini, 2009:169).

The adoption of the new constitution after the country became a democracy in 1994 has provided the basis for curriculum change and development in South Africa. This has led to the adoption of outcomes-based education (OBE) which was followed by the introduction of curriculum (c2005) in 1998 (Chisholm, 2005:80). The adoption of outcomes-based education brought many changes in the education system. The changes affected the old system which was based on teacher-centred philosophy. The outcomes-based education (OBE) opposed traditional education known as Bantu education, which primarily focused on the resources that were available and required that learners demonstrate the required skills and content (Lekgoathi, 2010:107). However, outcomes-based education promoted curricular and assessment based on constructivism and opposed traditional educational approaches (Lekgoathi, 2010:107). Curriculum 2005 was revised to national curriculum statement (NCS), which became a policy in 2002 (Chisholm, 2005:80). The main aim of the curriculum revision was to “cleanse” the Bantu education system of its racist and sexist elements (Chisholm, 2005:80). However, the Department of Education, in setting out of its proposals, put little or no responsibility on how these changes can be delivered or implemented (Gultig, et al., 2001:180).

Implementation of the change in curriculum is resource-intensive; as such availability of adequate school buildings and science apparatus may be critical for its success. However, the key driver to curriculum change success is the development of teachers’ knowledge, skills, attitudes, and the alignment of teacher training methods. As a result, failure to consider the various issues that facilitate and impact learning and change, when developing a model, may lead to lack of implementation of the curriculum reforms by the educators (Bantwini, 2009:180). The literature indicates that the existing research on teachers’ feeling and attitudes
towards change tend to give only a limited understanding of the issues (Witz & Lee, 2009:411). This research will investigate and identify teachers’ attitudes towards curriculum change. It will also look at how attitudes towards curriculum change impact on the teaching and learning of science in rural schools. This will help to understand some teachers’ attitudes towards reform (Witz & Lee, 2009:415).

Disparities in the availability of resources between schools in rural areas and those in urban areas need serious attention. From my experience as science teacher, it is difficult to teach science in a school where there are limited science resources and particularly no laboratories. This situation contrasts that of urban schools that have well equipped laboratories. Consequently, many schools in rural areas perform below standards in maths and science. Moreover, the literature indicates that the evaluation of numeracy and science performance by international comparisons shows that South African children are not performing up to the standards required (Bloch, 2009:17). Therefore, there is a need to improve scientific and mathematics performance of underprivileged learners (Chisholm et al., 2003:150).

Hence, this study will explore the impact of curriculum change in the teaching and learning of science in schools with limited resources. Chisholm (2005:87) argues that the curriculum change can be implemented with ease in well-resourced contexts possessing well trained educators. Furthermore, Stears (2009:399) points out that more South African educators seem to resist change when it comes to teaching science and still use the old approaches. This may be an indication of the shortage of science expertise in South African schools.

From my experience as a secondary educator, I have seen many schools struggling to implement the changes in curriculum because of shortage of resources and the necessary skills. Many schools do not have qualified science educators, let alone science laboratories where they can conduct the experiments. As a result, the idea of curriculum change in science becomes unrealistic. If these persisting problems are left unattended, learners will continue to underperform in maths and science in schools in rural areas. My concern regarding the shortage of materials and human resources lent impetus to my decision to undertake this research.

1.2. PROBLEM STATEMENT

The main problem is the impact of curriculum change in teaching and learning of science subjects in under-resourced schools. The challenges of curriculum change are inappropriate
curriculum structures and inequalities and disparities in allocation of resources and capacity. Shortages of skilled science teachers, science curriculum specialists, learning materials, adequate classrooms, science laboratories, and technology are the main problem areas that hinder the success of current curriculum in teaching and learning of science subjects in Vhembe District.

The following research questions will help to demarcate the research problem more clearly.

➢ What are the effects of curriculum changes in the teaching and learning of science in Vhembe District?
➢ What are the constraints or factors that might be affecting the effectiveness of new changes in teaching and learning of science in Vhembe District?
➢ What are the suggestions for future planning of changes in curriculum?
➢ How does support and monitoring of changes occur in the science curriculum?

1.3. AIMS OF THE STUDY

The aim of this study is to investigate the impact of curriculum change in the teaching and learning of science in Vhembe District.

1.4. LITERATURE REVIEW

The aim of any curriculum change is to have a desired achievement at the end of its implementation. Lekgoathi (2010:107) and Chisholm (2005:80) indicate that South Africa adopted OBE to replace the Bantu Education system. However, Rogan and Grayson (2003:1171) and Bantwini (2009:169) argue that the implementation of curriculum changes in South Africa was mainly focused on the desired educational and political achievement than the how part of its implementation.

Many schools in Vhembe District are under-resourced. It is difficult to find a school with well-equipped laboratory, enough classes and learner support materials. It seems as if the availability of learning resources has been overlooked. Davies (1994:262) Rogan and Grayson (2003:1173-1174) and Bowker, Davies, Hopkin, James, Kelly, Peacock and Sharp (2009:250) and Chisholm (2005:94) describe the shortage of resources as the main factor that make curriculum reform impact in an unintended way in teaching and learning in schools.
Therefore, it would have been important for curriculum developers and policy makers to have understood the diversities of schools when it comes to resources, before introducing a new curriculum in South Africa. This is because some schools may not have the necessary resources to implement the curriculum. Rogan and Grayson (2003:1173-1174) and Dezendorf, et al. (2005:108) emphasize that those who are responsible for curriculum change activities should understand what resources are available and the degree of resources available to support the change. The present research will also investigate the impact of shortage of resources in the implementation of curriculum changes in the teaching and learning of science in Vhembe District.

There is a need for support from science curriculum advisors to monitor the process of curriculum change processes in each and every school. Support provided may limit the problems teachers are encountering in their daily process of dealing with problems and questions related to curriculum. This could happen if the issue of school based curriculum advisors and curriculum committees are considered in many schools in Vhembe District. According to Bantwini (2009:176) shortage of curriculum advisors and human capacity in science subjects make the monitoring of schools focus only on few schools. Many schools end up not being visited for the whole year, especially in science streams. This could be another factor which hinders the success of curriculum change in teaching and learning of science. Schwartz and Sadler (2007:991) point to the fact that effective teaching and learning require support and scaffolding to ensure that teachers and students operate at their optimal skills level.

Shortage of science teachers and science expertise is a reality that exists in many schools in Vhembe District. Bantwini (2009:177) and Rogan and Grayson (2003:1186) note that curriculum change may impact on the teachers’ own background, training and level of confidence to teaching. Another problem is that some teachers who teach science did not major in it, but they do so because of the shortage of science educators. Due to lack of science background some teachers choose what they could teach and disregard what they could not. Further, research needs to be done because the problem seems to persist. This could be another factor that makes curriculum change impact in an unexpected way in teaching and learning in many schools in Vhembe District.

During the process of curriculum change, science curriculum also changed its approaches in the teaching of science. According to Van Driel et al. (2008:107-108) the change of
curriculum was aimed at changing learners’ attitudes towards science and making science more relevant to learners. However, Yip (2009:759) and Bantwini (2009:177) argue that teachers and learners’ attitudes towards change should have been checked before the implementation of curriculum change and the perceptions they have towards changes in curriculum. Therefore, lack of knowledge and understanding toward curriculum change could be another factor that hinders the success of curriculum change. As a science teacher, I have observed many educators and find out that they still teach the same way as before the introduction of the curriculum change. Therefore, there is a need for further research to identify the learners and educators’ attitudes towards change in science curriculum in Vhembe District.

1.5. SIGNIFICANCE OF THE STUDY

According to McMillan and Schumacher (2001:99) the significance of the study tells the reader why the study is important and indicates the reasons for the researcher’s choice of a particular study or problem. The schools in rural areas face many constraints when it comes to learning resources; as a result curriculum change impacts negatively on the effectiveness of teaching and learning. The research had been a wakeup call to the educational authorities that the issue of resources need to be given attention, especially rural schools.

The study investigated how the shortage of resources impact on the implementation of curriculum changes in the teaching and learning of science and how this problem can be addressed to make curriculum change impact in a positive way. The research will find out the attitudes of learners and educators towards the new methods of teaching in science and how they feel about the changes. This is a problem which is prevalent in many schools. The research found out that those teachers are still using the positivism approaches while teaching in their classes and what could be done to change educators’ attitudes towards the new curriculum.

Many researchers focus mainly on the knowledge part of curriculum change and give less attention on the constraints that make curriculum change impact negatively in teaching and learning of science. Investigation into educators’ and learners’ attitudes would play a significant role in making the curriculum change impact in a positive way.
1.6. CLARIFICATION OF CONCEPTS

1.6.1. CURRICULUM

Curriculum is defined differently by different authors, Marsh and Wills (2007:19) argue that curriculum reflect the historical, social, economic, and political context of the society in which they have been trained. According to Ornsteins and Hunkins (2009:19) curriculum can be defined in five different ways. Firstly, they define it as plan for achieving goals; secondly dealing with the learners experience; thirdly as a system for dealing with people, and fourthly as a field of study. Finally, they define curriculum in terms of subject matter: (maths, science, English, history, and so on) and content (the way information is organized and assimilated).

1.6.2. TEACHING

We can define teaching in many ways as we like. Since our curriculum started to change teaching has been defined in some new different ways. According to Du Plessis et al. (2007:2) teaching can be seen as creating opportunities for learning to take place, as well as the process of helping learners to learn.

1.6.3. LEARNING

According to Du Plessis et al. (2007:3) learning process of experience that changes the individual. They go on to point out that it entails change in a person as regards the individual’s insights, behaviour, perception or motivation and which change leads to add knowledge or the ability to do something that learners could not do before. This study looks at the learners’ experience in class. It also looks at what the learners have gained through their experience in the learning process.

1.6.4. SCIENCE

According to Cope and Kalantzis (2008: XIV) science has a contradictory range of meaning. They argue that when the word scientist is mentioned, the first thing that may spring to mind is person in a laboratory coat, conducting an experiment. One might think of subjects like chemistry, physics, geology and biology in schools and universities. This meaning refers to the natural and technological worlds. It can also be used in some of the social sciences. In this study it refers to a subject taught in the classroom.
1.6.5. UNDER-RESOURCED SCHOOL

Under-resourced school is a school that has inadequate skills, materials, technology, infrastructure, attitudes and knowledge to effect the intended change in curriculum. According to Macmillan English Dictionary (2002:1562), under-resourced is defined as without enough money or equipment to operate effectively.

1.7. CHAPTER DIVISION

Chapter 1 will introduce the study, giving background and rationale of the study, the problem statement, aims of the study, research questions, significance of study and theoretical frameworks. Chapter 2 will deal with literature review. It will discuss the impact of the curriculum change in teaching and learning of science, constraints that make curriculum change impact negatively, attitude of educators and learners towards curriculum change, and the effect of curriculum change to educators, learners, principals and curriculum developers. Chapter 3 will deal with methodology. It will describe the research method employed, research design, subject of the study, conceptualization and measurement. Chapter 4 will deal with data collection. It will discuss biographic information, data analysis, general findings of the interviews and conclusion. Finally, Chapter 5 will present the summary, conclusion, recommendations and suggestions for further study in the area.

1.8. CONCLUSION

This chapter started by briefly presenting the historical background. This followed by the description of the problem statement and aim of the study. A brief literature review followed dealing with the impact of curriculum changes on teaching and learning in schools. The significance of the study was also discussed and indicated the importance and reasons for the choice of the study. It ended by clarifying the key concepts.

The next chapter will deal with literature in a more detailed manner to show how changes in curriculum impact on teaching and learning. The chapter begins by giving presenting a detailed discussion on the historical background of changes in curriculum, starting from the apartheid education system to curriculum and assessment policy statement (CAPS).
CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Education in South Africa has always been seen a contested arena, with complex issues to be dealt with. Many policies have been introduced in order to bring about equality and better education for all its citizens. Post-1994 education practices focused mainly on desegregation and expanding access to education for all South Africans. Change strategies in curriculum were at the top of the agenda to make the curriculum more attractive and responsive to the socio-economic and labour markets needs of the country (Davies, 1994:2600). However, Jansen (1999:147) disagrees with the above statement, noting that there is no evidence which supports the claims that education should be viewed as a prerequisite for economic growth in South Africa. Moreover, the introduction of outcomes-based education seems to have brought complex curriculum reform with inadequate preparation and support. As a result, this also brought serious problems for schools which were historically underprivileged when it comes to the management of new policies, because of their state of being under-resourced.

Lekgoathi (2010:108) and Jansen (1999:149) argue that it is right to be concerned with the equity implications of OBE (outcomes-based education), with the likelihood of it improving white privileged schools and further disadvantaging school children in marginalized schools. Furthermore, Weber (2007:13) states that teachers with access to better resources, that is teachers in the former whites-only schools, are more responsive to educational change than teachers in poor schools. Therefore, shortage of resources and inadequately trained teachers might be the cause of unsuccessful implementation of changes in curriculum in many schools. Plek (1991:130-131) indicates that it is the quality of teachers, the principals and inspectors including their knowledge and background that can guarantee success.

This chapter will provide a review on the impact of changes in curriculum starting from the historical background of curriculum changes in South Africa. It will attempt to indicate the impact of curriculum changes in South Africa before 1994, going back to the introduction of the Bantu Education Act of 1953 until the introduction of the curriculum and assessment policy statement (CAPS). The chapter will also focus on the disparities between previously advantaged and disadvantaged schools and how these differences influence the impact of curriculum change on teaching and learning of science subjects. It will mainly focus on the factors that hinder the success of curriculum change in science. It will also compare South
Africa with other countries on how curriculum change impacts teaching and learning of science, and the importance of understanding the theories behind the science curriculum.

2.2. HISTORICAL BACKGROUND OF CURRICULUM CHANGE IN SOUTH AFRICA

2.2.1 The effect of curriculum change prior 1994 (Apartheid Education)

The effect of curriculum change started many years ago in South Africa. Curriculum change has its own mark in the history of South African education. The Bantu Education Act of 1953 has had a great effect on teachers and learners in South Africa. Learners were forced to use Afrikaans as the medium of instruction which led to the Soweto uprising in 1976. In 1975 the Minister of Bantu Education announced that half of the subjects in standard five and six now called grades seven and eight were to be taught in Afrikaans as a medium of instruction (Christie, 1991:240).

The effect of the Bantu Education Act on teachers was that, they were expected to work long hours, no improvement in the salaries, large classes and they must be Government employees. It led to teachers resisting Bantu education, seeing it as the new apartheid measures that were beginning to affect people’s lives (Christie, 1991:288-229). Furthermore, there was a new call for people’s education in 1985. People’s education saw its task as the translation of the educational implications of the freedom charter into practice. Its main objectives were to enable the oppressed to understand the wrongs of apartheid and to provide them with an alternative education that would prepare them for participation in a non-racial and democratic society (Davies, 1994:261). The unrest even continued during the unbanning of the ANC, PAC and the release of Nelson Mandela in 1990 until the ANC appointed to its education desk tasking it to address on education policies which were full unequal and racially based (Christie, 1991:229; Jansen, 1999:58 and Lekgoathi, 2010:106). Davies (1994:262) emphasizes that the African National Congress’s (ANC) capacity to effect change has been affected by inadequate financial resources and political unrest. Davies further notes that the African National Congress’s emphasis was on the teaching of applied sciences, technology and information technology with the aim of making education in South Africa more labour market-oriented.
2.2.2. Curriculum 2005

1994 was marked as another era of political and educational changes in South Africa. During the period in question, new policies and legislations were passed in order to implement educational changes. This process led to the introduction of Outcomes-Based Education (OBE) as the educational reform model introduced by the new Government from March 1997 as both the replacement and solution to the apartheid curriculum. The new curriculum was adopted from countries such as Australia and the United States of America. The introduction of OBE has brought about many changes in the South African curriculum. It has always promoted curriculum and assessment based on constructivism approach and discouraged traditional education approaches which were based on direct instruction of facts and standard methods (Lekgoathi, 2010:107).

During 1997, the minister of education, Professor Sibusiso Bengu announced the adoption of the new policy known, OBE, which was an internationally borrowed form of standard-based national curriculum linked to formative and continuous rather than summative assessment (Chisholm, 2005:80).

However, OBE has always been criticised since its introduction and implementation process in South Africa. The review committee has always criticised OBE’s essential features. They emphasized that the implementation of OBE was confounded by the following:

- A skewed curriculum structure and design.
- Complexity of language.
- Lack of alignment between curriculum and assessment policy.
- Inadequate orientation, training and development of teachers.
- Learning support materials that are variable in quality, often unavailable and not sufficiently used in the classroom.
- Shortage of personnel and resources to implement and support curriculum (c2005). (Chisholm, 2005: 87).

The review committee also emphasized that attention must be paid to implementation weaknesses related to inadequate resourcing, manageable timeframes for implementation and regular monitoring. Moreover, OBE has always been criticised even in countries like the United States of America and Australia where it was first introduced before it was introduced in South Africa (Chisholm, 2005:87 and Van der Horst and McDonald, 1999:16). However,
Curriculum developers were advised not to tamper with what is working from the old system and help teachers to cope with the new method of teaching and learning by understanding the new approaches underpinning the new curriculum reforms. Furthermore, Lovat and Smith (2003:210) emphasize that for change in school to be successful; there must be more emphasis on the development of teachers and shared perception so that teachers understand the reason for change. As a result, lack of clear explanation about changes, inadequate skills, knowledge to perform the new role and unavailable required material might contribute to teachers’ lack of motivation, which might affect the success of changes that need to be implemented (Jackson, 1992:206).

2.2.3. Revised National Curriculum Statement (RNCS)

Chisholm (2005:80) and Bantwini (2009:171) state that the review of Curriculum 2005 in 2000 led to the formation of Revised National Curriculum Statement (RNCS) which was a streamlined version of curriculum 2005 (C2005). The Department of Education (2002:2) states that this curriculum will strengthen the implementation of OBE, human rights and inclusivity. Chisholm (2005:88) states that the proposed revision by the then Minister of Education, Kader Asmal, was necessary in the light of existing inequalities of under-resourced schools which had large classes and many untrained teachers in learner-centred education. However, the South African Democratic Teachers’ Union (SADTU) recommended the RNCS revision for its clarity and accessibility and expressed support for the underlying principles of the revised curriculum (Chisholm, 2005:90).

The key principles that indicated changes in RNCS were the comprehensive outcomes and the assessment standards which indicate the skills and knowledge required. The revised national curriculum statement was based on the following principle:

- Outcomes-based education.
- Clarity and accessibility.
- Progression and integration.
- A high level of skills and knowledge for all.
- Social justice, a healthy environment, human rights and inclusivity.
Focusing mainly on natural sciences, it takes into consideration that all learners should have access to a meaningful science education. These are the teaching strategies that might help learners to rectify their misconceptions and construct a proper understanding of scientific ideas (Yip, 2000:758). The natural science learning area statement promotes:

- The development and application of scientific knowledge and understanding.
- The development and use of scientific process skills in different settings.
- Appreciation of the relationships and responsibilities between science, society and environment (DoE, 2002).

### 2.2.4. Curriculum and Assessment Policy Statement (CAPS)

The introduction of outcomes education left teachers with the main responsibilities of implementing new changes in the curriculum. The question that came to the mind of everybody affected by those changes was these changes are going to affect teaching and learning in school. According to Ornstein & Hunkins (2009:253) the aim of curriculum development, regardless of level, is to make a difference to enable students to attain the aim of education. Moreover, the essential part of curriculum development is to bring into reality anticipated changes. However, people who are responsible for the development of curriculum should ask themselves the following questions: what happens when change occurs? What are the roles and values of change? What really motivates people to change and what are the consequences of change to students and the general society? (Ornstein & Hunkins, 2009:253). Moreover, change needs to be understood. Ornstein & Hunkins (2009:253) further argue that even if people do have all that has been mentioned above, they cannot predict how successful the change activities will look like in those who are part of the change and those who experience change, who are most likely to be the learners.

As a result of OBE, the curriculum in South Africa was always faced with many challenges that started way back during the apartheid education period. The implementation of outcomes based education was faced with many problems which prompted a review in 2000, which led to the first curriculum revision i.e. Revised National Curriculum Statement. The implementation challenges continued until the current Minister of Education, Angie Motshekga, decided to call a committee that would work on the revision of the Revised National Curriculum Statement in 2009 (Department of education, 2011:4).
The aim of implementing the new changes was to identify the challenges and pressure points that impacted negatively on the quality of teaching in schools and to propose other strategies that could address the problems. (Department of Education, 2011:4). All these changes came because of many challenges facing curriculum developers and implementers counting from way back in the history of curriculum development in South Africa and around the World. The task team appointed by the Minister of Education the new policy called Curriculum and Assessment and Policy Statement (CAPS) to be implemented in grade R-3 and grade 10 in the year 2012 and grade 4-9 and 11 in 2013 and grade 12 in 2014.(DoE, 2011:6-7). However, their aim was not to completely eradicate the Revised National Curriculum Statement. They use the RNCS as a starting point by reducing what was not effective and putting what they think will address the challenges on curriculum implementation. (DoE, 2011:7).

The report given by the task team after the revision of the Revised National Curriculum Statement was that teachers were overloaded, confused, demotivated and underpinning. As a result they detailed a number of recommendations which are as follows:

- Producing one clear and accessible policy document.
- Writing a more streamlined curriculum.
- Going back to subjects and essential subjects knowledge.
- Standardising assessment.

(DoE, 2011:14):

The first things to be removed were all the OBE policy terminology, critical and development outcomes, assessment standards and learning outcomes which reappeared as the general aims and specific aims in the Curriculum and Assessment Policy Statement documents.

Looking specifically at the changes that took place in (CAPS) documents, one can anticipate a different impact of curriculum change in teaching and learning of science in schools. In the recent policy (CAPS) Curriculum and Assessment Policy Statement, the purpose of studying science is biased on the following taken from the DoE (2011:12-13)

- The development of science knowledge and understanding.
- The development of science process skills (scientific investigation).
- The development of an understanding of sciences’ role in society.

The purpose mentioned above relates to the three specific aims in life sciences. Learners are now expected to have knowledge of the subject content, to do practical work and
investigation and be able to apply life science knowledge to their everyday life (DoE, 2011:13).

The changes after 1994 faced many challenges which might have led the minister to appoint a ministerial task team to review the implementation of National Curriculum Statement in Grade R-12. The aim was to find out the challenges and pressure that impacted undesirably on quality of teaching in schools so that they can come up with mechanisms that could address the problems (Curriculum News, 2011:4). As a result, the minister of Basic Education, Angie Motshekga, announced the new policy, CAPS, to be implemented in 2012 in Grade 10 and Grade R-3 (Curriculum News, 2011:5).

Education in South Africa has always been faced with many challenges since the early years of apartheid until to date. The challenges include resistance, inadequate teachers’ knowledge and skills, educators’ development and training, resources, disparities between rural and urban schools and lack of support and monitoring. All these challenges might be the factors affecting adversely the teaching and learning of science in South Africa. Christie (1991:302) puts more emphasis on the inequalities of social class and differences between rural and urban schools pointing out that they still persist. Most schools in rural areas are still inadequately resourced as compared to schools in urban areas which enjoy abundance of learning resources and suitable infrastructure.

2.3. EFFECTS OF CURRICULUM CHANGE IN TEACHING AND LEARNING OF SCIENCE

2.3.1 Approaches behind the learning and teaching of science

Change can arouse emotions and despair; at the same time if taken positively it can raise hope, growth and progress. Jacobs, Vakalisa & Gawe (2004:314) point out that despite training that is meant to prepare teachers for changes in curriculum, teachers always show the sign of confusion and struggle to apply change in their classrooms. The adoption of new approach, OBE, has shifted the emphasis of learning and teaching away from rote learning to concrete educational results called outcomes (Jacob, Vakalisa & Gawe 2004:2) Furthermore, the roles of teachers as transmitters of knowledge changed to facilitators, to help learners
achieve the desired goals, and the classroom activities mainly focused on learner-centred approach (Chisholm, 2005:91).

There were many reasons why the education system was changed. One was based on the principles of OBE in South Africa. Killen (2000: vi-vii) states that South African education reforms were designed to encourage all the people to be lifelong learners who will be responsible and productive members of society. Schartz & Sadler (2007:989) note that the lessons with effective goals allow learners to continually evaluate the dynamic interaction between the goal, and their actions, and feedback. Without that, learners cannot identify ways to take action, evaluate their impact of their actions, or recognize their responsibility as learners.

Luehman and Barab (2003:455) point out that this shift in approaches involved curriculum and teaching strategies that embed content in rich inquiry contents through which learners appreciate content and those situations in which content has value. Weber (2007:37) states that under the banner of C2005 and OBE teachers were overloaded with unprecedented decision making authority and a lot of heightened expectations like outcomes-based teaching, more administrative work, integrated science which resulted in them not having time to have proper lesson preparation. Therefore teachers claimed that they were overloaded and overworked that they did not have the time to be more responsive to the C2005 intentions. Hart (2002:1239) argues that the curricular ideologies that have dominated science education for decades are undergoing significant challenges. From the look of things, curriculum in South Africa is faced with many challenges. This has resulted in South Africa continuously drafting new policies and approaches in teaching and learning in schools.

Yip (2001:760) states that it seems as if subjects still adhered to the transmission mode of science learning in their practice, despite the fact that teachers had acquired some notions about the constructivists’ instruction approach from the teaching course. It seems as if teachers’ lack of knowledge in their new approach and subject matter has impacted on the success of new approach in teaching and learning of science. Yip (2001:764) further argues that, many biology teachers do not possess an adequate understanding of the topics that they teach. As a result their lack of deep and coherent understanding of the subject matter may also limit their ability to design and use higher order thinking skills to probe students’ understanding needed by constructivist approach in teaching of science.
(Mc Combs & Whisler, 1997:166) stated that teachers need to be competent within the new curriculum, in order for them to be able to produce the required results. This might need commitment in developing necessary resources, knowledge and skills.

During the adoption of OBE in South Africa, science teaching and learning approaches were changed and the adoption of constructivist’s point of view was encouraged. This has highlighted the impact of learners’ preconception on the process of developing new knowledge and the need for an instructional strategy that encourages active conceptual change rather than the passive transmission of knowledge (Yip, 2001:755).

However, many teachers never shifted an inch from the old approach with a positivist point of view in teaching and learning of science in many schools in South Africa.

Although the positivist’s approach has received a lot of criticism by many researchers in the last few years, Minister Angie Motshega has recently announced the “back to basics” approach. She made an announcement on the development of new assessment policy called Curriculum and Assessment Policy Statement (CAPS) to be implemented in the beginning of 2012 academic year in some grades (Department of Education 2011:4). Rogan and Grayson (2003:1175) emphasize that in South Africa, there appears to be a tendency of ignoring existing differences and mandate complex and comprehensive changes in systems that may or may not be ready to cope with them. Furthermore, Wallace & Fleit (2005:188-189) point out that those factors affecting the success of curriculum reform include the inability of reform makers to accurately diagnose the problem or to accurately evaluate programmes before implementation. As a result they state that factors leading to successful reform in one situation may not necessarily apply to another.

2.3.2. Perceptions of teachers towards curriculum change in science

The aim of this section is to give a brief exploration of teachers’ perception toward curriculum change in science and how it impacted on the teaching and learning of science subjects in schools. The way teachers perceive curriculum change might be the reason curriculum change impacts negatively or positively on teaching and learning. Many teachers seem to be confused and lack understanding of what curriculum change in science is. As Wallace and Fleit (2005:192) note, teachers and administrators are faced with the degree to
which they choose to accept or reject change. Jackson (1992:206) points out that educators’ lack of clarity concerning innovation skills and knowledge, as well as the unavailability of required instructional materials reinforces their lack of motivation. This might be the cause of teachers’ resistance to change in curriculum innovation.

Pretorius (1999: v) points out that there are many teachers who consider themselves to be inadequately trained to work with OBE. Furthermore, Lyman et al. (2005:108) emphasize that the reality of teachers resistance to change has led significant amount of professional literature dealing with understanding of the curriculum change environment and the development of the effective strategies to achieve curriculum change.

However, Witz & Lee (2009:411) state that other teachers, especially biology (life sciences) and environmental science teachers tend to be more responsive to the fact that science is not anymore standing pure and separate from all involvements in society than the physics and chemistry teachers. Wits & Lee (2009:411) emphasize that to understand teachers’ attitudes and reaction more fully it may be helpful to examine the motives for involving students in actions.

The fact that teachers have to deal with many changes, with them not understanding what is expected from them and to use to make the change process succeed might be the cause of their resistance and negative attitudes towards the curriculum change endeavour. Wallace & Fleit (2005:191) state that acceptance dilemma happens when teachers have to deal with curriculum constraints such as texts, tests, and staffing as well as systemic constraints such as curriculum guidelines calling for particular methods of instructions or assessment. Therefore, there could be a considerable mismatch between “what is said and what is done” in schools.

Furthermore, teachers still need to face challenges of adapting with the local environment and some constraints that hinder their progress to implement the changing curriculum needs. Barab & Lechmann (2002:463) state that while teachers are still adapting with the curriculum to meet the local needs, they were doing so under more challenging constraints for example, larger classes, difficult behaviour and higher profile accountability. This led to local adaptation that resulted in less reform type classroom instruction. As a result, this might be the cause of teachers’ frustration and negative attitudes toward curriculum change.

Teachers are still struggling with the sudden changes of policies and approaches in the curriculum, and are still facing challenges on whether to adopt or resist the new changes.
while facing those challenges. The minister of education has already established the new policy called curriculum and assessment policy statement (CAPS), which is already implemented in some of the grades in 2012. The fact that teachers are expected to implement one change after another in curriculum might be the cause of their attitudes toward curriculum reforms which lead them to resistance in knowledge and skills. Hargreaves (1995) in Bantwini (2009:179) argues that when teachers are exposed to or trained in new knowledge and skills they often resist or reject the new knowledge and skills. They sometimes select what they want and delay acceptance of new reforms until other innovations supersede them.

2.3.3 The effect of curriculum change on teacher development and training

The shift in approaches in science has influenced the impact of curriculum change on teacher development and training. Schartz & Saddler (2007:988) argue that in the face of any end result, and what students can accomplish is influenced by their growth developmentally and the degree of environmental support they receive. As a result, when teachers and learners are differentially empowered, it always impacts on their teaching and learning. For instance, teachers acquired their knowledge from training institutions that did not teach the skills and knowledge which are being advanced by the curriculum reforms. This could be another hindrance that makes teachers unable to implement the changes in curriculum.

Rogoff, 1990 & Vygotsky 1998 in Schartz and Sadler (2007:991) emphasize that teaching and learning require support and scaffolding to ensure that teachers and learners operate at their optimal skills levels. This means that teachers’ different learning styles and needs must be given serious attention. As a result, this will enable teachers to internalize the use of various approaches and pedagogical knowledge in their teaching practice (Bantwini; 2009:179). Furthermore, Bantwini (2009:179) emphasizes that good learning opportunities for teaching build on their current science knowledge, skills and attitudes. However, Rogan and Grayson (2005:1176) Bantwini (2009:178) and Lekgoathi (2010:109) caution about teachers’ training and lack of pedagogical content knowledge and deficiency in the use of various instructional approaches and knowledge and that these problems still persist in our schools.
Furthermore, Sharp et al. (2009:250) points out to the fact that many teachers possess neither the subject knowledge nor pedagogical content knowledge required to implement the science curriculum effectively, therefore a clear understanding of policy and practice is needed. Bantwini (2009:176) states that at various levels, teachers are needed who possess different science content knowledge, levels of teaching experience and science teaching qualifications. Witz & Lee (2009:427) emphasize that it is necessary that teachers’ intellectual experience of the power of the discipline and their higher vision of science, to the extent they do figure in their lives, should be taken into account in both in-service and service teacher education.

Furthermore, Khishfe & Lederman (2007:939) and Bantwini (2009:169) argue that there must be a good understanding and common goals to all recent reform movements in science and successful Continued Professional Development (CPD) model which addresses both the internal and external factors. This will result on achievement on scientific literacy. This cannot be ignored as there is mounting evidence that curricular ideologies that have dominated science education for decades are undergoing significant challenges. (Hart; 2002:1239) taking into consideration the development of teachers to suite the changes in curriculum might be a stepping stone to the success of curriculum implementation of sciences.

However, UK Government tried to raise standards of teacher’s science subjects’ knowledge in both pre-service and in-service teacher education to improve science teaching in schools (Parker; 2006:1545). Moreover, Parker (2006:1546) emphasized that this development need trainees develop not only relevant personal knowledge of how to translate and represent this knowledge effectively in classroom practice. It is suggested that teachers need support and encouragement to take responsibility for their own learning and professional development (McCombs and Whistler: 1997:161)

Sharp et al. (2009:247) in a research done in the (UK) indicated that the successive revisions of the national primary science curriculum have brought about many changes, each impacting on the primary profession in different ways and reflecting the political and educational landscapes of the day. Parker (2006:1548) argues that the programmes of development should serve the dual purpose by supporting students in developing personal knowledge of science and the pedagogical knowledge appropriate to effective translation in teaching.
Research done by Black (2002:113) indicates that not all educators who receive professional development and support in maths and science have gained experience that caused them to change their practice.

2.3.4. Monitoring and support on curriculum change

Education system of South Africa has undergone major changes since 1994; this gives a reason for advisory service offered by advisors to drastically change to match the curriculum reform. Positive support offered to teachers could bring about positive results during this curriculum change (Grobler, 2003:34)

Lovat and Smith (2003:195) emphasize that, at times of change even the well-adjusted individual or cohesive family or organization will require extra support. This means that despite the fact that teachers have had their theoretical training they are often confused when faced with fast changes in their classrooms (Jacobs, Vakalisa & Gawe, 2004:314)

McCombs & Whistler (1997:166) argue that effective change requires commitment to developing necessary resources, including indispensable knowledge, skills and training. However, it is the quality of teachers, principals and supervisors knowledge, background and progressiveness that will guarantee success in the new dispensation of curriculum reforms (Plek, 1991:13-131)

This means that people who are supposed to monitor and support change in curriculum should be of more qualified. For curriculum advisors to be able to give enough support to teachers and learners, they must acquire knowledge of science. However, Witz & Lee (2009:409) note that these changes include widening scientific literacy as an educational goal, advocating familiarity of both learners and teachers of the nature of science and encouraging science, technology and society. Moreover, Witz & Lee (2009:427) also emphasize that teachers’ intellectual power of discipline and their higher vision of science should be considered in both in-service and pre-service teacher education. This may help science teachers to enhance their classroom and educational practice in school. However, Rogan and Grayson (2003:1187) emphasize that change has to be realistically planned and subsequently monitored. Those who are in charge of change should be supported in a variety of ways. Rogan & Grayson (2003:1179) argue further that there is no point in running
workshops for teachers on laboratory work if their schools have no equipment and even laboratory to perform the practicals. They go on to state that building capacity without linking it to implementation might yield fruitless undesirable outcome. Rogan and Grayson (2003:1196) stress that in order for capacity to support innovation, there is a need to plan to spend time and resources in the development of capacity in situations where it is lacking. Wallace & Fleit (2005:188-199) cite factors affecting the success of curriculum reform makers to accurately diagnose the systemic problems or correctly evaluate programmes before implementation, as factors leading to successful reform in one situation may not necessarily apply to another.

2.4. Factors inhibiting science curriculum implementation in schools

Effective change requires commitment to developing necessary capacity to support changes. These include necessary resources, indispensable knowledge and skills and the ability to identify differences or disparities between schools that can effect changes.

Bantwini (2009:169) and Rogan & Grayson (2003:1179) argue that well designed new curriculum failed because of ignorance on the implementation part and more focus has been put on the desired educational change only. Furthermore, Sayed and Jansen (2001:180-182) point out the fact that some head teachers have welcomed the changes, but they lack capacity to lead the transformation.

Green et al (2005:108) argue that it is necessary to understand change environment and the degree of resources available to support the change effort. However, Jansen (1999:59) emphasizes that curriculum development as a long term development needs rearrangement of content including text book revision. At this point in schools, the new policy (CAPS) is expected to have started in grade ten (10). From my own experience some content have been removed and replaced by other content and there is no single text book available for learners at the beginning of the academic year.

Rogan and Grayson (2003:1174-1175) state that there is a big range in the quality of schools in South Africa, and there is also a big range in the skills and knowledge of teachers. This problem is claimed to be particularly serious when it comes to mathematics and science teachers. A number of teachers seem to have no formal training in the subject they teach i.e. mathematics and science.
Sharp et al (2009:250) indicate that factors that impact in science teaching are that teachers lack subject knowledge, science-specific curricular expertise and confidence to teach. They further indicate that large classes and lack of access to trained classroom assistance might be another factor that hinders the success of teaching science in schools. Moreover, Yip (2001:768) notes that inadequate subject matter knowledge and understanding of nature science may lead to teachers’ inability to appreciate the learning problems faced by learners or to design questions and activities that can probe learners’ understanding.

Parker (2006:1547) indicates that it is important for teachers to distinguish between knowledge and understanding as development of meaningful explanation and more demanding cognitive challenge than knowing about science fact and theories only.

However, Keddie (2008:184) emphasizes that much work needs to be done in terms of examining the attitude and knowledge of teachers with respect to citizenship and citizenship education. This will give a more comprehensive understanding of how citizenship teachers might be better supported to translate their knowledge into practice.

Based on the research done in South Africa, Bantwini (2009:178) says that despite the reforms in place, most teachers lack adequate pedagogical content knowledge, lesson planning and are deficient in the use of various instructional approaches and assessment approaches. Therefore it is crucial to address the issues identified because of their direct and severe impact on teacher quality and performance and eventually on learners’ science learning.

Rogan and Grayson (2003:1178) also emphasize that more work needs to be done on implementation issues in South Africa in order to make curriculum impact on its intended way in school. They also claim that the whole process of the implementation of C2005 was hopelessly underestimated and inadequately resourced and supported.
2.4.1. Disparities between previously disadvantaged and advantaged schools

New Government in South Africa introduced curriculum 2005 as a way of overcoming inequalities of the past and preparing its citizens for participation in democracy. (Rogan and Grayson, 2003:1173). However, most schools in South Africa are still suffering the inequalities when it comes to provision of resources. Therefore, Rogan and Grayson (2003:1174) note that it is necessary for the theory of implementation to take diversity of schools into account. Moreover Sharp et al. (2009:249) point out that they have found out that the implementation of requirement varies widely from class to class and school to school. This means that the needs for previously disadvantaged schools cannot be the same when compared to previously advantaged schools. More on that Dean (1998:45) states that schools in previously disadvantaged areas are still faced with acute shortage of resources, overcrowded classrooms and demoralised and under trained teachers.

Furthermore, Rogan and Grayson (2003:1174) note that in South Africa schools differ in terms of quality, knowledge and skills of teachers when it comes to mathematics and science. Furthermore, Rogan and Grayson (2003:1175) argue that since some schools have far much better resources than others, including both physical and human, they are better placed to take advantage of the benefit of the new curriculum in South Africa. Furthermore, Rogan and Grayson (2003:1175 point out that that there is a tendency in South Africa of not taking into consideration the existing diversity of schools and mandate complex and comprehensive changes in systems that may or may not be ready to cope with them. Therefore, many schools seem to be having difficulties when it comes to the implementation of curriculum reform because they do not have capacity that can support all the changes in the curriculum. The main problem with the C2005 is that its implementation was based on the assumption that all schools are the same and will therefore benefit from the same kind of in-service training and strategies. This might be the increase of disparities in the effect of curriculum change in many schools in South Africa.

Rogan and Grayson (2003:1186) in the theory of implementation states that the construct capacity to support innovation is an attempt to understand and elaborate on the factors that can support or inhibit the implementation of new ideas and practices in a system such as a school. Therefore, it is necessary to recognize that not all the schools have the capacity to implement changes to the same extent.
2.5. Comparative impact of curriculum change between South Africa and other Countries

It is prevalent in most countries that curriculum change has consequential impact in teaching and learning. Sharp et al. (2009:247) state that the successive revision of national primary science in England and Wales has brought about many changes, each impacting on different ways, and each impacting in different ways.

This part of the study is going to check and provides balance on how curriculum changes impacted teaching and learning in other countries. This analogy might help South Africa to use other countries as a barometer to gauge curriculum success and failures, so that we may not repeat problems and mistakes suffered by those countries.

Although the capacity of schools in the (UK) seems to be in good state to conduct and deliver science curriculum, it seems as if there are certain challenges and inhibiting factors that still need careful consideration (Sharp et al., 2009:248). It is stated that factors like teachers’ knowledge and expertise, appropriate teaching resources; unplanned nature of in-service training and disparities according to place or region is a major concern that needs special scrutiny and understanding (Sharp et al., 2009:250).

These inhibiting factors are similar to the ones faced by South Africa when it comes to the implementation of curriculum in schools. It looks as if factors that hinder the success of the curriculum change are common in various countries, although there might be differences on how those factors seriously influence the impact of teaching and learning of science subjects. Besides all the challenges, the UK seems to have enjoyed scientific enquiry as the element of teaching (Sharp et al., 2009:255). However, teachers lack of knowledge and skills led them to use different strategies that they can cope with and end up limiting effects on teaching and learning of children in schools (Sharp et al., 2009:249-250).

In the context of South Africa, the disparities between areas exist as well as in England, especially when it comes to the provision of support. Furthermore, Sharp et al. (2009:260) points out the fact that perception among teachers and coordinators on how well schools are prepared to implement and deliver science from one area to another were unexpected and problematic in education system striving to achieve positive results (Sharp et al., 2009:260).
However, the introduction of national curriculum for science in the United Kingdom is driven by the government to focus on raising standards of teacher, science subject knowledge in both in-service and pre-service training to improve science teaching in schools. This enforced them to place subject knowledge related to specific curriculum area at the core of effective teaching (Parker, 2006:1545-1546).

The curriculum designers in South Africa seem to be focusing mainly on the desired results of the curriculum and unmindful about the how part of its implementation. Core problems that manifested in the curriculum change seem to have been overlooked. This might be the reason curriculum in South Africa is still faced with many unresolved problems that are causing curriculum changes impact undesirably in teaching and learning. Fleit & Wallace (2005:188-189) argue that the inability of reform makers to accurately diagnose the systemic problems or to correctly evaluate programmes before implementation affect the success of curriculum.

Hopkins and Mac Gilchrist (1989) in Rogan & Grayson (2003:1175) while writing about schools in the UK, they opted for differentiated approach to implementation and professional development. In their writings they suggested the three tier approach. Their type one strategy was aimed at helping low-performing schools achieve some measure of success and goals that are within their reach. The moderately successful schools will be helped to improve in areas where they are already competent. The schools at some level of existence were aimed at helping them to introduce sophisticated teaching and learning methods of the kind that would characterize (C2005) at its best.

These strategies might have helped the UK in solving the problems of disparities in schools. However, most schools are still face problems of being able to handle the complexities of curriculum change in the some level based on their capacity and areas in which they are found. These might be the gaps that influence differences in the impact of curriculum changes schools in South Africa. Rogan & Grayson (2003:1175) pointed to the fact that South Africa seems to have the tendency of ignoring existing diversity and mandate complex and comprehensive changes in systems that may or may not be ready to cope with them. This is said to have created a considerable gap between what is intended and what is feasible. Therefore Rogan & Grayson (2003:1175) say that it is clear that implementation must take context of a particular place, its teachers, pupils, leadership and environment on account. However, Chisholm (2005:87) notes that the review committee also proposed that attention
be paid to implementation weaknesses related to adequate resourcing, manageable time frames for implementation and regular monitoring and review.

The challenges of the new curriculum in mathematics in the Netherlands demand teachers to attain new skills in order to match the needs of the new curriculum reform. Therefore, more effort was needed in the Netherlands to introduce all mathematics teachers to the new curriculum (Vos & Bos, 2005:201).

To ensure that curriculum process is moving smoothly, researchers opted to use what they call curricular alignments. They monitored the process on whether there is an alignment between the intended curriculum, the implemented curriculum and the attained curriculum. During the process they decided to use the comparison between countries and they have chosen Belgium as the benchmark country. They also match between subjects where they have chosen science subjects to measure whether there is curricular alignment. The system seemed successful as it enabled differentiation at all three levels and the results were acceptable (Vos & Bos, 2005:203). This means that serious attention needs to be given to people who are supposed to monitor and support changes in curriculum.

In South Africa, shortage of skills and high knowledge by the people who are supposed to monitor and support curriculum change is a problem that needs serious attention when planning to make some changes in a curriculum. Plek (1991:130-131) argues that it is the quality of teachers, principals and supervisors knowledge, background and progressiveness that can guarantee success in the new dispensation of curriculum reforms. Therefore, Rogan and Grayson (2003:1173) emphasize that much work needs to be done in development of implementation theories that can act as a guide for school-based practitioners, in-service training provides or change agents as well as policy makers in South Africa and other developing Countries.

2.6. Understanding changes in science curriculum

It is important to understand changes before developing or altering any curriculum reforms. Understanding changes might help curriculum development to identify problems that can hinder the success of the implementation of curriculum in time before undergoing many implications in the process of implementing the desired curriculum. In South Africa, it seems
as if many curriculum developers have overlooked many hindrances of curriculum, which might be the reason why the curriculum is not reaching the goals that we have expected during the development of the new curriculum reform.

Fleit and Wallace (2005:188-189) point to the fact that factors impacting the success of curriculum reform include the inability of reform makers to accurately diagnose the systemic problems or correctly evaluate programmes before implementation. The inability to evaluate the process of curriculum implementation by curriculum developers might have caused South Africa a lot of money, like printing of new curriculum materials that have not been in use in most schools. Rogan and Grayson (2003:1172) state that a great deal of time, money and effort may be wasted, as good ideas are never translated into classroom reality in South Africa. Rogan and Grayson (2003:1179) also provide that policy makers and politicians focused on desired curriculum change and neglected how the curriculum can be implemented. However, several authors like Lyman et al. (2005:108) argue that it is necessary to understand curriculum change environment before initiating any curriculum change activity.

2.6.1. Importance of understanding the theories behind science curriculum change

According to Stears (2009:398) the introduction of curriculum 2005 as a single national curriculum has encouraged the use of different approaches in education. Constructivism as a science theory has been widely used by many curriculum developers in the world. As a result, constructivism as a learning theory has also been widely accepted throughout the science education research as an alternative to a behaviourist point of view that learning is the absorption and reproduction of knowledge. However, the new policy) curriculum and assessment policy statements (CAPS aims to replace what appeared not to be working in the Revised National Curriculum policy (Curriculum News, 2011:14). This has broken the talk that teaching and learning practice is ‘going back to basics’. The reality is that CAPS policy has already been implemented in some of the grades in schools in South Africa. What is not known is whether teachers got enough training to understand what they are expected to do to implement the new changes.
In most cases people who are involved in curriculum development and reform seem to overlook how far curriculum change can impact the process of teaching and learning. There are some factors that hinder the success of curriculum change that has been overlooked by the curriculum developers in South Africa. Factors like availability of skills, knowledge, resources, and the capacity to support change seem to have been overlooked. Therefore, understanding the theories behind curriculum change in science might influence curriculum reformers to develop the programmes that can examine the success of new innovation in curriculum. However, Rogan and Grayson (2003:1187) state that change is a learning process which need willingness to try out new ideas and practices, to improvise and exposed to uncertainty.

Fullan (2006:3) says that change theory or knowledge can be very powerful in informing education change strategies and in turn, getting results, but only in the hands of people who have a deep understanding of dynamics of how the factors in question operate to get quality. Bantwini (2009:169) further argues that successful model should address both internal and external factors that influence peoples’ understanding of new reforms and their new practice.

According to Khishfe and Lederman (2007:939) in a research done in the United States of America note that common goals to all recent change movements in science education are to achieve scientific literacy. They further emphasize that the central goal is to help learners understand nature of science. However, constructivism is viewed as a learning theory in science that is integral to the new curriculum policies and the one that generates meaningful learning in science during the implementation of curriculum C2005.

There are factors that are very important in the implementation of new curriculum that need to be given interest. Many researchers have overlooked the fact that lack of resources can hinder the success of curriculum implementation. If the school does not have necessary equipment, skills and strong management, it can be difficult for schools to implement change. Most schools are without laboratories and skilled science teachers, especially in rural areas. Developing the model that can test whether a school has capacity to implement innovation might be a good idea. Rogan and Grayson (2003:1187-1188) have tried to create a profile of four factors. In each case, an increase in level indicates a greater capacity to support innovation. These types of models are very helpful as they can be the possible indicators of whether the developed curriculum is successfully implemented or not. They might also inform the curriculum developers of what factors need to be considered and how those factors
are impacting on the implementation of a newly developed curriculum. Furthermore, Atasoy, Akkus and Kadayifci (2009:268) point to the fact that when the reasons for alternative conceptions in different science subjects have been examined, it was found out that the environment, language, classroom materials, textbooks, students’ attitudes to the subject matter, incompatibility of teaching approaches with student learning styles and the fact that students are at levels of concrete thinking while the subjects presented are abstract might be some of the causes of alternative conceptions. Therefore, it might be necessary to take into consideration the conceptual change model.

2.6.2. Understanding nature of changes in science curriculum

In South Africa it might be of great importance for curriculum developers and curriculum implementers to understand the nature of changes in science. It seems as if most curriculum changes are implemented without deeper understanding about what learning and teaching really means and the specific circumstances and strategies that are likely to promote it. Changes are not just processes or sequences of events. Changes might involve interaction of various phases like teachers’ knowledge and understanding on the use of newly revised materials, teaching approaches, curriculum, teaching and learning practices of that reform. It is necessary that teachers have information about nature of changes as well as the understanding of the requirements of the new curriculum reform. However, Witz & Lee (2009:409) point out that changes include broadening of scientific literacy as an educational goal that advocates familiarity of both students and teachers with the nature of science and encourage integration in science, technology and society as a classroom approach. Witz & Lee (2009:411) also note that biology or life sciences and environmental science teachers are the one who tend to be more understanding that science is no longer standing pure and separate from all involvements in society than physics and chemistry teachers. Therefore, most science teachers still use the traditional view of science, that visioning science as pure knowledge; this might be the cause of impact on understanding of what science really is by science teachers and learners (Witz & Lee, 2009:416).

Most teachers still have positivist point of view and some of them seem to have not moved from that view point in their teaching practice. Teachers’ resistance and unwillingness to understand new approaches might have impacted curriculum implementation in schools. Lekgoathi (2010:120) also notes that new curriculum defines the role of the teacher as a facilitator of learning, one who has clear understanding of the outcomes of the lesson and
assessment criteria. However, the DoE has not provided enough support at local or District level or give adequate retraining of teachers to carry out their new responsibilities adequately. Van Driel et al. (2008:109) argue that student questions of why they are learning science can be answered by student understanding that science can be identified as:

- Cumulative knowledge.
- Reliable and valid knowledge.
- That science functions as a discipline.
- Science plays roles in decisions which are socially relevant.
- Understanding one’s own way of explaining events in terms of personal and cultural (including scientific) influences.
- Using science to understand both technology and everyday occurrences.

### 2.7. CONCLUSION

In this chapter the research has indicated the issues surrounding curriculum change and their impact on teaching and learning of science in schools. The chapter started by discussing the historical background of curriculum change in South Africa, starting from way back during the Bantu Education era, peoples education and education system after 1994 until to date. The literature review mainly focused on the impact of curriculum change in teaching and learning of science subjects. It revealed the theories and approaches behind teaching and learning of science and why it is important to understand the theory behind. Curriculum change in science it also highlighted the importance of understanding the nature of changes in science curriculum. The literature has also revealed how curriculum change impacted teachers’ development and monitoring and support by curriculum advisors. In the factors that hinder the success of curriculum change, the literature focused mainly on the shortage of learning and teaching resources and the disparities between schools in rural and urban areas. The provision of learning and teaching resources and how they impact on the implementation of curriculum reform were discussed. The chapter also discussed how shortage of skills and knowledge in science can impact teaching and learning. In this chapter the researcher has also indicated a comparative view on how curriculum changes impact teaching in learning in other countries. This has highlighted the fact that problems surrounding curriculum implementation are affecting most countries around the globe.
The attitudes and perceptions of teachers towards curriculum change have also been discussed. The researcher has highlighted the problems surrounding this new policy change as these problems have always haunted the implementation of various curriculum policies in education in South Africa. According to the reviewed literature in this chapter, it seems as if the impact of curriculum change in teaching and learning is a serious problem that needs serious intervention. Research methodology, research design, subject of the study, conceptualization and measurement will be presented and analysed in chapter three of the study.
CHAPTER 3: RESEARCH METHODOLOGY

3. Research Methods

3.1 Introduction

The Literature reviewed in the previous chapter revealed the historical background of curriculum changes in South Africa and how the changes in curriculum impacted teaching and learning in schools. The researcher also outlined from the reviewed literature, the comparative impact of curriculum changes, comparing South Africa with other countries. Literature reviewed identified various impacts that are caused by the changes in curriculum when it comes to teaching and learning. The aforementioned impact by the curriculum changes lent impetus to the researchers to investigate how changes in curriculum affect teaching and learning of science subjects in many schools in South Africa. This study was conducted in the form of case study and aimed at investigating the impact of curriculum change in the teaching and learning of science. This research might close the gaps that have been revealed in the reviewed literature. It might also help the researcher and the curriculum developer understand how changes in curriculum impact teaching and learning in a real situation.

In this section, the researcher will discuss and justify the research strategy, site and sample procedures, and data collection framework for data analysis and limitations and potential of the adopted approach of this study. In addition the ethical consideration of the study will be discussed.

3.2 Research Strategy

In this study the researcher was interested in an in-depth study with a real school environment. The researcher’s aim is to investigate the impact of the curriculum changes in teaching and learning of science. This study was conducted in the form of a case study that aimed in under-resourced schools in Vhembe District under the jurisdiction of Sibasa circuit. The research focused on six schools. The research looked at how teachers, learners and principals view and perceive the changes in curriculum when it comes to teaching and learning. The researcher collected information from other experts who are related to the school. This helped the researcher to obtain different stakeholders’ perspectives and views to aim a deeper understanding in this case in a broader setting.
The research’s purpose and objective is to study about the impact of curriculum changes in teaching and learning of science in schools. It investigated how the new curriculum policies are implemented and what effects they are making in teaching and learning of science in schools. The researcher realized that the case study will be the best approach for the topic and purpose of the study. According to John & Rule & (2011:134) case studies may be useful in relation to policy in a number of ways and they may contribute to developing policy by identifying problems that need to be addressed. This can be done by investigating best practice and making policy recommendation based on the findings. Therefore, case study can also contribute to the assessment of how policies are implemented.

The researcher realized that the historical research strategy might not be appropriate for this study as according to Biggam (2011:2750) the strategy is normally related to looking at non-contemporary phenomena, which is not the case in this research as it is interested in a contemporary phenomenon. Furthermore, the survey based research cannot address the aim of the researcher of wanting to get in-depth information from different stakeholders and observation of the school and real activities taking place in the school. The researcher wanted to study the school in its natural setting. The researcher’s reason on this was to probe deeper information from the participants.

This has given the nature of this study to be a case study. In this case the qualitative method was employed as a research method. According to Cohen and Manion (1995:106) in Biggam (2011:276) “case-study researcher typically observes the characteristics of an individual unit—a child, a class, a school or a community. The purpose of such observation is to probe deeply and analyse intensively the multifarious phenomena that constitute the life cycle of the unit.”

Although case study is described in Biggam (2011:277) as the in-depth study of a phenomena and time consuming undertaking, the researcher has decided to use it for the sake of triggering deep information from the participants on how they view the impact of changes and how these changes affect them with special reference to science teachers and learners. The researcher also wanted to relate what was discovered in the literature review cases with the findings of this case study to make sure that the case study meets the main aim of the study.

The researcher repeated the interview sessions for several times in order to get the generalizability of the study, because case studies have always been criticized as not being good enough to arrive at generalization as they focus on a single case. However, Biggam
(2011:179) concluded that generalization can also be reached in case study through repeated study of the case. For these reasons the researcher will visit the schools several times to reach the generalizability of the study so that it will be easy for the researcher to generalize how changes in curriculum are affecting teaching and learning in schools. The study will take place in six schools in Sibasa Circuit as they are in the same vicinity and experiencing the same condition of being under-resourced.

### 3.3. Ethical Considerations

Rule & John (2011:111) note that the key aspects of the quality of research are the ethical relationships and its practices. Therefore, conducting research in an ethical sound manner enhances the quality and trustworthiness of the research. That is the reason the researcher has applied for ethical clearance before the research began. Therefore it is the responsibility of the researcher to inform the participants about their rights. The participants have the right to privacy and confidentiality, as a result the researcher must assure the respondents that the information they provide to the researcher will be treated with confidentiality and make assurance on privacy (Babbie, 2001:473).

Referring to the aforementioned ethical requirements, the researcher wrote a letter asking for permission to the District office to be allowed to conduct research in six of the under-resourced schools which are in Sibasa Circuit in Vhembe District. Consent to conduct the case study was granted. The researcher also wrote an informed consent form for learners, to inform them about the process of the research and to ask for their permission to include them in the case study.

Babbie (2001:471) states that the ethical norms of voluntary participation and no harm to participants should be formalized in the concepts of informed consent. Therefore, the researcher will remind the participants about the rights to privacy and confidentiality of the information that they will provide and their names will remain anonymous if they do not want their names to be mentioned and the researcher is ready not use their real names.

According to Tuckmans (1994:14) and Babbie (2001:472) the researcher must guarantees confidentiality, more especially when dealing with interview sessions with the participants. As a result, all the participants have the right to remain
anonymous, which is their right to insist of their individual identities not to be salient features of the study. As a result the participants were made aware of the purpose of the study. They were also informed about their right to anonymity and that they could stop participating if they wanted. The issued consent form to the participants appears in the last pages together with the letter asking for permission and acceptance letter to conduct the investigation in Vhembe District (Sibasa Circuit).

3.4. Sampling Procedures

According to Gay (1992:123) sampling is described as a process of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which were selected and it is part of the population from which it is selected. Furthermore, Gay (1992:123) emphasises that it is important for a researcher to select a sample because the goodness of the sample determines the generalizability of the results.

The researcher used purposive sampling to select the site and the people that are supposed to be involved in the case. As this is a case study, it was in the researcher’s interest to choose six schools from all the ten schools in the circuit as it was not possible for a case study researcher to consult all the schools. The researcher also decided to choose two (2) science teachers from each school who teach grade 10 and chose two (2) per school. This brought the number of teachers involved in the study to twelve (12). The researcher provided questionnaires for both of them so that they could give their own perspectives and perceptions on the impact of curriculum changes in teaching and learning of science. The questionnaires were planned to probe teacher’s attitude and feeling towards the changes in curriculum. The researcher decided to observe teachers and learners activities in all the six classes together with the whole school infrastructure putting more emphasis in laboratory condition where learners conduct their experiments to see how the conditions might be influencing the way changes in curriculum affect teaching and learning in the schools. The researcher used observation checklist and video tape to collect the data which later were transcribed verbatim.

The researcher also used open-ended interview questions to interview the school principals, and the subject advisors’ related to the school. As this is a case study using qualitative method, the researcher had to choose people who could shed most light or different light on the impact of curriculum change in teaching and learning. The participants were chosen
because of their suitability in advancing the purpose of this case study using purposive sampling. The researcher decided not to use random sampling because according to John & Rule (2011:64) random sampling allows researchers to make generalizability from the sample to the entire population which the sample represents. However, a case study researcher by contrast is not mostly interested in representativeness of the sample, but in its ability to generate data which allow for full, in-depth and trustworthy account of the case. Therefore the researcher selected science teachers and science subject advisors because of their relevant knowledge, interest and experience in relation to the case. The researcher chose the aforementioned people because they are the primary role players in the implementation of changes in curriculum as this has been revealed by the literature reviewed in the study. The participants were chosen, hoping that they will give a clear picture of what is happening in the process of curriculum implementation in schools. The observation of the activities and school might be helpful as many literatures reviewed indicated that resources are the main factors in the implementation of curriculum changes.

3.5. Data Collection

3.5.1. Data collection techniques

According to Biggam (2011:286) selecting techniques by which data are to be collected is just as important as choosing an appropriate research strategy. This research aim is to collect data in the form of a case study and employ the qualitative method as data collection technique. This study used semi-structured interviews, open-ended questionnaire and observation as data collection techniques. O’Leary (2004:150) remarks that collecting credible data is a tough task and there is no technique that we can say is better than the other. As a result, the technique used depended upon the research goals and the advantages and disadvantages of each method. The nature of the study compelled the researcher to choose three data collection techniques aforementioned with the aim of obtaining deeper perspectives from the participants on the impact of changes in curriculum as this is the main objective of the case study. According to O’Leary (2004:162) the researcher has to know and select the right method for addressing the needs of the research question, therefore, the researcher has to make a decision and choose the correct method for that study. However, each data collection technique has its own complexities and demands.
3.5.2. INTERVIEWS

The researcher avoided to use structured interview because the research is of qualitative nature and there is a need to probe deep information which might not be the case with structured interview. According to Bryman (2001:118) probing can be a problem area for structured interview. Respondents may not understand the question and unable to answer it or the respondents may not have received sufficient information to answer the question. The selected techniques are going to be discussed in the following paragraph.

According to John & Rule (2011:64) and Biggam (2011:281) interview has long been the most popular method in qualitative research and is often used in the case studies. For the benefit of this case study, the researcher decided to use the interview to collect data from the principals and the learning area subject advisors. The researcher has seen the interview as the appropriate means of collecting qualitative data semi-structured interview questions were designed to give participants the chance to express themselves freely without strict limitations. However, the main aim of the researcher was to design the interview questions that would probe deeper information from the participants to cover the main research objectives. As such, interview was one of the research techniques that the study mostly relied on.

Biggam (2011:28) believes that interviews are essential source of case study information as most case studies are human affairs and can provide insights into a complex situation. Although this technique is time consuming, the researcher tried to put more focus in it to give participants the chance of giving their own views and perspectives on the main objectives which is the impact of curriculum change in teaching and learning of science. The interview questions also probed the information related to the main objective e.g. the attitude and perceptions toward changes in curriculum. Gay (1992:232) describe interview as the purposive interaction between two or more persons, with one trying to obtain information from the other. However, it has been asserted that interview permit researchers to obtain information that cannot be obtained from observations, that is participants’ emotions. The researcher also used semi-structured interview questions probing to clarify and extend the respondents’ comments. Insights tact and timing were used to make the interview process a success. The researcher interviewed the participants and recorded data at the same time which later provided the researcher with a verbatim account of the interview.
However, interviews do have a number of unique advantages and disadvantages, but Gay (1992:231) points out that when well conducted, it can produce in-depth data that are not possible with questionnaire. That is why the researcher has decided to use all three data collection techniques to probe deeper information from the participants.

### 3.5.2.1. Advantages of the interview

The researcher decided to use interview as data collection gathering technique because of the following advantages mentioned by Gay (1992:231):

- The interview is most appropriate for asking questions which cannot effectively be structured into a multiple-choice format, such as questions of a personal nature.
- The interview is flexible and the interviewer can adjust the questions to suit the situation.
- By establishing rapport and trust relationships, the researcher can often obtain information that participants would provide on a questionnaire.
- The interview may also result in more accurate and honest responses, since the interviewer can explain and clarify both the purpose of the research and individual questions.
- An interview can follow-up on incomplete or unclear response by asking additional probing questions.

As a result, it was imperative for the researcher to use interview because she was able to probe more valid information about the respondents' attitudes, values and their opinion which she could have not manage to get with any other method. Another advantage is its flexibility. The interviewer was able to adjust questions to get valid information. Moreover, the atmosphere allows the respondents to be open and honest unlike in the questionnaires where he/she can just feel the questions just to let it go.

### 3.5.2.2. Disadvantages

However, interviews also have number of disadvantages according to Bailey (1994:175):

- Interview can be extremely costly.
- Interview is lengthy and time consuming.
- Interview can be biased.
- The interview offers less assurance of anonymity than mailed questionnaire.
- It has got less standardized question wording.
- Lack of accessibility to respondents, if the respondents are busy, it won’t be easy to access them for interview.

Another factor that encourages the researcher to use semi-structured interview is that they are non-standardized and they are mostly used in qualitative analysis. The researcher is free to ask follow-up questions to get rich information from the participants and in return the participants are free to expand their answers without any limitations. Corbetta (2003:270) explains semi-structured interview as follows:

The orders in which the various topics are dealt with the wording of the questions are left to the interviewer’s discretion. Within each topic, the interviewer is free to conduct the conversation as he/she thinks fit, to ask the questions he/she deems appropriate in the words he/she considers best. This was to give explanation and ask for clarification if the answer is not clear, to prompt the respondent to elucidate further if necessary and establish his/her own style of conversation.

### 3.5.2.3. Observation

According to Marshal & Rossman (2006:98) observation entails the systematic noting and recording of events, behaviours, and artefacts (objects) in the social setting chosen for study. The researcher has chosen to use observation because it suits the nature of the study, as it has already been mentioned that the study is going to be done in the form of a case study in the natural setting which is the school. The researcher has planned to observe the learners and educators’ activities inside the classroom to see if there is any impact made by the changes in curriculum in the process of teaching and learning. The researcher also observed the classroom setting to see if there was any factor that might be affecting the process of teaching and learning. The researcher used highly structured, detailed notation of behaviour structured by checklist to a more holistic description of events and behaviour as mentioned in (Marshal & Rossman; 2011:98). The researcher used naturalistic observation to gather information to supplement data that have been collected through interview and questionnaires.

The researcher first visited the schools just to check the surroundings and build a good relationship with the participants before the real observation occurred. At the end of the
observation period the researcher made sure that observation records which includes, completed observation checklist or schedules, detailed notes of what was observed, notes that includes researcher’s impression and interpretations of action, memos as well as video recordings of events were available. This technique has been of great use to the study as it helped the researcher gather the information that will contribute a lot in the main objectives of the study.

The researcher observed naturally without disturbing any activities. Gay (1992:234) states that in naturalistic observation, certain kinds of behaviour can only be observed as they occur naturally. In the situation the researcher tried not to affect the observed situation in anyway. The researcher studied and recorded activities as they normally occurred. The researcher sat at the back of the class observing, using the checklist as a guide and videotaping the activities. The researcher informed the participants in advance that the participants would be videotaped. The researcher decided to use naturalistic observation with the aim of giving a narrative descriptive observation of the school setting, classroom setting and teachers and learners activities after observation. Simons (2009:55) states that observation is useful in a case study research, where we have to closely observe a specific case or interpret findings gained from other sources or methods in context.

The researcher has chosen to use observation because of the following advantages mentioned in Bailey (1994:243-244).

Non-verbal behaviour in contrast, an observer on the scene can discern on-going behaviour as it occurs. Another advantage of observation is that behaviour takes place in its natural environment. Longitudinal analysis, unlike interview that must compete with the respondent’s everyday activities and obligations for previous hour of his or her time for the interview, the observer is able to conduct his or her study in the subject’s natural environment.

However, observations also have disadvantages like any other data collection techniques that might be avoided depending on the nature of the study. According to Bailey (1994:245):

- There is lack of control; the researcher might have little control over extraneous variable that may affect the data.
- Difficulties in quantification.
- It can be used in a small sample size.
Observer may have difficulty obtaining approval for study e.g. gaining field entrance.
Lack of anonymity when studying sensitive issues.

3.5.2.4. Questionnaires

The researcher also decided to use questionnaires as a convenient data collection technique. According to Rule & John (2011:66) questionnaire is good in saving time and money and when you want to collect data from people simultaneously. However, the researcher loses opportunity to probe information further. Therefore, it is good for researcher to pilot the questionnaires before providing them to the participants. Besides some little pitfalls of using a questionnaire in a case study, the researcher decided to use it as she interviewed participants and observed them.

The researcher has chosen to use questionnaires as another data collection instrument because of the following advantages cited by Cohen & Manion (1989:11-12):

- Questionnaires are the least expensive method of data collection.
- Written questionnaires avoid possible interview bias. The way the interviewer asks questions and even the interviewer’s general appearance or interaction may influence respondent answers. Such biases can be completely eliminated in the written questionnaire.
- Questionnaires can be distributed to many respondents simultaneously; therefore large sample of population can be covered.
- They give respondent, more time to consider answer before final response.
- Respondents are given a chance to respond exactly to the same questions because standards instructions are given to the respondents.
- The data provided by questionnaires can be more easily analysed and interpreted than data obtained from verbal responses.
- Respondents can complete questionnaires in their own time and in a more relaxed atmosphere.
The administration of questionnaires, the coding, analysis and interpretation of data can be done without any special training.

However, the questionnaires also have disadvantages that the researcher needs to take care of while conducting research. An evaluation toolkit for e–library developments (2006:3 Para 3) cite the following disadvantages of questionnaires:

- If you forget to ask a question, you cannot usually go back to respondents, especially if they are anonymous.
- It is sometimes difficult to obtain a sufficient number of responses.
- Those who have an interest in the subject may be more likely to respond, skewing the sample.
- Respondents may ignore certain questions.
- Questionnaires may appear impersonal.
- Questions may be incorrectly completed.
- Respondents may misunderstand questions because of poor design and ambiguous language.

### 3.6. Framework for data analysis

To make analysis of data become easy, the researcher made sure that the interview questions reflect the main objectives of the study which is the impact of the curriculum change in teaching and learning of science. The interview questions were grouped according to their themes. The themes reflected the overall aim and objectives of the study and other main areas that arised from the reviewed literature. According to Bogdan and Biklen (1982:145) in Biggam (2011:165) dealing with qualitative data is described as working with data, organizing it, breaking it into manageable units, synthesizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others. Therefore, the researcher first described and analyse the teachers’ questionnaires findings and compare them with literature review findings, followed by the subject advisors and principal interview results. The researcher also described and analyse the observation results and compared them with literature review findings. Finally, the researcher compared the teachers’ questionnaire results against the principal and subject advisors interview results.
The questions were based on the attitude of the teachers, stakeholders towards changes in curriculum, the effects of curriculum change in teaching and learning, factors hindering the success of curriculum and monitoring and support. Under each theme, the principals of relevant schools were interviewed by the researcher using semi-structured interview questions. The interview technique was the main tool that was used to collect data from the participants. The researcher also used the interview questions to interview the subject advisors who are related to school, also responsible for science learning area or subjects. There was a slight difference between the principals’ and the subject advisors’ questions. Teachers answered open-ended questionnaires. The researcher’s aim of interviewing science subject advisors was because they are the ones who might be having the bigger picture of how the changes in curriculum are impacting teaching and learning as they are responsible with monitoring in the process of curriculum implementation and development. Another aim was to get expert perspectives on how the changes in curriculum are impacting in teaching and learning to get the rich information from people who are expert of curriculum. According to John & Rule (2011:64) people are selected because of their relevant knowledge, interest and experience in relation to the case. The subject advisors were included also to get perspectives towards curriculum change from the expert who generates data that will allow in-depth and trustworthy account of study.

The researcher decided to use observations, questionnaires and interview as data collection technique in this study. Data from all these techniques will be analysed. Data from principal and teachers will be analysed according to their themes to make analysis simple and easy. To achieve the aforementioned process the researcher took detailed notes as participants talk. The researcher also videotaped the interview process and transcribes the information later. The transcribed information will be put as appendixes to give extra details on the respondents’ responses.

During the observation, the researcher also used checklist and videotaped scene and the activities that were taking place. This was time consuming, but the benefit was rich qualitative data. Later the research findings were described and analysed, comparing and contrasting them with literature review findings on the impact of curriculum change in teaching and learning of science subjects in schools.

According to Bogdan and Bilden (1982:145) in Biggam (2011:165) dealing with qualitative data is described as working with data, organizing it, breaking it into manageable units,
synthesizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others. Therefore, the researcher first described and analyse the teachers questionnaire findings and compare them with literature review findings, secondly, the researcher described and analyse the supervisors and principals interview results and compared them with literature review findings, thirdly, the researcher describe and analyse the observation results and compared them with literature review findings. Finally, the researcher compared the teachers’ questionnaire results against the principal and supervisors interview results.

3.7. Limitations and potential problems

According to Marshal & Rossman (2006:42) there is no proposed research project that does not have limitation and none is perfectly done. The fact that generalizability cannot normally be made in a case study research, the research resorted mainly to the relatability and reliability. According to Biggam (2011:291) to deal with reliability in a case study is to make as many steps as operational as possible and to conduct the research as if someone were looking over your shoulder. That is the reason the researcher decided to use interview as the main means of data collection in this study. There is a relation in the site chosen by the research. This means that the problems that might be experienced by one under-resourced school might be always be the case in other schools that are also under-resourced.

To minimize bias, the researcher decided to choose another school instead of where she works as she is a teacher herself working in a school which is in the same area and experiencing the same problem of being under-resourced. As these schools are in the same vicinity with the researcher’s school, teachers know each other very well as they always meet in cluster meetings. To make the teachers to take it serious that she is visiting the school as a researcher and for them to participate as respondent. The researcher will give it a time to explain the importance of research findings and how this research is important for the benefit of education in the country and how important it is for them to assist in the study. To justify the trustworthiness of this study, the research has given a detailed description of the process or step by step methods that the researcher undertook in the process of data collection.

However, interviews do have number of unique disadvantages, but Gay (1992:231) emphasized that when well conducted, it can produce in-depth data that are not possible with questionnaire. Audio recording can have its own disadvantages as well. Simons (2009:52)
stated that the equipment can also fail, leaving you vulnerable to having no data at all. The researcher avoided the aforementioned pitfalls by always taking notes as well as video recording. This helped the researcher to keep track of the data collected and understanding of the data.

3.8. Conclusions

This chapter has provided all the details of the research method ranging from research strategy, data collection techniques, their advantages and disadvantages, detailed process of data analysis process that has been used. Minimization of limitations and potential problems has been addressed by mentioning the approaches that has been used to limit potential criticism as this is a case study. The following chapter will discuss and make analysis of the case study results.
CHAPTER 4: CASE STUDY FINDINGS

4. Case study Findings: Description, Analysis and synthesis

4.1. Introduction

This chapter outlines the findings of the case study. The research focused on the groups of stakeholders which are teachers, principals, learners and subject advisors. It also used observation as the research instrument. The main aim of the research is to investigate the impact of curriculum changes in the teaching and learning of science in under-resourced schools of Vhembe District (Sibasa Circuit). The case study took place in six of the under-resourced schools of Sibasa Circuit as it has been already mentioned in the research.

The researcher has chosen two science teachers from each school. This means that the teachers who answered the research questions were twelve. The questionnaires were given to teachers and ample time was allocated to complete the questionnaires. They were given five days to answer questionnaires as they were busy preparing learners for examination. The researcher gave more time in order to probe more information as she is dealing with a qualitative case study. It also gave teachers ample time to give their responses in their own spare time because the researcher has been warned not to disturb teaching time where ever possible. All six principals were available for interview questions and they were more than willing to participate. The principals’ age ranges from 40-55 years. They seem not to be well informed or have clear understanding of the new changes and of what is happening inside the classroom concerning the implementation of the new curriculum or new developments in curriculum. Almost all of them mentioned that they had never visited teachers in the classroom as they think it is the duty of the heads of departments. To add on that they mentioned that only teachers are the ones who have gone for training. They always referred the researcher to the heads of department when it comes to the matters related to the new changes in the curriculum. They mentioned also that what matters most for them is to see that teachers are religiously attending their lessons. The researcher also focused on the teachers who are involved in life sciences grade 10. The age group of teachers ranges from 26-48 years. Only four were female teachers and the rest were male teachers. The results of the study indicated that half of twelve teachers were more experienced in the teaching of science subject. Six of them have been teaching life science (biology) for more than 15 years. The other six have less than 10 years teaching science in a real classroom situation. Four teachers
have diplomas and they have done biology for two years which means that biology is not their major subject. Five teachers have diplomas with (biology) life sciences as their major subject. Three teachers have degree qualification and they have done life sciences up to their fourth level. Some of them have been teaching for more than fifteen 15 years. The other six have less than ten 10 years of teaching science subject in a real class situation. Only four teachers were trained to teach in the new curriculum and they said that they are familiar with the concepts and policies related to NCS and RNCS except the new curriculum development CAPS which have been recently introduced. Only two subject advisors who deal with the schools in the circuit were available for interview questions. Both subject advisors were the former lectures who were lecturing biology as a course in the former colleges around. It was not easy to get hold of them from their office as there are only eight subject advisors for more than 300 schools. It compels them not to concentrate in one circuit as there are no enough science subject advisors to cover the whole capacity in the whole district.

Teachers were given open-ended questionnaires to answer on the impact of curriculum change in teaching and learning of science in under-resourced schools of Sibasa Circuit. All the schools are specifically based at one circuit and studied under one circuit called (Sibasa) in the Vhembe District. The six principals and two subject advisors were interviewed using interview questions which were structured differently, but based on the same aspects. The purpose of interviewing principals and the subject advisors was to probe deep information on how the new changes in curriculum are affecting everyday teaching and learning of science at schools as principals are the ones who manage all the activities including teaching processes. The subject advisors have information on how the curriculum is implemented in the particular schools were the research has taken place as they are the one working with curriculum processes in the circuit and the whole district in Vhembe area. The researcher used observation checklist while observing the state of science laboratory and the teaching and learning processes inside the laboratories. The observation checklist was based mainly on the factors that might be affecting teaching and learning of science and the other factors that might be impacting curriculum development on the real teaching situation. The transcripts of the respondents’ responses are indicated on the tables below:
4.2. Results and Discussions

Reporting of results is done according to the structure which has been described in the research methods. The structure will be outlined in detail below. Data were analysed, described and synthesized or compared with the literature reviewed which was the point of initiating literature review in this study. The data for this study were structured according to themes and focus groups which led the researcher to divide research objectives. Teachers are addressed as teacher 1 to 12, principals are addressed as principal 1 to 6 and subject advisors as subject advisor 1 to 2. Schools are addressed as school 1 to 6.

The findings are structured as follows:

4.2.1. Theme 1: How changes in curriculum affected teaching and learning

Focus group 1: Teachers

Describe how you presently feel about changes in curriculum.

Do changes in curriculum affected your ways of teaching, and how?

Focus group 2: Principals

Do you think there is a need for new curriculum development at this stage in South Africa?

How do changes in curriculum affect teaching and learning of science at your school?

Focus group 3: Subject advisors

How do you feel about changes in the curriculum?

What effects do changes in curriculum have on teachers and learners at your schools?

How do changes in curriculum affect your role as science subject advisor?

4.2.2. Theme 2: Factors that affect changes in science curriculum (Research objectives)

Focus group 1: Teachers

What are the factors that you think affect the implementation of new changes in curriculum at your school?

Describe the state of science laboratory at your school.
What effects does the state of science laboratory have on teaching and learning of science in this period of new curriculum reform?

What are the challenges that you face while implementing changes in science curriculum in your school?

Focus group 2: Principals

What are the factors that you think affect teaching and learning of science during this time of on-going changes in curriculum development?

Which difficulties are faced by science teachers when it comes to the implementation new changes in curriculum and why?

Focus group 3: Subject advisors

What are the factors that you think might be affecting the success of changes in curriculum more specifically in science teaching and learning?

4.2.3. Theme 3: Support and monitoring of changes in science curriculum (Research objectives 3)

Focus group 1: Teachers

What kind of support are you receiving from the school management, when it comes to the implementation of new changes in science curriculums?

How do you measure your understanding of new curriculum policies? And what kind of support are you getting from science subject advisors?

Do you think as science teacher, feel adequately trained with necessary skills and knowledge to can implement changes in curriculum?

Focus group 2: Principals

Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

Focus group 3. Subject advisors.
Is there any support you are receiving from the Department of Education when it comes to monitoring and support of new curriculum dispensation in science?

Do you think you have enough capacity to support and monitor changes in science curriculum?

What are the main challenges that you encounter during monitoring and support of changes in science curriculum?

4.2.4. Theme 4: suggestion for future planning of changes in curriculum (Research objective 4)

Focus group 1: Teachers

What are your suggestions for the future planning of science curriculum, especially for the schools that are under-resourced?

Focus group 2: Principals

What are your suggestions for the future planning of science curriculum, especially to the provision of learning resources in under-resourced school?

Focus group 3: Subject advisors

What are your future suggestions in the planning of new curriculum development in science school that are under-resourced?

Discussion of observation results, analysis and comparison of observation results with the literature reviewed.

4.3. Theme 1. (How changes in curriculum affect teaching and learning.)

4.3.1. Theme 1: teachers (focus group 1) responses

Discussion

Teacher (10), teacher (2) and teacher (3), indicated that they never changed the way they teach because they do not see any reason for them to change their method of teaching. The reason being that the training that they have received is not enough for them to be able to change their original method. They also responded that the new method confused them and they decided to use the method that they are familiar with as long as, it will leave the learner
with understanding of what they want them to know. Teacher (4), teacher (5) and teacher (6) continued and mentioned that, for them to change their method it demand resources which they do not have. Furthermore, they responded that it also needs learners who are ready for the changes. However, they have tried to change their teaching method and at long run they realized that learners are not used to the new method and they decided to switch back to their original method of teaching. Teacher (7), teacher (8), teacher (9) and teacher (10), indicated that the new method of teaching is what they know because they are the newly trained teachers. Therefore, they are trying very hard to make it work. The only stumbling block is the resources, because they have to improvise, which take too much time of teaching and learning. These resulted on them not managing to complete their pace setter in time. It ends up affecting learners and teachers in a negative way. Another response they gave is that, the main problem they are faced with while trying to make the new method of teaching work is that some teachers believe on their own method of teaching which is very difficult to break that barrier among teachers and learners. Learners are not used to taking responsibility for their own learning and they seem not to be used to learner-centred method because most of the teachers resorted to teacher-centred methods because learners are getting it difficult to cope with the new method. Learners have to switch from one method to another during each and every period, which affect their learning and confuse them. This affects their progress on trying to stick on the new method of teaching.

One educator said that he cannot tell how changes in curriculum has affected him because he does not know specifically whether his method of teaching is in accordance with the method of teaching in the new curriculum and also indicated that he cannot notice the difference on the way he teaches now and the way he taught in the past. From his own point of view he thinks there is no effect that the new curriculum has imposed in the way he teaches science in the classroom. What he indicated is that he could notice the decline in the standard of learner’s knowledge in science for grade ten (10) learners

Teacher 11 and teacher 12 indicated that since the beginning of new changes in curriculum, they are faced with too much administrative work. For example they talk about the preparation of learner’s portfolios, which demand more time of teaching and learning. They further indicated that the new curriculum (CAPS) demand grade ten (10) learners to conduct experiments and learners are expected to write practical exam. They saw it as good idea, but the problem is the inadequate laboratory equipment’s which they can use to conduct the experiments. This affects their performance and that of learners, all these reduce their
teaching time because they expected to improvise and some chemicals they cannot manage to improvise.

Teacher (4), teacher(5), and teacher (6) indicated that teaching classes where there is an inadequacy in teaching and learning resources is frustrating and affects their progress. They cited the unavailability of text books during the beginning of the year. They indicate that it is not easy to teach science to learners that do not have books to refer to. They further cited scenario of giving learners homework, teachers are expected to use a chalk and chalkboard which is time consuming and frustrating for both the learners and teachers. The aforementioned problem affects effective implementation of curriculum changes.

In terms of changes that are taking place from RNCS to the newly introduced policy (CAPS) by the minister of education, teacher (7), teacher (9), teacher (8) and teacher (10) indicated that, changes are taking place very fast. Before they acclimatize with one policy, they are expected to catch-up with another and move to another change. Teacher (9) remarked that “I feel these changes are happening very fast and it is confusing us in such a way that we do not know whether to use it or resort to the old method of teaching’’. They also indicate that they are well versed with the old method as compared to the new method which they are struggling to cope with, as it is not working for teachers and learners. They also highlighted that some of the things that are related to the new policies, they just do them for the sake of compliance. They are of the opinion that it drops the standards of teaching. They also mentioned they are confused because they do not know they are moving forward or backward with the changes in curriculum. The way forward remains inevitable for them as they are expected to move from known to unknown.

Analysis

None of the twelve (12) teachers who seem to view the new changes in curriculum as solution oriented. They hold the view that the curriculum would have positive effect if it had adequate learning resources. It seems as if the condition of the schools is not conducive for the positive effects of teaching and learning of science in schools. Teacher (1), teacher (2) and teacher (3), are of the view that there is no reason for them to switch from their original method of teaching as they could not notice any impact on how learners acquire knowledge. As long as learners understand what they are taught, there is no need for them to change their mode of teaching. Teacher (4), teacher( 5) and teacher (6) seem to be worried about the learning resources which seems like the main issue that is affecting them not to be able to
change their method of teaching. The learners seem not to be ready to take responsibility of their own learning activities and working in groups. They seem to enjoy a classroom that is teacher-centred because that is what they are used to from other lessons. Although newly trained teachers seem to have knowledge for the method of teaching in the new curriculum reforms, they seem to always have criticism from learners and other staff members who are trained in the past that they are not putting more effort to teach learners in such a way they can improve in their maths and science. They indicated that it is the reason they resorted in switching back to teacher-centeredness classes. These are the comments from teacher (7), teacher (8), teacher (9), and teacher (10), who are newly trained teachers according to their profiles. It is obvious that both teachers are not of the view that curriculum change is impacting in a positive way due to some different reasons they have given. They blame the conditions they are working under as the main cause of the negative impact on teaching and learning of sciences. Teacher (11) and teacher (12) also indicated that the preparation of continuous assessment files is time consuming and taking much of their teaching time. According to teachers’ comments on the effects of new changes in curriculum, it is obvious that they feel that it is affecting their teaching in a negative way. From teacher’s point of view there is no one who seems to view the changes in curriculum as something that has brought positive effects in the way they teach science subjects in their school

Synthesis

Literature reviewed indicated number of factors that affected teaching and learning in the new curriculum dispensation. According to (Jacobs, Vakalisa & Gawe; 2004:2 and Chisholm; 2005:91). The new approach of (OBE) outcomes based education has moved the emphasis of learning and teaching away from rote learning to concrete educational results. Therefore, the role of the teacher is changed from being a transmitter of knowledge to facilitator. Activities are also shifted to learner centred approach. However, it looks like teacher (1); teacher (2) and teacher (3) do not feel like part and parcel of the above mentioned effects that came with the changes in the new curriculum reforms. It seems as if they are very comfortable with the “back to basics” approach that has been announced by the minister of education, Angie Motshega, when she introduced the curriculum and assessment policy statement (CAPS) to be implemented at the beginning of 2012 academic year in grade 10 (Department of education 2011:4).
Another factor that seems to be affecting teachers on how they teach in the new curriculum is the inadequacy in teaching and learning materials. Teacher (1), teacher (2) and teacher (3) further indicated that they do not have enough skills to implement the new changes in curriculum, which might be the reason they were obliged to move back to their original way of teaching and decided to abandon the new method.

Teacher (7), teacher (8), teacher (9) and teacher (10) indicated that, despite the fact that they have been trained how to teach in the new curriculum dispensation, they have received a lot of criticism that is why they have moved to the method that learners are used to. This affects their chance of expressing themselves freely. Yip (2001:760) states that, it seems as if subjects still adhered to the transmission mode of science learning in their practice, despite the fact that teachers had argued some notions about the constraints instruction approach from the teaching course. Moreover, teachers view the new changes in curriculum as more demanding and having more of administrative work which affect their teaching time and preparations. In the literature reviewed, Weber (2007:37) notes that under the banner curriculum 2005 and OBE, teachers are overloaded with unprecedented decision making authority and a lot of heightened expectations like outcomes based teaching, more administrative work, integrated science which resulted in them not having time to prepare lesson properly. Therefore, all these expectations leave them with no time to be more responsive to the curriculum (RNCS) intentions.

It is interesting to realize that in both responses given by teachers, the changes in curriculum are affecting them, but it seems as if they are affecting them in a negative way because of some factors that they have mentioned. This conveys a message by teacher (4), teacher(5) and teacher (6) that the inadequacy in learning resources might be making changes in curriculum not rendered effectively in the teaching and learning of science.

4.3.2. Theme 1. Principals (focus group 2) response to theme 1

Description

The two principals (1) and principal (2) stated that what they know is that since the beginning of changes in curriculum, teachers were expected to change the way they teach in their classroom to follow the new policy. However, teachers seem to be overloaded with administrative work like preparation of continuous assessment (CASS) portfolios. They further indicated that the time between preparation of portfolios and submission due dates
affect teachers attendance of classes. In answering question 1 in table 4.2.3., he indicated that changes should have taken place slowly because of the shortage in resources. Therefore, he recommended that changes should have waited until people felt that they were ready concerning resources. In answering question (2), Principal (3) indicated that what he knows is that each and every teacher is provided with all policy documents and most of them have attended workshops on the implementation of new curriculum. What he is no sure of is whether teachers are practicing what they have been trained for from the workshops during classroom activities. He indicated that although he can visit the classrooms, the problem is that he does not have knowledge of what is happening in the new curriculum dispensation as he was trained as a teacher a long time ago. He continued and mentioned that the people who might be familiar with the curriculum development and what is happening are the subject advisors. However, he mentioned that it is rare to see them do classroom visits. He also cited inadequacy in learning resources for science teachers as another factor that is affecting the way they teach. However, other teachers are doing their best to cope by improvising most of the learning resources they use during practical classes. Although some teachers are trying their best to follow the new curriculum policy, the state of laboratory is the main set back that affects their progress in improving science teaching in their school.

Principal (4), principal (5) and principal (6) responses were closely related to principal (3) responses, they also indicated that they are not sure how the curriculum change is impacting in teachers inside the classroom as they are not familiar with the teaching in the new curriculum. What they have noticed is the decline in grade 10 performance in maths and science which leave the two subjects as the main contributing factor that affect learners pass rate in the grade mentioned above. Principal (4) in appendix B4 table indicated that many learners fail grade 10 because they receive low marks in maths and science. However, he doesn’t know whether the problem of high failure rate in science is caused by inadequate skills in science by teachers, changes in method of teaching or inadequate learning resources like well-equipped laboratory. Principal (5) in appendix B5 table indicated that changes have come at the right time when South Africa needs it. He indicated that the difficulties are the speed in which those changes are taking place. Principal (5) also indicated that although other teachers are trying their best to follow the instructions in the new policy framework, they are also faced with challenges of new policies that are introduced one after another. He cited the introduction of the new policy (CAPS) as an example. He further indicated that for other teachers it ends up confusing because when they thought their struggle with (RNCS) is over,
they are now expected to deal with another policy change. They end up not knowing whether
they can move forward or backward. He also highlighted that it might be affecting teachers to
proceed smoothly with their work, as science is the most demanding subject, teachers need
sufficient time to prepare their lessons and teaching time which is not easy in overcrowded
classes.

Analysis

It is common experience among principals that they are not sure as to how changes in
curriculum are affecting teachers inside the classroom. However, they seem to be seeing the
changes in curriculum as more demanding and time consuming. This might be caused by the
type of training that they have acquired. Their management experience makes it obvious that,
they have been trained based in the old curriculum. Their knowledge of the new education
strategies seem to be limited. According to the principals’ responses, it is evident that they
view curriculum change as inherent setback for effective teaching and learning processes. But
they did not want to point clearly that it is affecting in a positive or negative way because
they did not want to be caught off guard about the situation in their schools. However, all of
them tried to outline the views on how curriculum change affects teaching and learning.

Both teachers and principals hold the same view that the demands of new curriculum is time
consuming and is suspicious for costing teachers’ progress due to more administrative work.
Principal (5) point of view lies on the introduction of many policies while teachers are trying
to come to terms with another might also be the stumbling block in the process of teaching
and learning of sciences. Whereas teachers emphasized that the resources and overloaded
work might be affecting their progress in teaching and learning of sciences. The teachers
seem not be ready to change completely from their original method of teaching. At the same
breath, principals seem not to have skills to can be able to assess whether teachers are
working in accordance with the needs of the new policies in teaching and learning of science
subjects. However, both teachers and principals seem to be more worried about resources and
they said that resources seem to be making change in curriculum impact in an undesirable
way when it comes to teaching and learning. By the look of things, the principals seem not to
have good idea on how the curriculum needs to be implemented. What they do is to provide
the teachers with the necessary documents required for the new curriculum policy. The
principals seem to be interested on the results than seeing how the results can be achieved.
The curriculum workers in South Africa seem to be focusing mainly on the desired results of
the curriculum and unmindful about how part of its implementation. According to literature reviewed, Fleit & Wallace (2005:188-159) argue that the inability of reform makers to accurately diagnose the systemic problems or to correctly evaluate programmes before implementation affects the success of the curriculum. It is true that the plan to train the principals about the curriculum should have been put in place before the implementation so that they are able to see how the curriculum changes are affecting teaching and learning in their schools.

4.3.3. Theme 1. (Focus group 3) science subject advisors responses

How do changes in curriculum affect your roles as science subject advisors?

What effects do changes in curriculum have on teachers and learners?

*Description*

Subject advisor (1) and subject advisor (2) who are responsible for science were contacted to respond to the interview questions and both were available for interview questions. In responding to the first questions, subject advisor (1) mentioned that there are two factors that affect their roles as curriculum advisors since the introduction of new changes in the curriculum. She indicated that the number of science subject advisors is not enough even for the whole District. Therefore, it is not easy for them to be able to visit all the schools in one circle. They decided to choose schools that are experiencing serious problems and concentrate on them. She further indicated that, in reality the subject advisors for science should be visiting all the schools regularly in order to monitor teachers’ and learners’ activities during the lessons. However, subject advisors who are available are working tirelessly in order to satisfy the needs of the new curriculum. Subject advisor (2) indicated that other factors affecting them besides less capacity, is the inadequacy in resources and the state of the roads. She indicated that some of the roads are not in good conditions; therefore, it is not easy to access some of the schools that are in need. Although they can manage to assess learners’ portfolio and teachers’ files, it is not easy to assess teachers and learners during the classroom activities.

After they have discovered that some of the activities and practicals set by teachers where not reaching the expected standards, subject advisor (1) said that they decided to design common practicals for all the schools. That took too much of their time as they were supposed to be conducting workshops.
To respond to the second question in theme 1, subject advisor (2) mentioned that a lot has changed when it comes to teachers' roles. He indicated that teachers are expected to follow what is in the curriculum policy document. They are expected to conduct their classes according to the learner centeredness method. In the same vein they are supposed to prepare learners’ portfolios and their own files for assessment, each and every quarter. He emphasized that because of all mentioned above, he is of the view that teacher’s role has changed because they are no longer transmitters of knowledge, although it is not simple and easy to change to that role.

Subject advisor (1) also indicated that even though the teachers’ role is expected to change according to the new curriculum, there are teachers who seem to be resisting following the new method of teaching. She further outlined that there are others who seem to be happy about the introduction of the new curriculum policy (CAPS). She went on to indicate that those who were resisting change indicated that the new curriculum policy (CAPS) will suit them. However, there are others who indicate that they have been trained to teach curriculum (2005) and it confuses them to differentiate between (2005) and the new curriculum policy (CAPS). She went on to illustrate that although teachers are managing to submit files and learners portfolio in time, what they are not sure of is how they take care of their classroom activities because the subject advisors are not enough to can reach the demand in the circuit as well as the whole district.

Analysis

According to the subject advisors (1) and (2), it is clear that the changes in curriculum do affect teachers and subject advisors in different ways. Although there are similarities in the inadequacy, when it comes to resources. The subject advisor who responded to the question in theme one (1) indicated that a lot has changed when it comes to teachers’ role and activities. They concur on the issue of portfolios for the learners and their monitoring process in teachers’ and learners’ work. They also emphasize that it is not easy for them to complete their work in time because of the escalated workload. This is caused by the shortage of subject advisors, which is affecting their progress of monitoring and assessment. She indicated that another concern is the lack of adequate resources such as text books and well equipped laboratory for science teachers to be able to conduct experiments for learners. Subject advisor (1) remarked that you can find learners with teachers and learners trying to do their practical in a laboratory that do not have single equipment, let alone running water,
what you can see is an empty room full of empty bottles without any chemical. She further expresses her concern that conditions teachers find themselves in might be the reasons that affect them and learners. Relevant teaching aid is seen as a tool for realizing positive impact on curriculum. She further cited lack of appropriate learners’ support materials for science as cause of concern that affect teachers and learners effective classroom activities. These in turn might be affecting the implementation of the new changes in curriculum negatively.

Comparing the responses drawn among the teachers, principals and the subject advisors they are all strike common concern about unavailability of fundamental resources. The subject advisors and principals are all worried about how the curriculum is genuinely affecting teachers and learners in their classroom activities as it is not easy for them to observe what teachers and learners really do inside the classroom regularly because of time constraints and shortage of staff on the side of curriculum advisors. Time and shortage of staff compelled them to collect files for grade 12 only and promise a school visit which end up other schools not visited at all. The reports they can give in the effect of changes in curriculum are mainly based on the teachers’ files and learners’ portfolios.

Teachers are worried about the short passage of time between the period files are prepared and submission dates. Subject advisors are concerned about the workload caused by shortage of staff. These brought us to a conclusion that inadequate resources might be the major factors that affect teachers and learners. The subject advisors also specified the inadequacy in learning resources which they think might be affecting the effective implementation of new changes in curriculum more specifically in science subjects as, they see them as more demanding subjects when it comes to learning resources.

**Synthesis**

According to literature reviewed, Fleit and Wallace (2005:188-189) argued that the inability of reform makers to accurately diagnose the systemic problems or to correctly evaluate programmes before implementation affect the success of curriculum. The fact that principals and subject advisors indicated that they are not sure about what is exactly happening inside the classroom is a sign that, a plan was not put in place on how teachers and learners activities will be assessed before the implementation of the new curriculum. According to the respondents’ comments, it is obvious that the issue of resources has been overlooked as it is the main worry of all the respondents. The inability of the curriculum reform makers to accurately diagnose problems seems to be having an on-going effect in teaching and learning.
of science in most schools. Sayed and Jansen (2001:180-182) also pointed to the fact that some head-teachers have welcomed the changes, but they lack capacity to lead transformation.

4.4. Theme 2. “Factors that affect changes in science curriculum”

Teachers’ responses to theme 2 questions.

1. What are the factors that you think hinder the success of changes in curriculum?

2. Describe the state of the laboratory at your school.

3. What effects does the state of laboratory have in teaching and learning of science in these new curriculum changes?

4. What are the challenges that you face while implementing new changes in curriculum as a science?

4.4.1. Theme 2: Teacher’s responses (focus group 1)

Description

Response of teachers in theme (2), question (1) was as follows. Teacher (4), (5), (6), (7), (8), (9) and (10) indicated that the main factor that hinders the success of changes in curriculum is the shortage of learning resources. Moreover, they indicated that it is not easy to conduct experiments without proper resources. Although they manage to improvise, there are chemicals that they cannot improvise, as they need more financial resources to get them. Teacher (7) and (8) cited lack of knowledge and skills in curriculum. They indicated that there are teachers who qualified prior to the introduction of curriculum 2005. The teachers who are subject to the latter era lack knowledge of the new curriculum. Teacher (3) explains that it is not easy for teachers who have not been exposed to the method of teaching in the new curriculum; workshops cannot be enough to help them gain knowledge because they are conducted within a short space of time. Teacher (1) and (2) indicated lack of support structure that deal with curriculum support in school. Teacher (11) and (12) indicated that lack of confidence by teachers while conducting science lesson is one of the factors that might be inhibiting the effectiveness of teaching and learning in the classroom.

In answering theme 2 question 2
Teacher (1), (2), (3), (4), (5), and (6), who are from nearby indicated that their school does not have something they can call a laboratory “it is just rooms full of empty bottles”. This is the response from one of the six teachers in appendix (A6). However, they are expected to use it as laboratory for science learners.

Teacher (7), (8), (9) (10), (11) and (12) also indicated that their laboratory is not up to standard. Teacher (7) in appendix (A6) remarked “when you enter our laboratory you will see a pile of old books, if you have not been told that it is a laboratory, you can mistake it with a store room.” They further indicated that the state of their laboratory is not conducive for learners to perform their practical effectively.

**Analysis**

Teachers’ responses in theme 2 indicated that lack of or shortage of resources is the main factor that affects their success in teaching and learning of sciences in their schools. They also indicate that the states of their laboratories where they are supposed to conduct their experiments with learners are not conducive to learning. According to the report by teachers in this theme, it is obvious that they see the state of their laboratories as inhibiting factor for them to succeed in the implementation of changes in curriculum more specifically science subjects. It is also the effectiveness of changes in curriculum

**Synthesis**

The results given by teachers interviewed indicate that the schools lack capacity to support change in teaching and learning of sciences. According to the literature reviewed, Rogan and Grayson (2003:1175) notes that the construct capacity to support innovation is an attempt to understand and elaborate on the factors that can support or inhibit the implementation of new ideas and practices in a system such as a school. As a result, it is necessary to recognize that not all the schools have the capacity to implement changes to the same extent. Rogan and Grayson (2003:1175) further emphasizes that in South Africa there is a tendency that seem to ignore the existing diversity and mandate complex and comprehensive changes in systems that may or may not be ready to cope with them. Therefore, implementation must take context of a particular, its teachers, pupils, leadership and environment in account.

Chisholm (2005:87) also proposes that attention be paid to implementation weaknesses related to resourcing manageable time frames and regular monitoring and review. Chisholm’s statement supports the view of teachers that shortage of resources and inadequate laboratories
should be the factors that need to be taken into consideration because of its effects on teaching and learning in their schools.

4.4.2. Theme 2. Principals’ responses (Focus group 2)

What are the factors that you think affect the success of curriculum reform at your school?

Which difficulties are faced by science teachers when it comes to the implementation of curriculum and why?

Description

Principal (1) viewed it on the basis of the lack of confidence by the teachers. He identified it as the number one factor working against the teaching of science in the school. He cited the lack of confidence by science teachers as the main factor that might be affecting their success to implement science curriculum affectively. He is also of the view that poor resources is one of the major constraints that affect the quality of teaching science subjects in the school as they are the most demanding subject in the school. He highlighted the state of their laboratories as another factor that affects teachers’ progress in implementing new changes in curriculum.

Principal (2) indicated that lack of support from outside or the department is the number one factor that impacts on the success of curriculum change. From his own point of view in appendix (B2) he pointed out that “the government has the obligation to provide us with the learning resources more specifically text books” He further explains that unavailability of text book in grade ten (10) is the burning issue that should have been taken into consideration by Government. He emphasized that if a learner does not have a text book, the idea of implementing new policy becomes practically impossible. He insisted on the surety that his name must not be disclosed to avoid any implications. He also indicated that teachers seem to be experiencing difficulties when it comes to teaching aids that are scarce in his school. He continued and indicated that the fact that learners are exempted from paying school fees might be another contributing factor. As he compared the time schools used to pay school fees, things were fairly easy because they could manage to augment the acquisition of resources. “Each and every department would have its budget allocation to help towards
buying resources that are needed, but as for now it is no longer happening,” he said. He indicated this in his responses in appendix (B2) also.

In appendix (B3) principal (3) indicated that science teachers are faced with difficulties of not having enough resources like equipment to conduct science practicals. He continued and responded to question 4 and indicated that he saw the issue of inadequate learning resources as the main factor. Principal (4) indicated that the fact that his school does not have well equipped laboratory might be making it difficult for teachers to perform experiments with the learners. He continued and indicated that the fact that many teachers ignore some practice which comes with changes influence how changes in science curriculum affect teaching and learning. Principal (5) mentioned that teachers are faced with overcrowded classes which leave them with difficulties to impart their knowledge and skills. In his response to question (4), he indicated the issue of inadequate skills and long trained teachers as the factor affecting teaching and learning in the new curriculum. Principal (6) mentioned the issue of learners who have attitude towards science subjects and the problem of resources that are scarce. He also mentioned that teacher’s attitude affect teaching and learning of science during this era of changes in curriculum.

Analysis

Both teachers and principals indicate that the inadequacy in learning resources as the main factor that affect the success of curriculum change. Principals describe the state of unequipped laboratories as a factor that affects the effectiveness of teaching and learning of science. Therefore, the positive impact of the curriculum is hindered. Teachers also view the inadequacy of teaching aids as the main factor that affects their progress.

Synthesis

With reference to the results of the latter interview, it is evident that under-privileged school still experience inadequate teaching and learning resources. The respondents view the shortage of learning resources as the dominant factor that affect the implementation of new changes. Based on the literature as reviewed, Sharp et al. (2009:249) argued that it is revealed that the implementation requirements vary widely from class-to-class and school to school. Therefore, the needs of the previously disadvantaged schools cannot be the same with
previously advantaged schools. Dean (1998:45) further emphasize that the schools in previously disadvantaged areas are still faced resource scarcity and overcrowded classrooms. Chisholm (2005:87) also argues that the curriculum change can be implemented with ease in well-resource contexts with well-trained teachers. As a result, Rogan and Grayson (2003:1173-1174) and Sharp et al. (2009:250) describe the shortage of resources as the main factor that make curriculum reform impact in an unintended way in teaching and learning in schools. It is also clear that teachers and learners' attitude contribute on how changes can affect teaching and learning of science in this time of new curriculum dispensation. Wits & Lee (2009:411) state that to understand teachers’ attitudes and reaction more fully, it may help to examine the motives for involving student in actions.

4.4.3. Theme 2. Subject advisors response (focus group 3)

What are the factors that you think affect the success of curriculum change?

_Description_

To find result for these questions the researcher interviewed the subject advisors that are in the circuit within the jurisdiction of the case study. For the generalizability of the study the researcher was supposed to also interview subject advisors as they visit all the schools in the circuit within the confines the case study. Only two subject advisors were available for interview questions. The two subject advisors gave their perspective to the following factors:

- Lack of educators’ knowledge and skills.
- Teachers’ attitude towards curriculum change.
- Inadequate learning resources.
- Language barrier by learners.

Subject advisor (1) and subject advisor (2) were concerned about the level of understanding teachers have when it comes to science teaching. Most teachers find their understanding of science being challenged by the demand of new changes in curriculum. Subject advisor (1) indicated that many teachers ignore practical work and focus their effort on content subject matters. Their avoidance mentality leads to complete or partial lack of knowledge in practical matters. That is the reason they decided to set the practicals by themselves. Most of the teachers have been trained in the old system, so their knowledge of curriculum 2005 up to
(CAPS) is limited. The skills and knowledge they have acquired from the in-service training workshops might have not been sufficient for them to satisfy the abilities to implement the new changes in curriculum effectively. They also indicated that because of the scarcity of science teachers, most of the science teachers are from our neighbouring countries like Zimbabwe. Therefore, it is necessary to equip those teachers with the knowledge and skills that subscribe to the new curriculum in South Africa. Despite the fact that those teachers might have extensive knowledge of sciences, special attention needs to be directed to the tactical application of the new curriculum so that they become abreast with South Africa curriculum needs.

The subject advisors also view the attitudes of teachers as a factor that could also be affecting the effectiveness of curriculum change. They are convinced that some of the teachers avoid to teach in grades which require them prepare learners portfolio and their files all the time. Their reasons are grounded on the basis of avoiding submission of files every quarter for continuous assessment (CASS). They further indicate that others might be lacking the know-how on how to prepare portfolios, whereas others complain about time and workload. They also highlighted the lack of readiness by teachers to attend workshops. They cited example of recently organised workshop which displayed poor attendance. Their failure to attend makes it difficult to implement changes in a curriculum change, since those who fail to attend remain locked in the old system.

The subject advisors (1) and (2) also view inadequate learning resources as a cause of concern for effective learning of science. They indicated that schools in their circuit cluster are without well-equipped laboratories that scenario includes two schools in the confines of the case study. The current state of affairs makes it difficult for teachers and learners to conduct scientific investigation under this condition. Teachers resorted on drawing structures of the experiments on the chalk board and explain everything to the learners without learners being involved on the inquiry activities.

Another problem viewed by subject advisors is the language barrier as a factor that affects the success of curriculum change.

Analysis

Although subjects advisors were interviewed to give the results of the school under the study, their response were very helpful in order to conclude generalizability or reliability of the
study. They have general idea on what is happening in the circuit. Their response gave a light on general activities that are taking place in schools including the schools within the framework of the case study. An issue of learning resources has been highlighted by all respondents. The subject advisors indicated that despite the effort by teachers on trying to improvise some teaching aid that are needed for their lessons, there are some that cannot be improvised which leaves teachers with no option but resorting to use chalk and board to explain and demonstrate experiments. The latter effort seems to be not working to improve the quality in schools. From the point of view of all the respondents, the issue of resources seem to be the main factor affecting the success of curriculum change in teaching and learning of science. However, there are high possibilities of reluctance and attitude by teachers. The subject advisors are of the view that teachers are not ready to comply in attending workshops more especially during school holidays and this results in poor attendance. The attitude towards the new change could have been grounded on lack of money to pay transport to and from the workshops. The latter is not viewed as a genuine reason why teachers are so reluctant to attend workshops. The challenge needs to be given a serious consideration by the government if the business of curriculum change is to be implemented effectively. The issue of resources and unequipped laboratories need a serious consideration. Sciences remain empirical subjects, therefore teachers and learners work on their practical work without fully equipped laboratories. Inefficiencies of laboratories make it difficult for teachers and learners to comply with the needs of curriculum change. All the respondents believe that government under-estimated the provision of resources at schools.

**Synthesis**

Literature reviewed highlighted quite a number of factors that could affect the effectiveness the new curriculum change. Rogan and Grayson (2003:1196) stress that in order for capacity to support innovation, there is a need to plan to spend resources in the development of capacity in situations where it is lacking. Rogan and Grayson (2003:1179) further argue that there is no need of running workshops for teachers on laboratory work if their schools have no equipment or even laboratory where they can perform the practical.

The subject advisors view the inadequacy in teachers’ skills and knowledge as one of the factors that is affecting the positive effect of curriculum changes teaching of science in schools. Teachers technical knowledge of science discipline is obligatory if at all we have to achieve effective science education. Therefore, teachers need to have basic knowledge of new
approaches of the new curriculum in science and understand the nature of science enquiry in the new curriculum dispensation. However, Mccombs & Whistler (1997:166) argue that effective change requires commitment to developing necessary resources, including indispensable knowledge, skills and training. Therefore, it is the quality of teachers, principals and supervisors knowledge, background and progressiveness that might guarantee success in the new dispensation of curriculum reform (Piek, 1991:130-131). The subject advisors also indicated the issue of attitudes by teachers where teachers seem to be reluctant to attend workshops. It is viewed as factor that needs to be given serious attention in order to succeed in the implementation of science curriculum at its best. However, Keddie (2008:184) stressed that much work needs to be done in terms of examining the attitude and knowledge of teachers with respect to citizenship and this might give understanding of how citizen teachers might be better supported to produce the best knowledge.

4.5. Theme 3: Support and monitoring of changes in science curriculum.

4.5.1. Theme 3. Focus group 1 (teachers responses).

*Description.*

Teacher (11) and (12) response in theme 3 question 1 indicated that teachers are taken as recipients and are expected to apply the curriculum that has been developed by specialists somewhere else without them being involved in the planning process. The management does not care about what is happening in the real classroom situation. The support they give is to provide the teachers with curriculum materials. They further indicate that the management just allows them to go and attend workshops based on the changes in curriculum. That is the only support they are getting from their school. “It seems as if the management does not have any idea of what is happening inside the classroom” that is the remarks from teacher (12). Teacher (2) and (3) also indicated that they are not getting any support from the management because they have no idea about changes taking place in subjects. They further believe that they are less knowledgeable about what is happening in the classroom situation as they are not specialists on the subject and changes that are taking place. Teacher (1) and (4) complained about not getting any other support except that of attending workshops every time there are changes in curriculum development.

Teacher (5), (6), (7), and (8) responses indicated that although the school management tries so hard to support them emotionally and otherwise, the problem remains with lack of funds
for the schools. They need financial resources for the acquisition of chemicals to conduct experiments and essential resources. Their support is being affected and it also impacts on teaching and learning of sciences as funds are needed to buy chemicals. Teacher (9) and (10) also view that support from school management is not enough for effective implementation of curriculum change.

Responding to question 2 (two) and 3 (three) theme 3 teachers (focus group 1). Teacher (11) and (12) also indicated that due to short duration of workshops it makes them fail to acquire sufficient knowledge and skills that enables them to implement the changes. They read policies on their own but, application and interpretation leaves much to be desired. It is not easy for them to translate the material theory into practice in real classroom situation. The supports they are getting from subject advisors are still limited to short workshops and once off visit to their schools. As a result curriculum change effectiveness in classroom is compromised especially in science classroom activities,

Teacher (7) and teacher (8) indicated that they do understand changes that are taking place in science curriculum as they are newly trained teachers from the university; however it is not easy to implement all the changes they have learned. What they do not understand clearly is the newly developed policy called curriculum assessment policy statement (CAPS). They indicate that the training period appeared to be very short for them to can understand how the policy works. The support they are getting from the subject advisors is better because they set the experiments by themselves because they understand that there might be a problem when it comes to the setting standards of the experiments. They resorted in setting common experiments so that they can maintain reasonable standards.

Responses from teacher (5), (6), (7), (8), (9), (10), (11) and (12) indicated that the subject advisors seem not to have clear understanding of what they are doing. They continued and indicated that sometimes they go to workshops for support and comeback without understanding what they are expected to do concerning the changes in curriculum development. These results on them not being able to implement the new changes successfully. Teacher (1), (4), (2) and (3) indicated that although they do understand the changes that have taken place throughout all the years in science, it is difficult for them to do it practically in a real classroom situation. However, they try to practice some of the changes, for other activities it is not easy due to inadequate resources they are expected to use. Concerning support they indicate that after workshops that took two to three days nobody
cares about what is going to happen in the classroom and which materials are needed to implement those changes they have learned from the workshops. Four teachers are of the view that they understand the changes that are taking place in the science curriculum, but they are of the opinion that science needs a lot of resources which is not at their disposal in their schools. They remarked that, although they understand how to teach on the new curriculum, they are faced with learners who are not ready for all the changes due to the fact that they cannot read nor write in the language of teaching (English) which makes it difficult for them to practise all the necessary skills inside the classroom. When it comes to support by subject advisors, they indicate that their visits are not sufficient to enable them to implement a successful curriculum change. The other four teachers could not give clear indication of whether the support from subject advisors is sufficient enough for them implement curriculum change successfully.

Analysis

The responses from teachers from school 1 and 2 for theme 3 question 1 are almost the same. Both the views evidently show that they are not getting support from the management. Their management just allows them to attend workshops that are related to curriculum changes in sciences when changes in curriculum development take place. The management does not do follow-ups to ensure teachers are doing what they have been trained from the workshops and the practical application inside the classroom. These shortfalls render the development of science curriculum ineffective. Some of the managers seem not to understand a thing about the new changes in curriculum. As a result, they have got no idea of what is happening. They are interested in seeing teachers attending their classes and what is happening while the teachers are inside the classroom does not matter most. From the look of things at the response of teachers from schools 1 and 2, it seems as if there is ignorance on how the changes are affecting teaching and learning of science in schools which do not have enough resources. Managers of schools should have been trained adequately to oversee the developments of curriculum implementation so that they can assist teachers who are unable to implement the changes in curriculum due to resource constraints.

Based on the responses of teachers from school 3, 4, 5 and 6, it is evident that although management is willing to help them, resource constraint is the main cause of concern that affect their progress of providing or supporting their teachers to implement curriculum change effectively. Shortage of funds hit hard on under-resourced schools and it ended up
affecting the effectiveness of curriculum implementation. Teachers from the latter schools have experienced common challenges that are exacerbated by inadequate funds. Teachers from the first two schools are of the view that their management is negligent and clueless on how the curriculum can be implemented.

Teachers from school 1 are worried about the workshops that are attended for a short period of time. They seem not to be impressed by the workshops on the implementation of new curriculum development are taking place. They conclude that they fear the support they are getting from the subject advisors is not enough for them to understand how the changes in curriculum need to be implemented for effective teaching and learning of science in their schools.

Teachers from school 2 seem to be comfortable with the new changes as they are newly trained teachers from university. Although they are newly trained, they seem not to be familiar with the new curriculum, CAPS. This leaves subject advisors setting experiments and tests to maintain the standards.

Eight (8) teachers from school 3, 4, 5 and 6 also seem to have good understanding on some of the changes in curriculum. It is not clear as to whether they have been trained or have acquired the knowledge by themselves. Their problem in realizing the effectiveness remains the inadequacy of resources. Another problem area is the lack of proficiency in the language of teaching as learners still struggle to read and write. In the case of support, teacher (1), (4), (2) and (3) also mentioned that there is no after training monitoring by subject advisors to affirm the effectiveness on the implementation of the new curriculum. The other four teachers are not certain as to whether they are getting enough support from the subject advisors.

*Synthesis*

According to the response of teachers on support and monitoring, it goes without saying that there are those who need special support to understand the changes in curriculum. These are the generation trained before the development of outcomes based education (OBE). However, there are others who seem to have been trained, but as changes come one after another they seem to be confused. It becomes apparent that these teachers need enough curriculum support and extended time of training by subject advisors. The literature reviewed emphasized that, at times of change even the most well-adjusted individual or cohesive family or organisation will need extra support. This tells that despite the fact that teachers have had their theoretical
training, they are often confused when faced with fast changes in their classrooms. (Jacobs, Vakalisa&Gawe; 2004:314) and (Lovat& Smith; 2003:195).

Other teachers complained about resources that even though they understand how to implement curriculum change, the issue of resources is the main cause of ineffective teaching and learning of science during this new curriculum dispensation in science more especially in under resourced schools. According to Rogan and Grayson (2003:1196) in literature reviewed, they stresses that in order for capacity to support innovation there is a need to plan to spend time and resources in the development of capacity in situations where it is lacking.

According to views by teachers, it means there might be needs of support that can help them to make changes in science curriculum have positive effects on teaching and learning of science. There is need for subject advisors to match the changes that taking place in the new curriculum reform. Moreover, the literature reviewed also assert that, since the beginning of new changes in 1994, it would have been of great importance for advisory service offered by advisors to change to match the curriculum change. As a result, positive support offered to teachers could bring about positive results during this period of curriculum reform (Grobler, 2003:34). It implies that monitoring and support is crucial in the time of curriculum change. Furthermore, Rogan and Grayson (2003:1187) emphasized that change has to be realistically planned and subsequently monitored and those who in charge should be supported in many ways.

4.5.2. Theme 3: principal responses (Focus group 2) theme 3.

Description

Principals from school 1, 2 and 3 indicated that for curriculum innovation to be effective, all the stakeholders must feel as part of the innovation. The response from the above principals shows positivity when it comes to the involvement of the management in supporting curriculum reforms in their schools. They also indicated that is not only the school management teams who are supposed to be involved or to take responsible part in the process of curriculum development. They also indicated the issue of parents who feel like they are not part of the curriculum development in their schools. Principal (5), principal (2) and principal (1) indicated that they have tried to develop the curriculum support team in their schools, of which is the part of it is comprised by the school management team.
They further indicated that although, there are no people who have specialized on curriculum in their schools, they try by all means that the committee is effective and functional. However, those committees also need support from outside which is support of the subject advisors as they view them to have expert knowledge in curriculum. These are other inputs from the two principals from three schools mentioned above. Principals from schools 4 and 5 were closely related. They indicated that even if they would like to be involved in the curriculum development, the problem is that they have got no idea of what is happening in the curriculum development themselves. They further indicated that it would have been if the people who deal with curriculum thought of training them as school management as they feel like they are part of curriculum innovation not just oversee of it. Principal (5) and principal (1) indicated that there is no need of managing something that do not have good understanding of it because you do not have what is right or wrong from what you are supposed to observe. Principal (6) also mentioned that may be the curriculum changes, more especially in science would have had a positive effect if the issue of training the managers in curriculum changes have been taken into consideration.

Principal (4) was very clear in his respond for themes. He mentioned that his work is to manage the school, but the issue of curriculum and changes that are taking place is the work of the subject head which is something he think is being taken care by the people concerned. He indicated that the school management need to be involved and support every activity that are related to the changes in science more especially science subjects as they are subjects that seem to be very difficult for learners in his school. What he differs from others is that although he understands that the school management should be more serious in supporting curriculum innovation, he had not attempted to form a curriculum committee that can help with curriculum activities in his school and it never crossed his mind except that we are taking about it. He indicated that may be if they can start to take this matter seriously, there might be an improvement in the effect of curriculum changes in his school.

Looking at the response given by the teachers in theme 3, there is clear indication that teachers are most worried about the support was mainly focused on the resources and training they got from subjects advisors. However, they mentioned a little bit about the support from the principals which is only to allow them attend workshops based on changes in curriculum. From the look of things, it seems as if the teachers feels that the support they are getting from the principals are not enough for them to can implement or make the changes in curriculum have positive effects. However, the principals’ feels like issues concerning curriculum do not
concern them most in their everyday activities of running the school. It is like what matters the most is to see if teachers are attending workshops and attending their classes religiously.

The principals’ responses indicate that their skills of knowing what is happening in the curriculum are not taken seriously by the curriculum developers. Most of them are even reluctant to form curriculum support committees which they indicate they will start considering them after the interviews. They also emphasized that issue of not understanding the changes in curriculum development which is not enabling them to see what is expected from them when it comes to curriculum support in their schools. It results on them not being able to support their teachers on the process of implementing effective changes in curriculum.

Principal (5), (2) and (1) responses indicated that, it is necessary for management to be up to date with changes that are taking place, not only in science as they are the ones who are supposed to respond to questions on how the changes in curriculum development are affecting teaching and learning. They also indicate that training for the school manager to be able to have an idea in curriculum is of great importance to make the positive effects of science curriculum in teaching and learning. It is clear that supportive leadership from the management is crucial so that they can facilitate change process and the implementation of new ideas in curriculum development. Therefore, the training of principals as managers of the school might be very important to avoid the feeling of being disempowered by the teachers. Teachers might feel like they are not getting enough support which can also affect the success of curriculum in teaching and learning. It is clear that the management failed to report back to their staff concerning the effect of curriculum development might be the result of them not having enough training to can do that. Therefore, it is important for the, management of the school of the schools to have knowledge and capability to perform their duties and continue their support and monitoring of new curriculum development in their school. Referring to the response by the principals this might improve the effectiveness of new changes in curriculum.

**Synthesis**

According to literature reviewed, Bantwini (2001:169) argued that it might be wise for the successful model to can address both internal and external factors that influence peoples understanding of new curriculum reforms and their new practices. Therefore, the principals’ inadequate skills on the new curriculum development are a clear indication that it is high time the curriculum model consider the training of skills not only to the teacher and the school managers themselves.
The issue of resources have been mentioned by the teachers throughout the responses in the dissertation. According to literature reviewed, Rogan and Grayson (2003:1175) emphasized that there is a tendency in South Africa of not taking into consideration the existing diversity of schools and mandate complex and comprehensive changes in the systems that may or may not be ready to cope with those changes. According to teachers’ response on theme 3, it is clear that the issue of resources and skills in supporting curriculum has been overlooked by those who are responsible for the curriculum development and support in the circuit.

4.5.3. Theme 3: subject advisors responses (focus group 3)

Discussion

The question on monitoring and support were considered very interesting by subject advisors. According to responses that they have given, it gives a clear picture that these are the question they have been waiting for all these times. Subject advisor (1) indicated that, although they are trying very hard to monitor the schools in the area, the resources remain the burning issue; she further indicated that the accessibility in some of the schools is not easy. Many roads leading to the schools are not in good condition more especially after heavy rains. She also indicated that in other areas it needs a four wheel drive vehicle access the schools. These make their job of monitoring difficult. In her response she indicated that the science subject advisors are faced with large number of school as they not only to monitor the school the schools that are only found in their circuit (sibasa). They are also expected to monitor other schools in the District. As a result, only eight (8) subject advisors are expected to round up all the schools.

Subject advisor (2) indicated that the issue of accessibility to all the school is the most challenging issue. He further indicated that they decided to concentrate mostly in the school that have underperformed and ignore those that are performing up to their level best. He mentioned that they have noticed an improvement from all the schools that they have visited throughout the year. He indicated that they have problems of transport. He also mentioned that the issue of capacity. He indicated that the number of subject advisors in science is not enough to can manage all the schools. He indicated that only eight subject advisors are expected to monitor two hundred schools in the whole district. He said “The scarcity of subject advisors might also have contributed to the changes in science teaching and learning in the circuit as well as the whole District”. He indicated this in his response in appendix (C2). He continued and mentioned that although the Government is trying to give them
training to support the changes in curriculum, it seems as if the issue of resources in under resourced schools have been underestimated. Subject advisor (2) also indicated that although they wish to see what teachers are doing in the class after training, it is no easy because most of the schools do not even have laboratories. They are expected to take learners to science centres in order to conduct experiments.

Comparison

Trying to compare the responses given by the subject advisors, it seems as if they are all facing the challenges of resources when it comes to the implementation of the changes in curriculum. Teachers are worried about the support they are getting from the subject advisors. The subject advisors also have challenges of acute shortages and challenges and non-filling of available vacant post for subject advisors for the whole District. They are also worried about accessibility and transportation to can be able to reach all the schools in time.

Teachers are also facing challenges of the management which is not having enough skills to can manage the changes in curriculum. It seems as if the issue of looking at how these changes are impacting the real teaching and learning activities inside the classroom has been overlooked or not considered as important. The number of subject advisors and other commitment they are involved in, make it not possible for them to can visit teachers and observe the lessons to see whether they are doing exactly what they have been taught in the workshops. Looking at all responses from focus group 1,2 and 3 for theme 3, it gives the clue that the main issue that is affecting teaching and learning in the new curriculum development might be scarcity of resources.

Synthesis

According to the responses by the subject advisors, it seems as if the resources and capacity of subject advisors might be the main reason the subject advisors are unable to monitor and support teachers in the process of curriculum changes more especially in science subject in the schools in the rural areas. However, in comparative education from other countries Sharp et al (2009:250) also stated the same problem that factors like teachers’ knowledge and expertise, appropriate teaching resources, unplanned nature of service of in-service training and disparities according to place or region is a major concern that need special scrutiny and understanding. According to the subject advisors response, it means that the fact that they are in rural areas where the schools are inaccessible because of the state of the roads, they should
have been provided with enough resources to can reach all places. However, they are trying their best to reach those places which take long time than it was expected more especially during rainy season.

It means that, may be it would have been better if the provision of resources could have been planned not overlooking the geographical areas where most of the schools are found. Therefore, this might be the reason the changes in curriculum are still faced with unresolved problems that are impacting curriculum in negative ways. According to the responses given by the subject advisors, it is clear that they might not be getting the support they need for them to support and monitor changes in curriculum with ease. It seems as if they might have waited too long for the support they expect to be getting from the department which makes them to be unable to give teachers and learners the support they need to can make the changes in curriculum effect teaching in desirable.

4.6. Theme 4. (Suggestion for future planning of changes in curriculum)

4.6.1. Theme 4: Teacher’s responses (focus group1)

Discussion

Most of the teachers’ responses were almost the same in answering theme four. They were all concerned about the resources. Seven teachers made it clear that it would be of great importance if people who work with curriculum consider the issue of teacher and learner support material before they start implementing the new curriculum development. They further indicated that teachers skills must be taken seriously by training teachers in accordance with the changes which are about to take place as this might be the solution to a situation where you find a teacher not knowing what he or she is expected to do in order to implement the changes in curriculum.

Two teachers indicated that there must be support structures that will help them after workshops by defining in details which approach they must follow and how they can implement what they had been trained from the workshops. However, most teachers were not happy about the support they are getting and the after workshop service. Most of them suggested that there must be a provision of support that checks whether what has been done in the workshops is actually implemented in the real school situation. Two teachers from
school 1 also emphasized that the time frame between curriculum development and implementation should be prolonged in the future so that the curriculum workers might get enough time to train them the skills on how to implement the new curriculum development. They further indicated that people who conduct workshops must be well trained so that they can give them information they can understand. They also emphasized that if training of people who are supposed to workshop them might take too long, they must be people relevantly well qualified to work with curriculum to ease the pitfalls. It will ensure better understanding by the teachers who are expected to implement those changes effectively. One teacher suggested that for the effective changes in science curriculum, each and every school must be provided with a qualified curriculum advisor who can give advice whenever it is needed. He gave the reason that sometimes needs practical help from the subject advisors, but because of their capacity is not easy for them to be available in time. For one to get help, he/she have to visit them in offices and it is not easy to get hold of them because of their time schedule. He also indicated that subject advisors are available; they would help to set the state of the laboratories in their schools.

Analysis

In responding to theme 4, teachers seem to be emphasizing that teacher support and learners support materials might bring effective changes in curriculum. The main setback is resource constraints which hinders the effectiveness of the curriculum in positive way. However, others seem to be ignorant or resisting to move from one change to another. It is not clear whether is the problem of learning resources, inadequate skills or the attitude that the teachers might be having in the changes of new curriculum. They are also criticizing the training they receive during curriculum development that the time for training is too short for them to implement the changes effectively. They seem to be concerned about the newly developed curriculum, curriculum assessment policy statements (CAPS) which have been introduced to grade ten (10) without supply of textbooks. The curriculum was believed to be more user friendly than, revised national curriculum statement (RNCS). They indicated that although it seems to be coming with some correct measures that can improve the effectiveness of curriculum, the main problem they are encountering are the learning resources that are not available. From the basis of the above statement indicated by some the teachers, it seems as if history might repeat itself. Although there is a wish that the curriculum development gets improvement from all the angles, planning remains one of the problems faced by the people who are involved in curriculum development. The grade ten (10) learners are expected to
write practical work which constitutes their marks for final exam. However, teachers are complaining about some of their schools which do not have a single equipment in the laboratory. They are expected to take their learners to one science centre in the district, which is not easy for all the learners to get a chance.

Synthesis

The teacher’s suggestion for future planning is mainly based on the support and provision of learning resources in science. They also indicated that the skills which they have acquired during the workshops are not enough. This might be caused by the short space of time between curriculum development and its implementation. They suggested that for future planning of curriculum, there must be provision of enough time when it comes to training for the training of new curriculum development in science as these are the subjects that seem to be very difficult for learners. Khishfe & Lederman (2007:939) and Bantwini (2009:169) argue that there must be a good understanding and common goals to all recent reform movements in science and successful continued professional development model which can address both the internal and external factors and this might result in achievement on scientific literacy. Furthermore, Hart (2002:1239) emphasizes that it might be imperative to take into consideration the development of teachers’ knowledge to suit the changes in curriculum. According to the literature reviewed this might be a stepping stone to the success of curriculum implementation of science.

4.6.2. Theme 4 principals’ responses (focus group 2)

Discussion

Principal (1) and principal (2) suggested that the future curriculum developer in science must have pre-planning before they start implementing the changes in science curriculum as sciences are very demanding subjects when it comes to skills and resources. They also indicated that principals must also get training on curriculum as they are dealing with everyday activities in the school including managing the whole school. They also suggested that if that is not possible, there must be a provision of school-based subject advisors who can help teachers on a day-to-day basis of implementing the changes in curriculum.

The suggestions for future planning from principal (3), (4), and (5) and (6) were closely related with the one of teachers. They indicated that the resources are the main problems including the skills and knowledge by teachers more especially in science. They suggested
that in future this must be taken into consideration before the changes in curriculum are implemented. Principal (5) in appendix (B5) remarked that teachers must have clear understanding of science curriculum for them to be able to make changes in science curriculum effectively.

There is no big difference between the suggestion given by teachers and the ones given by the principals. However, principals are mainly emphasizing that the issue of skills and knowledge for teachers must also be taken into account by the curriculum developer in science. Teachers and the principals also suggested that provision of resources must be looked at before any development that might take place in curriculum in future for successful changes in science curriculum.

Analysis

It is clear that teachers and principals see that there is a need for resources in the schools that are in rural areas. Their views indicate that, the under-resourced schools are finding it difficult to implement the set standards of the changes in science curriculum. They view inadequacy in resources as the stumbling block to effective curriculum changes in under-resourced schools.

Synthesis

According to the literature reviewed on the issue of schools that are under-resourced, Grayson (2003:1175) emphasizes that there is a tendency in South Africa of not taking into consideration the existing diversity of schools when it comes to the provision of learning resources and skills. They further indicate that there might be a complex and comprehensive changes in the systems that those schools may or may not be ready to cope with them. Principals also indicated the issue of skills and knowledge in science curriculum by them and teachers as important for effective implementation of curriculum change as a suggestion for of future planning of the changes in curriculum reform. Moreover, Witz & Lee (2009:409) in the literature reviewed suggest that changes must include broadening of scientific literacy as an educational goal that encourage the familiarity of both students and teachers with the nature of science and advocate integration in science, technology and society as a classroom approach. This means that the teacher understands the nature of science and the changes that are taking place in science might make a positive effect in teaching and learning of science.
4.6.3. Theme 4 subject advisors (focus group 3) (subject advisor focus group 3)

Discussion

All two subject advisors suggested that it would be better if they were given enough time to conduct the workshops than just five days for each group. They also indicated that there are no enough science subject advisors. It would be wise if the government increased the number of staff responsible for monitoring and support of curriculum in the near future. They further indicated that they are only eight (8) science subject advisors for the whole District. It is not easy for them to can reach all the schools or focus in their own circuit only. They are supposed to round up the entire District. They suggested that the number of the curriculum workers must be increased so that they can be able to see how the changes in curriculum are affecting teaching and learning of science.

They also suggested that there must be a provision of transport that can help them to access the areas where it is difficult reach because of roads conditions. They indicated that it would be better if the government speed up the provision of vehicles to them so that they can manage to reach all possible places.

It seems as if all the focus groups are suggesting resources. Teachers and principals are mainly focusing on the teaching and learning resources. The subject advisors are mainly focusing on administrative support to enable them carry their line function of monitoring and support. The issue of transport and shortage of subject advisors which is not enough for them to can monitor and support the effective changes in science curriculum as the main challenge that need to be addressed.

Analysis

The subject advisors are also not happy about the resources. It means that the issue of resources is not affecting teachers only. The science subject advisors also indicated that their staff are not sufficient to reach the capacity of schools they are expected to monitor and support. That might be the reason they suggested that the number of subject advisors must be increased so that they can reach the capacity needed by the changes in science curriculum. They also indicate the issue of time. They suggested that time must be prolonged to suit the needs of the changes in science curriculum. Teachers must be given enough time of training so that they can have enough knowledge and skills on how to implement the changes or the
development in science curriculum in more effective way. It would also help them understand what is expected from them by the curriculum planners.

**Synthesis**

According to the literature reviewed, Rogan and Grayson (2003:1187) suggest that understanding the theories behind curriculum change in science might be crucial in influencing curriculum reforms to developing the programmes that might examine the success of new innovation in curriculum. Therefore, the subject advisors also suggested that they also need clear understanding of new changes in science curriculum. This can be done by giving them training that is enough for them to effectively train teachers on the new curriculum development that may take place. The issue of training and resources also remain a challenge even in well developed countries like United Kingdom (UK). The literature reviewed on the comparative impact of curriculum change in other countries revealed that factors like teacher’s knowledge and expertise, appropriate teaching resources, unplanned nature of in-service training and disparities according to place or region is a major concern that needs to be taken seriously (Sharp et al, 2009:250)
### 4.7. Observation Results

Appendix: D1: Observation guide and comments for school 1

| School…1……………………………………………………… |
| Subject…life sciences……………………………………………………… |
| Researcher arrival…8:00………………………………………… |
| Observation Start…8:30………………………………………… |
| Number of learners …65………………………………………… |
| Boys…30………………………………………………………… |
| Girls…35………………………………………………………… |
| Date…18/07/2012………………………………………………………… |

Checklist for observation in school 1 (A guide for observation)

<table>
<thead>
<tr>
<th>Activities, interaction and environment checklist</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Classroom: Is the classroom adequate for teaching and learning e.g. is sitting space conducive for learning and fit for classroom practice?</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>2. Classroom or laboratory: equipped with chart, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscope slides and cover slips et cetera.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3. Learners: adapt to the changes, demonstrate good group work skills, confidence.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4. Teacher understands new approaches, positive about new curriculum reforms, makes use of new approaches, understands new curriculum policies in science, manages to implement changes in class, shows knowledge and skills to teach the subject.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5. Classroom: classroom setting conducive for learners to interact in activities in their groups.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6. Learners’ activities: classroom activities are learner-centred.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7. Teachers: Teachers work as facilitators of lessons.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8. Teacher: skills and knowledge are in accordance with the new changes in curriculum.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>9. Teachers: are able to engage students in high order thinking.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>10. Teachers: are able to deliver high quality feedback.</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Teachers and learners: they have positive relationships and teachers engage learners in active participation.

Comments:

In the classroom learners were seating in rows as there was no space to put a round table. Learners sat in groups of three at desks that fit only two people. It was not easy for learners to interact with each other as they were forced to sit in rows. The laboratory was full of empty bottles. It was not easy for learners to demonstrate their group work as there was no space even for the teacher to move around. The teacher seemed to understand the new approaches, but it is not easy to practise them because of the classroom environment. The teacher tried to make learners work in groups which did not work and he switched back to teacher-centred method for the smooth going of the lesson. The feedback was not clear as learners seemed not to have confidence when it came to active participation.
Table 4.4.2

<table>
<thead>
<tr>
<th>Activities, interaction and environment checklist</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Classroom: Is the classroom adequate for teaching and learning e.g. is sitting space conducive for learning and fit for classroom practice?</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>2. Classroom or laboratory: equipped with chart, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscope slides and cover slips et cetera.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3. Learners: adapt to the changes, demonstrate good group work skills, confidence.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4. Teacher understands new approaches, positive about new curriculum reforms, makes use of new approaches, understands new curriculum policies in science, manages to implement changes in class, shows knowledge and skills to teach the subject.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5. Classroom: classroom setting conducive for learners to interact in activities in their groups.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6. Learner’s activities: classroom activities are learner-centred.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>7. Teachers: Teachers work as facilitators of lessons.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>8. Teachers: skills and knowledge are in accordance with the new changes in curriculum.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>9. Teachers: are able to engage students in high order thinking.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>10. Teachers: are able to deliver high quality feedback.</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Comments

When the researcher arrived in school 2 (two), the learners were already waiting in the laboratory. There was no sign which indicated whether the room was a laboratory or an ordinary classroom. It seemed as if the other part of the lab was used as a store room because when the researcher entered the room there were boxes full of old textbooks. One could not differentiate whether one was entering a store room or a laboratory. There was no way learners could have managed to work in activities because there was no single chemical or equipment. The teacher started explaining the experiment by writing some of the information on the board. What the researcher saw was learners who were busy writing or copying the experiment from the board. The lesson plan written by the teacher indicated all the activities and the instruments that were needed to carry out the experiment, but according to the observation it was not easy for the teacher to bring theory to practice because of the inadequacy in learning resources. A well written lesson plan was just a theory on paper. After discussion the teacher gave learners feedback. The researcher decided to just sit at the back with the learners recording the information without interrupting any activity as she had promised. The lesson plan indicated that the teacher had the knowledge and skills of the new changes.
Table 4.4.3

School...3………………………………………………………
Subject…Life sciences………………………………………………………
Researcher arrival…8:00…………………………………………
Observation Start…8:35……………………………………
Number of learners …60…………………………………………
Boys…25…………………………………………………………
Girls…35…………………………………………………………
Date…26/07/2012…………………………………………………………

Checklist for observation in school 3 (A guide for observation)

<table>
<thead>
<tr>
<th>Activities, interaction and environment checklist.</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Classroom: Is the classroom adequate for teaching and learning e.g. is sitting space conducive for learning and fit for classroom practice?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>2</strong> Classroom or laboratory: equipped with chart, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscope slides and cover slips et cetera.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>3</strong> Learners: adapt to the changes, demonstrate good group work skills, confidence.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>4</strong> Teacher understands new approaches, positive about new curriculum reforms, makes use of new approaches, understands new curriculum policies in science, manages to implement changes in class, shows knowledge and skills to teach the subject.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>5</strong> Classroom: conducive for learners to interact in activities in their groups.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>6</strong> Learners’ activities: Leaner-centred.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>7</strong> Teachers: teacher work as facilitator of lesson</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>8</strong> Teacher: skills and knowledge are in accordance with the new changes in curriculum.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>9</strong> Teachers: are able to engage students in high order thinking.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong> Teachers: are able to deliver high quality feedback.</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Comments

When the researcher entered the room, she saw the room full of empty bottles and broken equipment. There was no running water. Learners were sitting in rows. There was no interaction taking place between learners. There was no picture on the wall that indicates that the room was a place to conduct experiments. What the researcher saw were shelves with some old textbooks on the wall. The room looked like it had never been cleaned for some time. The teacher introduced the researcher to the learners. The researcher was sat at the back row in the classroom while the lesson was in progress. The room was packed in such a way that it was difficult for the teacher to move around. Learners were forced to sit in rows. It was like the teacher was a transmitter of knowledge while learners just listened. Learners seemed not to understand as there were no practicals taking place. The experiments were done in the form of a theory. The teacher seemed to be enjoying explaining everything while learners were just sitting copying what he was writing on the board. They were expected to have had answers to some questions they raised but did not get the feedback. Maybe it was because of time as the lesson was only one period which is 35 minutes.
Appendix D4: Observation guide and comments for school 4

Table 4.4.4

<table>
<thead>
<tr>
<th>Activities, interaction and environment checklist</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Classroom: Is the classroom adequate for teaching and learning e.g. is sitting space conducive for learning and fit for classroom practice?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2 Classroom or laboratory: equipped with chart, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscope slides and cover slips et cetera.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3 Learners: adapt to the changes, demonstrate good group work skills, confidence.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4 Teacher understands new approaches, positive about new curriculum reforms, makes use of new approaches, understands new curriculum policies in science, manages to implement changes in class, shows knowledge and skills to teach the subject.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5 Classroom: conducive for learners to interact in activities in their groups.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6 Learners’ activities: leaner-centred.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7 Teachers: teachers work as facilitator of lesson.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8 Teacher: skills and knowledge are in accordance with the new changes in curriculum.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>9 Teachers: are able to engage students in high order thinking.</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Comments

School (4) does not have a laboratory at all. They do their practicals in the classroom. When resources arrived for observation learners sat in rows in groups of three at desks meant to seat only two people. Inside the classroom there were 70 learners the classroom sitting arrangement was not conducive for group work. It was difficult for the researcher to move from the front to be back where she was supposed to sit while videotaping and taking some notes. The classroom was mostly teacher-centred. Learners were quiet and listening to the teacher as he taught. The researcher heard the learners talking at the beginning of the lesson while the teacher introduced. That was all. Learners were quiet until the end of the lesson. However, they took notes. It was not clear whether the learners were afraid to see a new person in the class or they were used to that mode of teaching. The researcher was sitting at the back with the learners observing and taking notes. In the classroom there was no equipment related to science except textbooks that learners were sharing. The teacher showed no skill of understanding the new changes in science curriculum.
Appendix D5: Observation guide and comments for school 5.

Table 4.4.5

<table>
<thead>
<tr>
<th>Activities, interaction and environment checklist</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Classroom: Is the classroom adequate for teaching and learning e.g. is sitting space conducive for learning and fit for classroom practice?</td>
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</tr>
<tr>
<td>2 Classroom or laboratory: equipped with chart, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscope slides and cover slips et cetera.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3 Learners: adapt to the changes, demonstrate good group work skills, confidence.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4 Teacher understands new approaches, positive about new curriculum reforms, makes use of new approaches, understands new curriculum policies in science, manages to implement changes in class, shows knowledge and skills to teach the subject.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5 Classroom: conducive for learners to interact in activities in their groups.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6 Learners activities: learner-centred.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>7 Teachers: teachers work as facilitators of lesson.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>8 Teacher: skills and knowledge are in accordance with the new changes in curriculum.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>9 Teachers: are able to engage students in high order thinking.</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Comments

The researcher arrived early at school 5 (Five). The researchers visit was more than expected as she asked for the consent two weeks before the real observation took place. When the researcher arrived, the lesson was to start in 30 minutes. The researcher asked for permission to be directed to the laboratory to observe the laboratory setting before the lesson began. In the laboratory, the researcher saw the laboratory tables and taps, but there was no running water. It seemed as if the laboratory was not in use for a long period of time because there was no sign of experimental activities taking place there. After 30 minutes the lesson began. As laboratory chairs were not enough some learners were forced to stand. The researcher was introduced again by the teacher and read to the learners the importance of observation. The researcher moved to the back row and stood there. She managed to video tape activities and wrote notes. The teacher seemed to have skills and knowledge of the new curriculum as learners were engaged in active participation. The classroom activities were in accordance with the new changes in science curriculum. Most of the resources and equipment used during the lesson were improvised by the learners and teachers. They managed to improvise the equipment because of the nature of the experiment.
Appendix D6: Observation guide and comments for school

| School…6………………………………………………………………… |
| Subject…Life sciences……………………………………………………… |
| Researcher’s Arrival…8:30………………………………………………… |
| Observation Start…8:45………………………………………………… |
| Number of Learners …70………………………………………………… |
| Boys…25…………………………………………………………………… |
| Girls…45…………………………………………………………………… |
| Date…23/08/2012………………………………………………………… |

Checklist for observation in school 6 (A guide for observation)

<table>
<thead>
<tr>
<th>Activities, interaction and environment checklist</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Classroom: Is the classroom adequate for teaching and learning e.g. is sitting space conducive for learning and fit for classroom practice?</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>2 Classroom or laboratory: equipped with chart, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscope slides and cover slips et cetera.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3 Learners: adapt to the changes, demonstrate good group work skills, confidence.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4 Teacher understands new approaches, positive about new curriculum reforms, makes use of new approaches, understands new curriculum policies in science, manages to implement changes in class, shows knowledge and skills to teach the subject.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5 Classroom: conducive for learners to interact in activities in their groups.</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Comments

Immediately after the researcher and the teacher arrived in the laboratory, the teacher introduced the researcher to the learners and reminded them of the purpose of the visit as the researcher had already asked for permission weeks earlier. The researcher moved to the back seat without interrupting classroom activities. The laboratory looked untidy. At the corner there were two microscopes which were covered in dust. This was an indication that they had not been in use for quite a long time. The laboratory equipment that were available were scattered all over the place. Some were broken indicating that there was no one who looked after them. The lesson of the day was on how to use microscopes. Each and every learner was holding an onion from home to use during the experiment. The classroom condition was not conducive for learning as there was dust all over the place. The teacher seemed to have knowledge of the new changes as he was trying by all means to engage learners during classroom activities. The teacher showed to have skills and knowledge that are in accordance with the new changes in curriculum even though it was not easy to put them into practice because of the learning environment and inadequate resources. However, the teacher managed to give learners quality feedback.

Discussion

Observation was also part of data collection method. The researcher also used observation because certain information can best be obtained through observation. The researcher conducted observation on teachers and learners’ activities. The researcher also observed the state of laboratories and classroom settings. The idea was to observe the factors that affect the
implementation of new changes in curriculum and how these changes are impacting teaching and learning. The researcher used a checklist and sat at the back of the classroom. The checklist focused at the interaction between teachers and learners and the teaching method. It also focused on laboratory or classroom in terms of equipment and setting.

Unlike in questionnaire and interviews where respondents participated positively, in observation only ten (10) teachers allowed observation during classroom activities. Two teachers did not. They only allowed laboratory observation without them doing activities with the learners. In all ten teachers allowed to be observed, five did not want to be videotaped or taken photos. They allowed the researcher to observe and write information only. The researcher did as she was told for the progress of the observation. However, the observation for ten (10) teachers went well.

In terms of adequacy of classroom for teaching and learning, most of the schools have broken windows and broken furniture. Most of the classes are overcrowded with more than seventy (70) learners in each classroom. The classroom setting was not suitable for group work because learners are supposed to sit in rows so that their tables fit the classroom.

As for laboratories, some schools do not even have a laboratory. Those that have laboratories did not have the necessary equipment or no equipment at all. Those that have equipment these are dilapidated and with no chemicals as if they had not been in use for long period of time. Although teachers were aware of the observation that was going to take place, they did not bother to set their laboratories well. Those who had laboratories indicated that they did not always work in laboratories with their learners because there were no materials. They just wrote experiments on the board and explained the processes to the learners. Some laboratories are used as staff rooms and storerooms for old text books.

In many instances group work was not possible because of overcrowded classrooms. The table setting seemed to be the one making learners not comfortable to work in groups. However, in most instances teachers never bothered to encourage group work inside the classroom. The classroom lessons were, for the most part, teacher-centred. Although, teachers seemed to be ready to present their lessons by also preparing their lessons plans, it was not easy for them to translate what was in the lesson plans in practice. It is like they prepared the lesson plans because they knew that they were going to be observed. They seemed not to be able to engage learners in group work and other skills that are supposed to be done during
classroom activities. This affected the learners in coping with the changes, not allowing them to demonstrate classroom activities based on the new changes in curriculum.

In the case of understanding the new policies, teachers seemed to understand new curriculum policies in science. However, they seemed to have difficulties in translating the theory into practice. Other teachers were aware of planning their lessons according to the needs of the new changes in science curriculum policies. When it came to practice they seemed to follow teacher-centred methods and learners were left doing little or nothing of what had been planned in the lesson plan. Others felt uncomfortable about the requirements of the new policies. This might be caused by resource constraints and teachers’ attitudes. Although, some of the teachers understood the new policies, they struggled to successfully translate the new method into practice. The lessons observed were still dominated by teacher centeredness and teacher talk and writing on the board where learners’ activities were merely to copy the notes. At the end of the lesson they were given homework. What is written in the lesson plans contradicts with the real practice in the classroom. The researcher realized that the confusion might be caused by lack of learning support materials. Some teachers seemed to have skills and knowledge of the new changes; however, the most difficult part was to put them into practice. Teachers ended up doing everything inside the classroom and learners sat like empty vessels that needed to be filled with knowledge.

Analysis

Checking from observation results there are certain factors that make the new changes in curriculum impact in a negative way in under-resourced schools. These factors seem to be contributing on the ineffectiveness of curriculum development and changes in most schools in the circuit.

The schools are still faced with challenges of large classes which make it difficult for teachers to move around. This leads to management problems which make affect teaching and learning negatively, watering down the effectiveness of the new curriculum development and implementation in science. Another factor seems to be learning support materials. This further frustrates teachers and learners alike and results in the ineffective implementation of the curriculum change, leaving the new change with little or no effect on teaching and learning in less resourced schools.
Lack of important resources in science such as laboratories or working laboratories, libraries, furniture and infrastructure also constrain the effectiveness of curriculum change and transformation. Teachers are overloaded in terms of teacher-learner ratio and this renders the effective facilitation of the new changes in science curriculum difficult. The schools are very far from public libraries which prevent learners from doing group research. The available libraries are poorly equipped with the necessary materials learners need for research. Inadequate knowledge also seems to be a problem. Some of the materials in schools that have little equipment look like they have never been touched. It might be the teachers’ inadequate knowledge on how to use the laboratory chemical that makes them feel reluctant to visit their laboratories for experimental activities. Most of the activities that need the laboratory are done inside the classroom by using chalk and board.

**Synthesis**

Green *et al.* (2005:108) have asserted that it is important to understand curriculum change environment before initiating any curriculum change activity. The observation results indicated that the environment where the changes in curriculum need to be implemented is not conducive for the changes to take place effectively. The classrooms that are overloaded are a clear indication of the situation. The state of laboratories and the fact that other schools do not have laboratories at all is another indicator that the environments where the new curriculum changes have to be implemented have been overlooked by the curriculum planner or developer. Barab & Lechmann (2002:463) also state that while teachers are still adapting with the curriculum to meet the local needs, they do so under more challenging constraints like large classes which in turn lead to less reform type classroom instruction.

Referring to the latter statement, the ineffective delivery of the new changes in science curriculum might be the result of inadequate learning resources and space. Teachers seem to have tendency of delaying acceptance to change which leave them being overtaken by new knowledge on the continuous development of curriculum. Hargreeves (1995) in Bantwini (2009:179) state that teachers are exposed to or trained in new knowledge and skills until other innovations supersede them. It was the researcher’s observation that other teachers seemed to be resisting change even though they know what they are expected to do. Others seemed to be getting well with the new curriculum policy, CAPS. However, there are others who seemed to confuse the new policy (CAPS) with the old way of teaching because the ministry of education termed it “back to basics”. The fact is that the curriculum development
committee decided to remove areas that they view are not working, replacing them with what they believe will be functional in the normal curriculum development process.

According to the observation results, schools in rural areas still experience problems of resources constraints. It seems as if there is a gap in terms of resources between schools in rural and urban areas. As Dean (1998:45) has already stated, schools in previously disadvantaged areas are still faced with inadequacy of learning resources, overcrowded classrooms, demoralized and under trained teachers.

4.8. Conclusion

This chapter discussed the research findings presented by the respondents who are teachers (focus group 1) principals (focus group 2) and subject advisors (focus group 3). The results of the research observation were also presented. The findings mainly focused on the research objectives and the constraints experienced by under-resourced schools. The issue of resources is still a burning issue that affect the effectiveness of the new changes in the schools that are located in rural areas. Historically disadvantage school are still faced with the problem of inadequate learning resources and necessary skills for the success of curriculum implementation and continuous sustainability of curriculum development.

The fact that many teachers still resist the importance of changes that are taking place in the new curriculum dispensation is a reality that needs serious intervention. For the curriculum to become effective, it still needs support and monitoring that will help in checking whether the intended changes in curriculum are being practised in a real classroom situation. The responses from the respondents indicated that there is still a gap that needs to be closed. Therefore, enough support is needed for the effective implementation of the curriculum in rural areas schools. According to the observation results, it is a reality that many teachers are still relying on teacher-centred methods. This situation will not help the new changes being introduced to revamp the curriculum. Observation results also discovered that the state of the laboratories is also a major constraint that affects the effectiveness of teaching and learning in science curriculum changes in some of the schools in Sibasa circuit. The inadequacy of learning resources seems to be the most important factor that affects the effectiveness of the curriculum in rural areas school.

The next chapter will discuss summary of chapters, research objectives (summary of findings and conclusions) and recommendations
CHAPTER 5: CONCLUSION (Recommendations and Implications)

5.1. Introduction

The main aim of this study was to investigate the impact of curriculum changes in the teaching and learning of science in Vhembe District schools.

The specific research questions were as follows:

- What are the effects of curriculum changes in the teaching and learning of science in Vhembe District?
- What are the constraints or factors that might be affecting the effectiveness of new changes in teaching and learning of science in Vhembe District?
- What are the suggestions for future planning of changes in curriculum?
- How do the attitudes of stakeholders affect the effectiveness of new changes in science curriculum?
- How do support and monitoring of changes in science curriculum occur?

This part of the research will revisit the research questions mentioned above, summarize the findings of the research results and offer conclusions based on the findings. As a result, it was necessary to make a brief summary of it. Recommendations for future research will be presented. The researcher will also reflect on the research process that has been undertaken. The conclusion will reflect on whether the main research aim and research questions have been met or answered by the outcomes of the study. It will also indicate how this study could be considered important. Guidance will also be given on how this study could progress in the future.

5.2. Summary of chapters

The researcher introduced the study in chapter 1 (one) and outlined the problem statement, aim of the study, literature review, significance of the study and clarification of concepts. The research problem is: the effects of curriculum change in teaching and learning of science subjects in under-resourced schools of Vhembe District. The research questions which helped to demarcate the research problem is also stated in chapter 1 (one).
Chapter 2 (two) detailed the outcome of the literature that has been studied. The literature studied revealed that a lot has happened since the introduction of new changes in South Africa. The literature revealed that each change has its own effect and challenges when it comes to its implementation. It was also indicated in the literature studied that the effects of new changes differ according to different geographical areas. It is also indicated that approaches in teaching science has been developed from one stage to another since the beginning of new changes up to date. It has also been revealed that the attitudes of teachers towards changes also affect the effectiveness of new changes in science curriculum in schools. It has also been revealed that improved teacher training and development could improve on the effectiveness of new changes in science curriculum. It again emphasized the improvement of monitoring and support on the new changes in curriculum. Furthermore, it was indicated in the literature studied that factors that affect the effectiveness of new changes should be taken into consideration. The literature studied continued and revealed that disparities between schools in the previously disadvantaged and advantaged should be considered to encourage positive effects of the new changes in science curriculum. It also indicated how other countries tried to deal with the challenges that come with the changes for positive effect of new developments in science curriculum. Understanding science curriculum and its new approaches is also stated in the literature studied as the most fundamental process that can improve the effectiveness of new changes in science curriculum.

The third chapter dealt with research methods which included research strategy, ethical considerations, sampling procedures, data collection which includes data collection, techniques such as interviews, observation and questionnaires. It also ended by describing the framework for data analysis, limitation and potential problem.

The fourth chapter discussed case study findings which were described, analysed and synthesized according to themes and research objectives. In this chapter the responses from all the respondents were presented in the form of tables. The research findings indicated that resources are the main factors that make new changes in science curriculum affect teaching and learning in an unexpected manner.

It was also been discovered that most schools in the rural areas lack support and monitoring to enable the effectiveness of the new changes in curriculum. It has also been found that the attitude of teachers towards new changes in curriculum contribute to the negative effects of new curriculum in many schools in the rural areas. It was also discovered that distribution of
learning resources such as textbooks in the new curriculum dispensation has affected the effectiveness of new changes in science curriculum. The research also discovered that the inadequate skills and knowledge by people who are responsible for curriculum implementation affects the real effectiveness of new curriculum development. Also, many schools do not have laboratories where experiments and practicals can be conducted as the CAPS stipulates that learners must do a certain numbers of experiments or practicals and examinations on practicals to progress to another grade in science subject e.g. life science. Inadequate laboratories and laboratory equipment make those changes become difficult to implement effectively. As a result, the government still has a responsibility of making sure that all schools which are under-resourced have enough resources needed by the new changes as the curriculum developments are on-going processes that are supposed to take place in every changing society.

5.3. Summary of findings and conclusions

5.3.1. Research objective 1(one) the effects of curriculum change in the teaching and learning of science in Vhembe District

The literature revealed that the effects of curriculum has always been experienced by teachers and learners long before the beginning of new changes that are taking place in South Africa and other countries. The literature also revealed that since the beginning of new changes there are many approaches that have taken place related to teaching and learning of science. However, the literature revealed that teacher’s perceptions and understanding of new changes in curriculum changes left them with challenges of choosing to accept or reject the changes. It has also been revealed in the literature that when teachers are differentially empowered with the needs of the new changes, it ends up backfiring on the effectiveness of the new changes that are expected to be implemented in the curriculum. It has also been said that it is of teacher’s nature when faced with the challenges of new changes to select what they want and delay the acceptance of new changes until other innovation supersede them. The literature further revealed that it is not all teachers who received professional development and support in math and science who have gained experience to change their practice.

According to the findings of the present case study, teachers indicated that they did not see any reason for them to change the way they teach because they have not received training that is enough for them to effectively implement the new changes. Some responded that new changes need learners who are ready for the new changes which seem not to be the case from
the learners that they have. The research also found out that there are other teachers who resist changing their method of teaching to new methods of teaching which becomes very difficult for those who are willing to support the effectiveness of new changes in teaching and learning of science in the school in Vhembe District. Some teachers indicated that they do not have understanding and knowledge of the new approaches that is why they cannot even notice that what they are doing is in accordance with the needs of new changes or not. In the research finding, teachers also indicated that the new changes have affected their work by bringing too much administrative work and the demand of the newly developed policy (CAPS) which demands more practicals for grade 10 (ten) learners. During the observation it was discovered that there were some teachers who did not have understanding of the changes, but they seemed to have difficulties in translating theory into practice because of the inadequate learning resources.

Although new changes in curriculum have been brought in with the aim of making positive effect in curriculum, there is a lot that needs to be done to make it work for the better of education when it comes to teaching and learning particularly in science subjects. Teachers seem not to have a clear understanding of the new changes in curriculum and in some instances they seem to be ignorant or resisting to take responsibility on the implementation of new changes. The dilemma of whether to change or not leaves teachers with confusion which affects the effectiveness of new changes in teaching and learning of science in schools in Vhembe District. This study indicates that teachers’ perceptions and understanding of new changes in curriculum need to be corrected to make new changes affect teaching and learning in a positive way.

5.3.2. Research objective 2(two): factors that affect changes in science curriculum

The literature identified different factors that determine how changes can affect teaching and learning in schools. The literature also identified the resources, knowledge and skills of the curriculum implementers, disparities between schools as main factors that determine the effectiveness of new changes in curriculum. It has been indicated from the literature that it is better to understand change environment and the degree of resources available to support the effectiveness of change in curriculum.
The study findings indicate that resources are the main factors that make changes in curriculum affecting teaching and learning in a negative way. Teachers indicated that it is not easy to conduct experiments and other activities in a place where there are no laboratories and equipment. During the study it was also discovered that teachers are still faced with the challenges of teaching overcrowded classrooms because of large numbers of learners and fewer classrooms. Principals and subject advisors indicated lack of understanding of curriculum by teachers, their attitude, resources and language barrier by learners as the factors affecting effectiveness of new changes in curriculum.

This study concludes that schools lack capacity and resources to support change. Teachers seem to be having some difficulties in implementing some of the needs of new changes in curriculum because of the inadequacy in teaching and learning resources together with the infrastructure that can make the effectiveness of new changes a success in school in Vhembe District.

5.3.3. Research objective 3(three): how is monitoring and support on the new changes in curriculum?

It has been revealed from the literature that for affective changes to take place, it requires commitment in developing relevant resources, knowledge, skills and training. As a result, even though teachers have their own theoretical training it is necessary for them to receive extra support as they are often confused when faced with fast changes.

The research findings discovered that it is not easy for the subject advisors to give support and monitoring required because of the inadequate resources and human capacity. It has also been discovered during the research that only 8 (eight) science subject advisors are expected to monitor the schools in the whole district, which is difficult. During observation it was found out that that many schools do not have well equipped laboratories which make it difficult for teachers and learners to conduct their experiments in a proper way. It has also been discovered that even people in management do not have enough knowledge of curriculum to support and help with monitoring as there are no enough subject advisors. As a result, it leaves classroom activities with no one to monitor on how effective the new changes in curriculum are being implemented.

According to research findings, lack of resources, skills and knowledge makes it difficult for people who are supposed to monitor and support the new changes in curriculum. This might
be the reason why the new changes in curriculum are not implemented according to the initial plans. According to the responses of teachers, principals and subject advisors, it is clear that inadequate provision of resources in schools that are under-resourced is the main contributing factor that makes the effectiveness of monitoring and support in the new changes in science not desirable.

5.4. Recommendations

5.4.1. Proposed model for preparation of effective curriculum changes and development in science

The main aim of the study was to investigate the impact of the curriculum change in the teaching and learning of science in under-resourced schools in Vhembe District. Based on the outcomes of the study, a model for planning of new changes in the curriculum has been proposed.

1. Provisioning of resources according to socio economic needs.

2. Resources should match the needs of the new development in curriculum.

3. Evaluation plan to assess the success or failure of curriculum development before its implementation.
4. Piloting of the new curriculum development to assess its needs and measure its impact on teaching and learning of science.

5. Prior training of teachers according to the future needs of new curriculum development.

6. Curriculum planners must learn from other counties on how they succeeded for better effectiveness of their own curriculum in science.

7. Support and monitoring on new changes in curriculum should be in place.

8. Materials and human capacity to support curriculum implementation should be in place.

9. Training of principals so that they have idea on how to support teachers on issues related to curriculum in their schools.

10. Should be supported by the Department of Education.
The proposed model indicates the information about the factors and elements that need to be considered before and during the implementation of new changes in science curriculum in order to make it affect teaching and learning in a positive way. The model starts with the provisioning of resources according to socio-economic needs. According to research findings, conclusion in objective I indicates that teachers sometimes fail to translate the theory of new changes in curriculum because of inadequate learning resources in under-resourced schools in rural areas. It might be important if the socio-economic backgrounds of the schools are considered when it comes to the provisioning of leaning resources in schools. Rogan and Grayson (2003: 1174) emphasize that it is necessary for the theory of implementation to take the diversity of schools into account.

The model also indicates that the resources should match the needs of the new developments in curriculum. For the new changes to be effective, the resources must be put in place before the development of any changes in curriculum. The research findings also concluded that the demand of newly developed curriculum policy (CAPS) is not easy to be realized because there are no resources that are provided for the smooth running of practicals. The positive effectiveness of the curriculum might be met if the resources provided are in accordance with the needs of curriculum development in science.

An evaluation plan must also be put in place by the curriculum workers and developers to assess the success or failure of curriculum development before its implementation. This can be done in the form of piloting of the new curriculum development. This will enable curriculum developers assess its needs and measure its impact before unforeseen damage could take place. The piloting process will help to find out:

a. How well the new changes are affecting teaching and learning of science schools.

b. Which changes should be made to make the new changes in curriculum affect teaching and learning in a positive way?
c. What are the resources that need to be provided for positive effect of the new changes in curriculum? The evaluation plan should always be in place to assess effectiveness of the pilot project.

The model further indicates that there must be prior training of teachers according to the future needs of new curriculum development in research objective 2 on the factors that affect changes in science curriculum. The principals and subject advisors indicated that lack of curriculum knowledge by most teachers is one of the main factors that affect changes in curriculum. Inadequate resources is another factor that needs to be considered before the implementation of new changes in curriculum so that teachers have clear understanding of what is expected from them.

It is important for curriculum planners to learn from the mistakes or success of others. There are countries like the UK which have experienced the same problem, e.g. teachers’ limited knowledge and expertise in curriculum, resources and unplanned nature of in-service training and disparities according to place or regions. These are the same problems faced by our country according to research findings and it has been reported that the same problems are affecting the effectiveness of new changes in science curriculum. It is advisable that in future, people who are planning the curriculum must learn from the success and mistakes made by other countries to make new changes in curriculum affect teaching and learning the way it is expected.

The positive effect of new changes in curriculum can also be achieved by seeing to it that monitoring and support by the Department of Education is up to its level best. These can be achieved by seeing to it that the relevant materials and human capacity to support curriculum changes are in place. It has been concluded in research objective 3 on how monitoring and support on the new changes in curriculum can occur. It has been discovered that the number of subject advisors is not enough for them to be able to monitor and support the effectiveness of new changes in science curriculum. Resources or material have also been mentioned as the factors affecting monitoring and support. It has also been indicated in model that for the principals to give enough support and monitoring; they must be trained in order to be grounded in the new changes in the curriculum.

The research findings also show that even people in management do not have any idea of what is happening in the new changes in curriculum. It would be wise for people like principals to get enough training on curriculum so that they are able to monitor and support
teachers in this area. It would also reduce the job of curriculum advisors who seem to be understaffed. The department should be the one providing skills, training and material needed during the process of monitoring and supporting of new changes in science curriculum. Rogan and Grayson (2003:1187) state that change has to be realistically planned and subsequently monitored and those who are in charge should be supported in a variety of ways.

Research objective 4 (four) on suggestion for future planning of changes in curriculum is addressed as recommendation. All the respondents seemed to be concerned about the provisioning of resources. Teachers and principals suggested that in the future there must be school-based subject advisors who will be able to monitor and support teachers on a daily basis. The subject advisors suggested that the number of subject advisors must be augmented in the future so that it will be easy to give maximum support on the implementation of the new changes in science curriculum.

I therefore suggest that curriculum support forums be established at the circuit and district levels. Functional cohesion of curriculum support forums would assist unveiling input from the aforementioned three levels that could forecast curriculum hiccups before and during the implementation of changes in curriculum. The provisioning of a science centre in each and every circuit can help as laboratory equipment are expensive for each and every school to afford and able to handle them.

The following limitations of the study are indicated in order to direct future studies. More research is still needed on the subject.

- The study was done in only one district which is Vhembe District out of five districts of Limpopo Province.
- The research only focused on secondary school level. Further research is needed at the primary school level.
- The research only focused on teachers, subject advisors and learners from Vhembe District. Further research is needed in other Limpopo districts.
- The research employed only the qualitative method. The quantitative method is also needed to provide further statistical evidence.
Besides the limitations of the study indicated here, the research managed to unravel how changes in curriculum are affect teaching and learning of science in under-resourced schools in Vhembe District.
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Appendix A1: Responses of teachers to question 1

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Age</th>
<th>Sex</th>
<th>Tertiary institution attended</th>
<th>Qualification achieved</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42</td>
<td>Female</td>
<td>Venda College of Education (VECO)</td>
<td>Diploma</td>
<td>I feel that there should have been enough time before the changes in curriculum were to be implemented. I feel comfortable with my original method of teaching and I do not see any reason for any change.</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>Female</td>
<td>Giyani College of Education</td>
<td>Higher Diploma</td>
<td>I do not see any reason for changes in curriculum because most of us were not taught to teach in the new curriculum during our tertiary education.</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>Male</td>
<td>Lemana College</td>
<td>Diploma</td>
<td>I feel that changes in curriculum would have important impact if teachers like us were prepared to teach in the new curriculum before it started. I do not think there is a need to change to something we are not ready for.</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
<td>Male</td>
<td>Venda College of Education</td>
<td>Diploma</td>
<td>I feel that people who planned the new changes in curriculum should have looked at the issue of learning resources. I think that our learning resources do not correspond with the needs of changing curriculum more especially in science.</td>
</tr>
<tr>
<td>5</td>
<td>39</td>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tertiary institution attended: Venda College of Education (VECO)
Qualification achieved: Diploma

Responses
I feel that our learners are not yet ready to cope with the new changes in curriculum. The issue of resources is also a burning issue that should have been solved before the start of new changes in curriculum in schools like ours.
Teacher 6
Age: 38
Sex: Female

Tertiary institution attended: Giyani College
Qualification achieved: Higher Diploma

Responses
I do not think it is necessary for me to change my method of teaching because our learners need me to tell them everything. Without doing that it is not easy for them to take responsibility of their own learning with me as a facilitator. I feel rather use teacher-centred methods which contradict with the needs of new changes in curriculum.
Age: 30
Teacher 7
Sex: Male

Tertiary institution attended: University of Venda
Qualification achieved: Degree

Responses
I feel that new changes in curriculum have come at the right time when our education needs to be redressed from the past. However, the problem that we are facing is availability of resources to suit the needs of the new changes in science curriculum in our schools.
Teacher 8
Age: 26
Sex: Male

Tertiary institution attended: University of Venda
Qualification achieved: Degree

Response
I feel that it high time teachers take responsibilities of implementing new changes in curriculum effectively so that we can experience positive effect of new changes in teaching and learning of science. Many teachers are still using the old method which makes it difficult to make learners to get used to the new method of teaching. Therefore, we end up using the method that the learners are used to.
Teacher 9
Age: 32
Sex: Male

Tertiary institution attended: Turffloop
Qualification achieved: Higher Diploma
Responses
The fact that learners seem not to be ready for changes and the shortage of resources, makes me feel that changes in curriculum should have taken place slowly. I feel these changes are happening very fast and it is confusing us in such a way that we do not know whether to use this one or the old method of teaching.
Teacher 10
Age: 36
Sex: Male
Tertiary institution attended: Giyani College
Qualification achieved: Higher Diploma

Responses
Although we have the knowledge of the new curriculum, the problem is the shortage of resources and support from the experienced teachers. It is difficult to change learners’ perception towards the new method of teaching.
Teacher 11
Age: 36
Sex: Male
Tertiary institution attended: Venda College
Qualification achieved: Diploma

Responses
I feel that new changes in curriculum have just added a burden of too much administration work. We spend too much time preparing learners’ files than teaching.
Teacher 12
Age: 48
Sex: Male
Tertiary institution: Giyani College
Qualification achieved: Higher Diploma

Responses
I feel that there is a lot of administration work than teaching. We also do not have laboratory where we can do the experiments demanded by new policy (CAPS). Finally we end up affecting the learners’ progress. I feel that each and every change in curriculum must come with its necessary demands.
Appendix A2: Response of teachers to question 2

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I don’t think there is a reason for me to change the way I teach.</td>
</tr>
<tr>
<td>2</td>
<td>I can’t change the way I teach because learners do not know what is expected from them. If you give them group work, they don’t understand what they must do during class discussion. Therefore it is not necessary to change the way I teach as learners are not ready for the change. We are not trained to teach in the new method, it won’t be necessary to use a method that we are not familiar with.</td>
</tr>
<tr>
<td>3</td>
<td>The training that we have received is not enough for us to completely change the way we teach. I have decided to use a method which is comfortable for both learners and me to avoid confusion.</td>
</tr>
<tr>
<td>4</td>
<td>It is not necessary to initiate changes in an environment that is not prepared for change. Changes demand resources that we do not have. The unavailability of text books is another factor, although we managed to change the way we teach.</td>
</tr>
<tr>
<td>5</td>
<td>I think there is no need to change because our school does not have enough learning resources, more especially in science. Therefore, we realized that it is better to switch back to our original method after realizing that learners are not coping with the new method of teaching. We mostly use chalk and board for classroom activities.</td>
</tr>
<tr>
<td>6</td>
<td>Resources that are inadequate are the main cause of us not being able to implement changes according to expectations. Learners are also not used to changes that are currently taking place, so they become confused. The changes end up affecting them in a negative way.</td>
</tr>
</tbody>
</table>
As a newly trained teacher, I understand the positive effect of changes in curriculum. However, it is not easy to practise the changes in the environment where the majority of teachers believe that their own method is the correct one and they condemn the practice of the newly trained teachers. Learners get used to the method and it becomes difficult to break that barrier. I feel that these changes are happening rather fast and it is confusing us in such a way that we do not know whether to use one method or resort to the old method of teaching that the other teachers are used to.

Teacher 8

Changing to the new method is what we always wanted and have been trained to do. The problem is when learners get used to one method and it becomes very difficult for them to switch to another. This affects teaching and learning in a negative way. Before we come to terms with one policy, we are expected to move to another one which makes it difficult to cope with those changes.

Teacher 9

I think resources are affecting the implementation of new changes in our schools. Many learners do not have text books where they can refer to, but we are still waiting for the text books to arrive. Most of us depend on chalk and board method when giving activities which is difficult for us to cope with the needs of the things related to policies, we just do them for the sake of compliance.

Teacher 10

Although we are trying to make these changes work effectively, we find learners not ready to adapt with the new changes. The issue of learning resources is also affecting the effectiveness of new changes in curriculum. Learners are also unable to take responsibility for their own learning as one of the prerequisites of changes in curriculum. This results in me not noticing the difference, whether I am teaching according to the new method or not. When it comes to science teaching, I don’t think I have moved to the new method because of some challenges that we are faced with.

Teacher 11

Since the beginning of the new changes in curriculum the change that I have noticed is the increase in administrative work like preparing learners’ portfolios.

Teacher 12

In the new policy that has been recently developed, we are also faced with challenges of resources. The new policy demands grade 10 learners to perform a certain number of experiments and write a practical exam. The
problem is that there is no laboratory that is well equipped to cater for the needs of the new changes in curriculum. This ends up affecting us in a negative way.
Appendix A3: Responses of teachers to question 3.

<table>
<thead>
<tr>
<th>4.1.3 Do you as science teachers feel adequately trained with the necessary skills and knowledge to implement changes in curriculum?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher 1</strong></td>
</tr>
<tr>
<td><em>Responses</em></td>
</tr>
<tr>
<td>Although I am not trained to teach in the new curriculum, I do understand some of the needs of the new curriculum implementation. However, the knowledge that I have is not enough for me to successfully implement the changes.</td>
</tr>
<tr>
<td><strong>Teacher 2</strong></td>
</tr>
<tr>
<td><em>Responses</em></td>
</tr>
<tr>
<td>I feel that the training that I have is not enough for me to implement the new changes as we also need to do it practically inside the classroom. The inadequacies in learning resources make us feel comfortable in using our original method of teaching.</td>
</tr>
<tr>
<td><strong>Teacher 3</strong></td>
</tr>
<tr>
<td><em>Responses</em></td>
</tr>
<tr>
<td>Although I tried to practice the new changes according to the way I understand it, the inadequacy in learning resources was the main problem. I feel that I don’t have enough training or the training took a short period of time for me to be able to implement the new changes.</td>
</tr>
<tr>
<td><strong>Teacher 4</strong></td>
</tr>
<tr>
<td><em>Responses</em></td>
</tr>
<tr>
<td>Although I am trained to teach in the old system, I do understand some of the needs of new changes in curriculum. However, it is not easy to do it practically as I don’t feel comfortable. And, learners show that they are not comfortable as they are used to the teacher-centred method.</td>
</tr>
<tr>
<td><strong>Teacher 5</strong></td>
</tr>
<tr>
<td><em>Responses</em></td>
</tr>
<tr>
<td>The knowledge that I have is the one I got from the workshop. Sometimes the people who are conducting these workshops seem not to have a clear understanding of what they are doing. This leaves us without enough knowledge to implement the changes successfully.</td>
</tr>
<tr>
<td><strong>Teacher 6</strong></td>
</tr>
<tr>
<td><em>Responses</em></td>
</tr>
<tr>
<td>I don’t think I have enough understanding of the new changes because even people who conduct the workshop on the changes in curriculum do not have enough understanding.</td>
</tr>
<tr>
<td><strong>Teacher 7</strong></td>
</tr>
</tbody>
</table>
Responses
I do have enough understanding of the new changes. I think training for the curriculum development must be prolonged so that we understand the new changes in curriculum, especially in science curriculum. What I don’t have is the knowledge of the newly developed policy, CAPS.

Teacher 8
Responses
I do understand the new changes in science curriculum as I am new in the field. The subject advisors try to help us, but it is not easy to implement the new changes in an environment where many people do not understand what you are doing.

Teacher 9
Responses
I understand how to teach in the new curriculum as I am newly trained. But new curriculum development needs to be given a long time and resources so that we understand it best.

Teacher 10
Responses
Although I understand to teach in the new curriculum I am worried with learners who are not ready for all the changes given the fact that they cannot read nor write in the language of teaching. It is also difficult for us to perfect all the skills needed by the curriculum inside the classroom.

Teacher 11
Responses
I don’t think I have enough skills and understanding of what is happening rather than confusion of new developments that are coming one after another.

Teacher 12
Responses
I don’t understand because the support I am getting is not enough and it confuses me. Even the management do not care whether what is happening in the classroom is in accordance with the needs of the new changes. All they want to see are the learners’ results.
Appendix A4: Response of teachers to question 4

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 1</td>
<td>I think lack of support structure and resources are the main factors that affect the success of the new curriculum changes in our school.</td>
</tr>
<tr>
<td>Teacher 2</td>
<td>We are not getting enough support from the people who are responsible for the curriculum in the science subject.</td>
</tr>
<tr>
<td>Teacher 3</td>
<td>The fact that some of us are not trained to teach in the new curriculum is a problem. It is not easy for teachers who have not been exposed to the method of teaching in the new curriculum. Workshops alone are not enough to help them gain knowledge because they are conducted within a short space of time.</td>
</tr>
<tr>
<td>Teacher 4</td>
<td>I think shortage of learning resources affects the success of teaching and learning of the new curriculum.</td>
</tr>
<tr>
<td>Teacher 5</td>
<td>Learning resources are the main factors that hinder the success of changes in curriculum. There is no way one can improvise everything when it comes to conducting an experiment.</td>
</tr>
<tr>
<td>Teacher 6</td>
<td>Shortage of chemicals when conducting experiments is the main factor that I think affects the effectiveness of teaching and learning in the new curriculum. We do not have laboratory. It is a room full of empty bottles with no running water.</td>
</tr>
<tr>
<td>Teacher 7</td>
<td>Shortage of learning resources and textbooks. Lack of knowledge and skills is another factor.</td>
</tr>
<tr>
<td>Teacher 8</td>
<td></td>
</tr>
</tbody>
</table>
The fact that other teachers were not trained to teach in the new curriculum is affecting the success of new changes in the curriculum because they lack skills and knowledge of the new curriculum.

**Teacher 9**

*Responses*

I think learning resources are the main factors that affect the effectiveness of the new changes in science curriculum. We also do not have people who have skills and knowledge in the implementation of science curriculum.

**Teacher 10**

*Responses*

Shortage of knowledge, skills and resources are the main causes that make changes in curriculum to impact in a negative way in teaching and learning of science.

**Teacher 11**

*Responses*

The fact that we do not even have well-equipped laboratory is a problem. When you enter our laboratory you will see a pile of old books. The room can easily be mistaken as a storeroom.

**Teacher 12**

*Responses*

The conditions of our laboratories are affecting the effectiveness of teaching and learning of science in our schools. The new curriculum development demands learners to conduct and write practical exams, something which is not easy to conduct without proper laboratories.
Appendix A5: Responses of teachers to question 5

4.1.5. How do you measure your understanding of the new curriculum policies?

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 1</td>
<td>I have learned the policies that came with the new changes in science, but I don’t have a clue how far I understand them.</td>
</tr>
<tr>
<td>Teacher 2</td>
<td>I have no comment on that.</td>
</tr>
<tr>
<td>Teacher 3</td>
<td>I don’t have any comment.</td>
</tr>
<tr>
<td>Teacher 4</td>
<td>I understand some of the policies.</td>
</tr>
<tr>
<td>Teacher 5</td>
<td>I don’t think I can measure my understanding because up to now I have not been tested on the knowledge that I have in the curriculum policies.</td>
</tr>
<tr>
<td>Teacher 6</td>
<td>I don’t have a comment on that.</td>
</tr>
<tr>
<td>Teacher 7</td>
<td>As a newly trained teacher, I still need training on the new policy, CAPS.</td>
</tr>
<tr>
<td>Teacher 8</td>
<td>I think I understand some of the policies, but I still need training in the new curriculum development to make it effective.</td>
</tr>
<tr>
<td>Teacher 9</td>
<td></td>
</tr>
</tbody>
</table>
I think my understanding of new policies is not enough.

Teacher 10

Responses
My understanding of the new policies is up to standard, but the problem is how to implement them.

Teacher 11

Responses
I don’t have a comment, because I don’t know how far I understand them.

Teacher 12

Responses
I have not been assessed on how I understand these policies.
### Appendix A6: Response of teachers to question 6

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Our laboratory does not have resources.</td>
</tr>
<tr>
<td>2</td>
<td>We don’t have a laboratory at all.</td>
</tr>
<tr>
<td>3</td>
<td>It is just a room full of empty bottles.</td>
</tr>
<tr>
<td>4</td>
<td>Our laboratory does not have relevant laboratory equipment.</td>
</tr>
<tr>
<td>5</td>
<td>There is no equipment in our laboratory, the chemicals that are there are old and have expired.</td>
</tr>
<tr>
<td>6</td>
<td>Our laboratory does not have equipment. It is just a room.</td>
</tr>
<tr>
<td>7</td>
<td>We do not have a laboratory. What we have is a room full of old text books. When you enter our laboratory you will see a pile of old text books. If you are not told that it is a laboratory, you can mistake it for a storeroom.</td>
</tr>
<tr>
<td>8</td>
<td>The state of our laboratory is not conducive for learning, it doesn’t even have running water, the equipment are broken and not in good condition.</td>
</tr>
<tr>
<td>9</td>
<td>Our laboratory looks like a storeroom.</td>
</tr>
</tbody>
</table>
Teacher 10

Responses
The laboratory is not in a good state; most of the equipment are not working.

Teacher 11

Responses
Our laboratory is used as a staffroom because of a shortage of space. There is no single equipment we can use for experiments.

Teacher 12

Responses
The laboratory is in a bad condition; the chemicals there are very old and completely neglected.
Appendix A7: Response of teachers to question 7

4.1.7. What effects does the state of your laboratory have on teaching and learning of science in this period of new curriculum reform?

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 1</td>
<td>I see the state of our laboratory as an inhibiting factor that make changes in curriculum ineffective. It is just a room full of empty bottles, no running water let alone laboratory equipment.</td>
</tr>
<tr>
<td>Teacher 2</td>
<td>The state of our laboratory is not conducive for learning.</td>
</tr>
<tr>
<td>Teacher 3</td>
<td>The condition of our laboratory affects teaching because there are no learning resources that are needed when conducting the experiments.</td>
</tr>
<tr>
<td>Teacher 4</td>
<td>How are we going to conduct experiments and other practicals when there is no well-equipped laboratory? It is obvious that learners’ activities will be affected.</td>
</tr>
<tr>
<td>Teacher 5</td>
<td>There is no way we can conduct experiments where there are no resources. What we can do is just fulfil the new curriculum needs without resources.</td>
</tr>
<tr>
<td>Teacher 6</td>
<td>It is clear that the shortage of resources in the laboratory affects the effectiveness of the implementation of the new changes in science curriculum.</td>
</tr>
<tr>
<td>Teacher 7</td>
<td>There are chemicals that we cannot improvise so easily. As a result, it is difficult to implement the needs of our new policy (CAPS) as it demands a lot of experiments.</td>
</tr>
<tr>
<td>Teacher 8</td>
<td></td>
</tr>
</tbody>
</table>
Learners cannot conduct their experiments without relevant materials. Teachers resort to explaining the experiments than doing them practically. This practice affects learners’ knowledge and skills of conducting experiments.

Teacher 9  
*Responses*  
Inadequate laboratory equipment affects learners’ knowledge of different types of equipment and chemicals needed to conduct some of the experiments. This affects the effectiveness of the dispensation of the new curriculum.

Teacher 10  
*Responses*  
The state of our laboratory affects teaching and learning because learners are finding it difficult to conduct their experiments.

Teacher 11  
*Responses*  
The state of our laboratory affects the implementation of new changes because learners and teachers cannot carry out their practicals successfully. This can lead to the ineffectiveness of new changes in the science curriculum.

Teacher 12  
*Responses*  
The state of our laboratory affects teaching and learning of science because they are not equipped according to the needs of the new curriculum changes in science.
4.1.8. What are the challenges that you face while implementing changes in curriculum in your class?

Teacher 1  
*Responses*  
Lack of support structure that manage the implementation of new changes in the classroom.

Teacher 2  
*Responses*  
Shortage of resources is a challenge and overcrowded classes. It is not easy to make learners work in groups under the above mentioned circumstances.

Teacher 3  
*Responses*  
It is not easy to translate the skills that you have not been trained in tertiary teacher training level.

Teacher 4  
*Responses*  
Shortage of learning resources is the main challenges that we face in the classroom while implementing changes in curriculum.

Teacher 5  
*Responses*  
The main challenges that affect the effectiveness of new changes are shortage of learning resources.

Teacher 6  
*Responses*  
The main challenge is that we are expected to improvise everything, which is time consuming.

Teacher 7  
*Responses*  
Overcrowded classes hinder the success of classroom activities. It is not easy for learners to work in groups under such circumstances.

Teacher 8  
*Responses*
There are teachers who are still use the old method of teacher-centred classroom. Learners get used to that method and it becomes difficult to make learners become responsible for their own learning activities.

Teacher 9

*Responses*

The fact that we do not have well-equipped laboratory is a challenge that affects teaching and learning of science in our school.

Teacher 10

*Responses*

Our school does not have capacity to support the changes in curriculum. It ends up affecting the classroom activities which affect the effectiveness of new changes in science curriculum.

Teacher 11

*Responses*

It is not easy for learners to perform all classroom activities because of the shortage of textbooks. Sometimes learners have to share one textbook.

Teacher 12

*Responses*

The allocation of resources in rural schools is a challenge that affects classroom activities.
### 4.1.9. What kind of support have you received from your school when implementing curriculum changes?

<table>
<thead>
<tr>
<th>Teacher 1</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>We do not get any support except attending workshops.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 2</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There is no support because these people seem like they do not have specialists knowledge on curriculum.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 3</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There is no support because these people seems like they do not have specialist knowledge on curriculum.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 4</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>We just attend workshops and nobody cares about what happens after the workshops. Workshops are the only support we are getting at the moment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 5</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sometimes the school tries to support us, but inadequate funds are the main problem.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 6</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The support we are getting is affected by inadequate funds.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 7</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Our school management are trying to give us support, but the problems are the resources that we need while we want to implement the changes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 8</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Although the school management tries very hard to give us support, lack of resources is a problem.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher 9</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The support we are getting is not enough for us to successfully implement changes in curriculum.</td>
</tr>
</tbody>
</table>
Teacher 10

*Responses*

I think the support we are getting from the school is not enough.

Teacher 11

*Responses*

The support we are getting is limited, it is rare to see the classroom visit by the management and the subject advisors attached to the school.

Teacher 12

*Responses*

The visit by the subject advisors and management leaves much to be desired.
### 4.1.10. What are your suggestions for future planning of science curriculum in schools?

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 1</td>
<td>I think for future planning, learning resources must be planned before any developments that must take place in the curriculum.</td>
</tr>
<tr>
<td>Teacher 2</td>
<td>Before the introduction of new changes, there must be a plan of training teachers according to the needs of the newly introduced curriculum.</td>
</tr>
<tr>
<td>Teacher 3</td>
<td>Learning resources and skills must be a priority before the new curriculum is introduced.</td>
</tr>
<tr>
<td>Teacher 4</td>
<td>People who deal with curriculum must have relevant knowledge and skills. Learners support material must be available prior to any development that takes place in the curriculum.</td>
</tr>
<tr>
<td>Teacher 5</td>
<td>Learning resources must be the first priorities before the implementation of the new curriculum as it affects its implementation.</td>
</tr>
<tr>
<td>Teacher 6</td>
<td>I think all the schools must have school-based advisors on the subjects like science. Relevant resources must also be available.</td>
</tr>
<tr>
<td>Teacher 7</td>
<td>I think the time between curriculum implementation and development should be prolonged so that enough time is available to provide learning resources.</td>
</tr>
<tr>
<td>Teacher 8</td>
<td>Teachers must be trained in accordance with the new changes. The availability of learning resources should be</td>
</tr>
</tbody>
</table>
prioritized for the curriculum to have better effects on teaching and learning of science subjects.

Teacher 9
Responses
Learners and teachers support materials should be considered important before any curriculum development.

Teacher 10
Responses
I think in the future there must be structures in schools that help us with knowledge on how we can implement those changes in a classroom situation. Learning resources and laboratories must be available.

Teacher 11
Responses
I think people who deal with curriculum must take contingent plan on the issue of resources as the problem still exists in our rural area schools.

Teacher 12
Responses
Teachers’ knowledge and skills of curriculum is a problem that is making the new changes ineffective. The curriculum workers must make sure that the relevant resources are available.
Appendix B1: Response of principal 1 to interview questions.

Table 4.2.1 Principal (1) Responses to semi-structured interview question

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think there is a need for new curriculum development at this stage in South Africa?</td>
<td>I think that teachers are not yet ready for the changes. They seem to be overloaded by work since the beginning of the new changes and the administrative work affects teacher attendance of classes because they are given a short space of time to prepare the files and submission date. The curriculum workers are not managing to check their work after workshops.</td>
</tr>
</tbody>
</table>

Question 2
Are there any effects that brought about by changes in curriculum in teaching and learning of science subjects at your school?

Responses
In answering or responding to question (2), the principal mentioned that he only heard that teachers must use a new method, but he has never been in class to verify if they are practically doing it.

Question 3
Which difficulties are faced by science teachers when it comes to the implementation of curriculum and why?

Responses
He mentioned that teachers are overloaded by preparing learners’ portfolios and at the same time they are given little time to undertake the whole process of preparing (CASS) files. They also have the problem of not having laboratory where they can perform the experiments that are needed by (CAPS) curriculum policy which has been recently introduced.

Question 4
What are the main factors that you think affect teaching and learning of science during this time of back to back changes in science curriculum?

Responses
Principal (1) indicated that lack of confidence by teachers might be the main factor that affects teaching and learning and the effectiveness of changes in science curriculum.

Question 5
Why it is necessary for the school management team to be involved in implementation of new changes in science curriculum?

*Responses*
He mentioned that for the curriculum to be effective, the management and other stakeholders must feel as part of the team. He further indicated that it is important for management to be part and parcel of the new curriculum innovator and supporter.

Question 6
What are your suggestions for future planning of science curriculum changes in schools?

*Responses*
He mentioned that the future curriculum workers in science must have pre-planning before implementation begins. He indicated that principal must get training on curriculum so that they would be acquainted with curriculum innovations and changes.
Appendix B2: Response of principal 2 to interview questions.

<table>
<thead>
<tr>
<th>Table 4.2.2. Principal (2) Responses to semi-structured interview questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question 1</strong></td>
</tr>
<tr>
<td>Do you think there is a need for new curriculum development at this stage in South Africa?</td>
</tr>
</tbody>
</table>

When the researcher arrived at school the principal was more than ready for the interview session because he had been informed about the interview earlier. Upon the researcher’s arrival the principal was still attending to his daily routine activities. The researcher started by greeting the principal. The principal seated behind his office desk, in a classroom which is used as an office. He shares the same office with his deputy (principal) and the administrative assistant. He assured the researcher that he was comfortable to be interviewed in the presence of his deputies and the administrative assistant, and these followed what I have asked concerning the presence of his staff members sharing same office space.

*Responses*

His response to question 1 was that he doesn’t think that the changes should have taken place very fast. He gave the reason that people who are responsible with the curriculum do not give teachers enough support. What they do is they just give them curriculum documents. They also do not make follow up on what is happening which might be caused by the shortage of curriculum workers. It might imply that South Africa was not ready for changes as there were no provisions for sufficient personnel to work on curriculum so that the curriculum could effectively have positive impact on learners and teachers.

| Question 2 |
| Are there any effects made by changes in curriculum in teaching and learning of science at your school? |

*Responses*

He mentioned that what he knows is that teachers were expected to change their method of teaching. He also notices that teachers are expected to prepare learners’ portfolio and their own files, which is time consuming because teachers are very busy with office work than being in the classroom. He further said that it seems as if there are changes because the teachers work for continuous assessment.

| Question 3 |
| Which difficulties are faced by science teacher when it comes to implementation of curriculum and why? |

*Responses*

He indicated that no matter how much teachers can try to work hard to implement the curriculum, the problem is that they do not have resources like textbooks and well-equipped laboratories.

| Question 4 |
| What are the main factors that you think affect teaching and learning of science during this time of on-going
changes in science curriculum?

Responses
Principal (2) indicated that lack of support from outside the department is the number one factor. He said “the government has the obligation to provide us with the learning resources more specifically textbooks” mentioning this it as the issue that must be taken into consideration by the government. He also mentioned the issue of learners who are not paying school fees as another factor that causes shortage of resources. Each and every department would have its own budget allocation to help towards buying resources that are needed, but as for now it is no longer happening.

Question 5
Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

Responses
Principal (2) indicated that all the stakeholders must be part of the innovation for the curriculum to be effective to learners and teachers of science. He indicated that parents must also be part of the innovation although they are not responsible in the implementation of new changes in the education of their children. He said that, although there are no people who specialized on curriculum in his school, he has managed to form curriculum committee to make new changes in curriculum effective and functional. He mentioned that the committee also needs support from the people with expert knowledge in curriculum so that it can have direction.

Question 6
What are your suggestions for future planning of science curriculum changes in schools?

Responses
He mentioned the issue of pre-planning that must take time before the implementation of new changes in science. He also mentioned the issue of training principals on curriculum so that they will be able to understand the process of curriculum implementation. He suggested the issue of school based subject advisors to be taken into consideration in future planning.
Table 4.2.3 Principal (3) Responses to semi-structured interview question

<table>
<thead>
<tr>
<th>Question 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think there is a need for new curriculum development at this stage in South Africa?</td>
</tr>
</tbody>
</table>

When the researcher arrived at the school the principal was not around. She was told that he went to the circuit for routine submissions. The researcher waited for him in his office as they have agreed on the appointment for the interview. The principal arrived after twenty minutes of the appointed time. He apologised for keeping the researcher waiting, and immediately the interview kicked off and it lasted more or less thirty minutes because the principal seemed to have much interest in the interview session.

*Responses*

The fact that learning resources is main problem in our school, I think that the new changes should have taken place gradually. He also indicated that although South Africa might be ready for the changes, the problem is the speed at which the changes are taking place which is overtaking the resources that we have. He further indicated that the state of their laboratory is not conducive for teaching and learning of sciences.

<table>
<thead>
<tr>
<th>Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there any effects made by changes in curriculum in teaching and learning of science at your school?</td>
</tr>
</tbody>
</table>

*Responses*

Principal (3) indicated that he is not sure whether the changes have effects on the teaching inside the classroom, as he does not have clear knowledge regarding the new curriculum because he received his teacher training some years ago. He indicated that what he knows is that teachers attended workshop to effect changes in the classroom, but he does not know whether it is functional and practical. He pointed out the issue of resources as a barrier that affects the implementation of changes in the science classroom.

<table>
<thead>
<tr>
<th>Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which difficulties are faced by the science teacher when it comes to the implementation of science curriculum and why?</td>
</tr>
</tbody>
</table>

*Responses*

He indicated that science teachers are faced with the shortage of science learning resources. He mentioned that they have no laboratory equipment to enable them to conduct the experiments that are demanded by the new curriculum development.

<table>
<thead>
<tr>
<th>Question 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the main factors that you think affect teaching and learning of science curriculum?</td>
</tr>
</tbody>
</table>
He cited inadequate learning resources and overcrowded classroom as cause for concern. He indicated lack of resources as a problem because for the teacher to conduct experiments, they are compelled to bus learners to the science centre which is far away from their school.

**Question 5**
Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

**Responses**
Principal (3) indicated that it is better if the management team gets involved in curriculum implementation as they are responsible for running the day-to-day line activities of the school. Their involvement could assist to oversee if teachers are correctly implementing the changes after attending curriculum trainings.

**Question 6**
What are your suggestions for future planning of science curriculum?

**Responses**
He indicated that for future curriculum change to be effective, resources should come first before the implementation of curriculum change.
Appendix B4: Responses of principal 4 to interview questions.

Table 4.2.4. Principal (4) Responses to semi-structured interview questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>Do you think there is a need for a new curriculum development at this stage in South Africa?</td>
</tr>
<tr>
<td></td>
<td>When the researcher arrived the principal was not around. He left the message that the researcher must come after two hours as he was called to attend an emergency meeting. The booking of the appointment was done two weeks before the day of the interview, though. After the lapse of two hours the principal arrived and he apologised for the inconvenience. We greeted each other, the principal welcomed and allowed us to conduct the interview as scheduled.</td>
</tr>
<tr>
<td>Responses</td>
<td>He indicated that he is of the view that there is a need for a new curriculum as the old system was full of prejudice and regression in the black community. He further cited the challenge in provisioning of learning resources which is planned parallel to the needs of the schools and the curriculum itself. He commented that he does not see South Africa as yet ready.</td>
</tr>
<tr>
<td>Question 2</td>
<td>Are there any effects made by changes in curriculum in teaching and learning of science at your school?</td>
</tr>
<tr>
<td>Responses</td>
<td>He indicated that educators lack of understanding of what they are supposed to do after the workshops. He further indicated that teachers are now trying to manage their files and learners’ portfolios knowing that they will be checked on that by the subject advisors. That is the effect he has noticed on their work.</td>
</tr>
<tr>
<td>Question 3</td>
<td>What difficulties are faced by science teachers when it comes to the implementation of science curriculum and why?</td>
</tr>
<tr>
<td>Responses</td>
<td>He indicated that his school did not have well equipped laboratory, therefore it was difficult for science teachers to perform some experiments with the learners. He also mentioned that, that might be the cause of high failure rate in maths and science or it might be the teachers’ lack of skills and knowledge.</td>
</tr>
<tr>
<td>Question 4</td>
<td>What are the main factors that you think affect teaching and learning of science during this time of on-going changes in science curriculum?</td>
</tr>
</tbody>
</table>
Responses
Principal (4) indicated that many teachers are not ready to switch from their original method of teaching. He also indicated that many teachers feel that they are not part of the change and start to ignore everything that comes with change, more especially classroom practice because he has seen many teachers who do not bother to engage learners during classroom activities. He indicated that may be the skills and knowledge that science teacher have are not enough for them to can engage learners according to the needs of the new changes in curriculum.

Question 5
Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

Responses
Principal (4) indicated that it is very important for the management team to check the classroom activities so that they can see if the new changes are implemented effectively. He also indicated that sometimes the management do not care about the classroom practice; they just wait to see the outcomes. He further indicated that for the management to be able to engage them in the curriculum implementation, they must be trained with their teachers.

Question 6
What are your suggestions for future planning of science curriculum?

Responses
He indicated that science is a subject that demands learning resources and expert skills. Therefore, the government must make sure that before any development of changes in science curriculum take place, they must first make sure that the material and skills needed are provided and this might make the curriculum become effective.
Appendix B5: Responses of Principal 5 to interview questions.

Table 4.2.5. Principal (5) Responses to semi-structured interview questions

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Do you think there is a need for new curriculum development at this stage in South Africa?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>The principal indicate that he thought it was necessary for South Africa curriculum to have changed because the old one was not addressing the needs of the learners. He also indicated that as a principal of a school, he is of the opinion that learners need a system that will make them be competitive globally and this the time for South Africa to make it happen for the sake of our learners who are our future generation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2</th>
<th>Are there any effects made by changes in curriculum in teaching and learning of science at your school?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>He indicated the effects of new changes in science are obvious. Learners are now expected to be active participants inside the classroom. It is no longer teachers who are expected to impart knowledge to learners only. He also indicated that although there are some effects that have taken place since the beginning of new changes, some activities are not easy to be practiced because of overcrowded classes and this affect the positive effectiveness of new changes in schools.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 3</th>
<th>Which difficulties are faced by science teachers when it comes to the implementation of science curriculum and why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>He indicated that sometimes teachers have difficulties to impact their skills and knowledge because they are faced with overcrowded classes. He also indicated that, teachers must have clear understanding of science curriculum for them to be able to make changes in science curriculum effective. They decide to devise some means to teach on those because it wouldn’t be easy and conducive to take learners out of the classes on daily basis. That can also compromise the management of school. He cited the issue of new policies like (CAPS) and</td>
</tr>
</tbody>
</table>
others which are introduced one after another.

Question 4
What are the main factors that you think affect teaching and learning of science during this time of on-going changes in science curriculum?

Responses
He indicated the issue of resources that are available in their school. He also mentioned that the fact that they do not have personnel which is proficient and skilful in curriculum remains a problem. He indicated that many teachers have been trained some time ago; therefore the new changes are not understandable. It ends up affecting the effectiveness of new changes in curriculum.

Question 5
Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

Responses
He indicated that the school management team need to be part of the changes in curriculum as they are the one working directly with teachers and learners on their daily basis.

Question 6
What are your suggestions for future planning of science curriculum?

Responses
He indicated that for future planning of science curriculum, the curriculum workers must liaise with the department to see to it that the resources are provided for any development that takes place in science curriculum. He further indicated that sometimes good changes can be done, but the implementation fails because of the inadequacy in teaching and learning resources. He cited an example of some of the practical work in science that need chemical and laboratory to make them work effectively.
### Question 1
Do you think there is a need for a new curriculum development at this stage in South Africa?

When the researcher arrived the principal was ready for the interview as he has been told before and agree on the interview date with the researcher. He was welcoming and relaxed. The researcher greeted the principal and then later they began with the interview session.

**Responses**
In his responses he indicated that the new curriculum development is good for South Africa, but he is not impressed with the preparations.

### Question 2
Are there any effects made by changes in curriculum in teaching and learning of science at your school?

**Responses**
He indicated that, it seems as if the standard has dropped, he also indicated that the main cause of failure in grade ten (10) in his school is maths and science. He further indicated that he is not quite sure whether the changes that have taken place contributed to high failure rate or is the learners’ attitude towards the subjects.

### Question 3
Which difficulties are faced by science teachers when it comes to the implementation of science curriculum and why?

**Responses**
He indicated that teachers are faced with learners who think that science subjects are the most difficult subjects of them all. That attitude makes teachers to find it difficult to implement new changes in curriculum effectively. He further indicated that unavailability of learning resources is ascribed to the ineffectiveness of implementing science curriculum.

### Question 4
What are the main factors that you think affect teaching and learning of science during this time of on-going changes in science curriculum?
Responses
He indicated that the school do not have resources that are appropriate for the implementation of new changes in science curriculum. He also indicated that attitude by teachers towards changes is another problem need to attended to.

Question 5
Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

Responses
He indicated that sciences are subjects that seem to be difficult for teachers and learners, therefore the management must give maximum support for both teachers and learners when it comes to the implementation of any changes that take place to get better result of new changes.

Question 6
What are your suggestions for future planning of science curriculum?

Responses
He indicated that it would be wise if the time between planning of new change or development and real implementation is prolonged to get enough time to prepare skills and relevant resources.
The interview with subject advisors took place at schools during subject advisor visit to the school. The researcher was lucky to get hold of the subject advisor as they were busy conducting (CAPS) workshops. During that time it was not possible to find the subject advisors in the office as they were always moving around the whole district for workshops. Although time was not on our side, the respondent managed to respond to all the interview questions. The questions and responses were as follows:

**Question 1**
How do changes in curriculum affect your roles as science curriculum advisor?

**Responses**
Subject advisor (1) indicated that there are factors that she thinks affect their role as subjects advisors she indicated that since the beginning of the new changes, the subject advisors are supposed to visit the schools for monitoring, conduct workshops as new development in curriculum are the on-going process and asses the teachers and learners files. She indicated that the number of science subject advisors is limited compared to the needs of the new changes in science curriculum. She indicated that only eight (8) subject advisors are expected to round the whole district which is a tough job as the schools are very scattered around the district. They decided to concentrate mostly in schools that are under performing to help improve their performance. She also indicated that sometimes they discovered that some of the activities and practicals are not up to standards and decided to do them themselves which also increase their workload during this era of new changes in curriculum.

**Question 2**
Do you think you have enough capacity to support and monitor changes in curriculum?

**Responses**
Subject advisor (1) indicated that no matter how much they wish to monitor and support teachers on how to implement new changes in curriculum, the problem is the inadequacy in resources and human capacity. She also indicated that it is not easy to reach some schools because of the nature of the roads. She indicated that only eight (8) subject advisors in science are expected to monitor the whole district. As a result it is not easy for them to cover all the school at a given time.

**Question 3**
What are the main challenges that you encounter during monitoring and support of changes in curriculum?

**Responses**
She again indicated that the issu of resources is a burning issue because for them to reach some schools they need vehicles that are suitable for the nature of the roads. She further indicated that the number of subject advisors is limited compared to the needs of the new changes in science curriculum.
advisors in science is superseded by the number of schools they are supposed to monitor.

Question 4
What affects do changes in curriculum have on teachers and learners?

Responses
Subject advisor (1) indicated that, although teachers role is expected to change there are others who are still resist changing to new method of teaching. She further indicated that there are others who are happy about the newly introduced curriculum development (CAPS) as they believe it takes them back from where they were. She indicated that there are other teachers who say that they have knowledge of curriculum (curriculum 2005) and the newly introduced curriculum development (CAPS) confuses them.

Question 5
What are the factors that you think might be affecting the success of changes in science curriculum?

Responses
She indicated that teachers’ attitude and their level of understanding when it comes to science teaching, as a result many teachers ignore the new change in science curriculum. She also indicated that they ignore practical work, may be it is because they do not have resources to conduct those experiments. She further indicated that because of the shortage of science teachers in the area, many science teachers were sourced from one of the neighbouring countries (Zimbabwe), which might have a different approach on curriculum which is not the same as that of South Africa. Therefore, there is a need for them to be trained according to curriculum needs, she explained.

Question 6
Is the support you are getting from the department, enough for you to monitor and support changes in science curriculum?

Responses
Subject advisor indicated that the issue of resources and human capacities is not taken seriously. She further indicated that they are still waiting for the respond from the department on their application of the vehicles that can make it easy for them to access some of the school in the remote areas

Question 7
What are your suggestions for the future planning of science curriculum?

Responses
Subject advisor (1) indicated that it will be wise if the government put the mechanism in place that could address shortage of subject advisors, as they do not match the demands of the new curriculum. She further suggested that there must be provision of vehicles that will enable them to access schools in remote areas. She further indicated additional provision of subject advisors and resources would turn the tables in curriculum change.
Appendix C2: Response of Subject advisor number two (2)

Table 4.3.2. Subject advisor (2) Responses to semi-structured interview questions

When the researcher arrived found the subject advisor ready for the interview as scheduled. The researcher and respondent exchange the greetings and wasted no time as the subject advisor was scheduled to conduct another workshop for the newly developed policy (CAPS) in the circuit. The subject advisor responded to all the questions even though he was in haste. His responses to the questions were as follows:

**Question 1**
How do changes in curriculum affect your roles as science curriculum advisor?

**Responses**
He indicated that shortage of science subject advisors affect their role as new changes in curriculum is flooded with many activities on their job specifications. He indicated that it is not easy to reach other schools as they are located in remote areas. As a result, it affects their roles and effectiveness of the new changes in science in curriculum.

**Question 2**
Do you think you have enough capacity to support and monitor changes in science curriculum?

**Responses**
On the issue of capacity, he indicated that the number of subject advisors is not sufficient to monitor and supports changes in science curriculum. He also indicated that it create barriers towards realizing effective teaching and learning of science in new curriculum dispensation. He further indicated that they are unable to meet the targets of covering all schools, due to the limited number of staff.

**Question 3**
What are main challenges that you encounter during monitoring and support of changes in science curriculum?

**Responses**
He indicated that even though they would like to visit teachers to see what they do during experiments classes, it is not easy because most of the schools do not have well equipped laboratories. He further indicated that the issue of resources in rural school has been under-estimated, which remains a challenge for them to can train teachers to implement changes effectively. He also indicated that, the scarcity of subject advisors might also have contributed to the slow changes in science teaching and learning in the circuit as well as the whole district.

**Question 4**
What effect do changes in curriculum have on teachers and learners?
Subject advisor (2) indicated that teachers’ roles have changed since the beginning of new curriculum. He indicated that teachers are now expected to teach according to what is written in the policy documents. He explained “teachers are now expected to be facilitators of classes than being transmitters of knowledge to learners”. He further indicated that teachers are now expected to prepare files and learners’ file for submission each and every quarter.

Question 5
What are the factors you think might be affecting the success of change in curriculum?

Responses
He indicated that teachers attitude toward changes might be a factor. He indicated that there are teachers who do not want to teach classes which need them to submit learners files quarterly. He also indicated that lack of knowledge and skills on curriculum by teachers might be the cause of their attitude. He further indicated that some teachers are not interested in attending workshops. He also emphasized the inadequacy of learning resources and infrastructure.

Question 6
Is the support you are getting from the department, enough for you to can monitor and support changes in science curriculum?

Responses
He indicated that the available subject advisors are not sufficient to can reach all schools in scheduled time is cause of concern to stakeholders. He indicated the provisioning of transport which is taking too long. He further indicated that the department turned a blind eye on the issue of providing laboratory equipment to schools, and laboratories in rural schools.

Question 7
What are your suggestions for the future planning of curriculum?

Responses
He indicated that the future curriculum workers must liaise with government to provide resources that are in accordance with the needs of the new changes in curriculum.
ANNEXURE: A1

Questionnaire For teachers

Open-ended questions

The impact of curriculum change in teaching and learning of science subjects

The purpose of this questionnaire is to gain insight into how curriculum changes impact on the teaching and learning of science in under-resourced schools in Vhembe District. Kindly try to answer all the questions to the best of your ability and as objectively as possible.

Age……………

Sex……………

Tertiary institution attended……………

Qualification…………………

Describe how you presently feel about changes in curriculum?...................................................................................................................................
......................................................................................................................................................
......................................................................................................................................................

Do changes in curriculum affect your way of teaching, and if so how?............................................................................................................................................
......................................................................................................................................................
.....................................................................................................................................................

Do you, as science teacher, feel adequately trained with the necessary skills and knowledge to be able to implement changes in curriculum?

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What are the factors that you think affect the implementation of the new changes in curriculum at your school?

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How do you measure your understanding of new curriculum policies? And what kind of support do you get from your curriculum advisors in science?
Describe the state of the science laboratory at your school?

What effect does the state of your laboratory have on teaching and learning of science in this period of new curriculum reform?

What are the challenges that you face while implementing changes in curriculum in your class?

What kind of support have you received from your school when implementing curriculum changes?

What are your suggestions for future planning of science curriculum in school?
ANNEXURE: A2

Semi-structured interview for Principals

Questions

Do you think there is a need for new curriculum development at this stage in South Africa?

How do changes in curriculum affect teaching and learning of science at your school?

Which difficulties are faced by science teachers when it comes to the implementation of curriculum and why?

What are the main factors that you think affect teaching and learning of science during this time of on-going changes in curriculum?

Why is it necessary for the school management team to be involved in the implementation of new changes in science curriculum?

What are your suggestions for the future planning of science curriculum changes in schools?
ANNEXURE: A3

Interview questions for the subject advisors

Questions

How do changes in curriculum affect your role as science curriculum advisors?

Do you think you have enough capacity to support and monitor changes in curriculum?

What are the main challenges that you encounter during monitoring and support of changes in curriculum?

What effects do changes in curriculum have on teachers and learners?

What are the factors you think might be affecting the success of changes in curriculum?

Is the support you are getting from the Department of Education enough for you to monitor and support changes in curriculum in science subjects?

What are your suggestions for the future planning of curriculum?
### ANNEXURE: A4

#### Observation checklist

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Classroom: is the classroom adequate for teaching and learning e.g. is seating space conducive to learning and fit for classroom practice?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Classroom or laboratory: equipped with charts, Bunsen burners, hand lenses, bio viewers and relevant bio strips, microscopes, slides and cover slips et cetera.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Learners: adapt with the changes, demonstrate good group work skills, confidence.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Teacher: understand new approaches, positive about new curriculum reforms, making use of new approaches; understand new curriculum policies in science, manage to implement changes in classroom, have positive attitude towards changes in curriculum and show skills and knowledge to teach the subject.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Classroom: the classroom setting is conducive for learners to engage in activities in their groups.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Learners Activities: classroom activities are learner-centred.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Teachers: teachers work as facilitators of lessons.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Teachers: skills and knowledge are in accordance with the new changes in curriculum.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Teachers: are able to engage learners in high order thinking.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Teachers: are able to deliver high quality feedback.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Teachers &amp; Learners: have positive relationships and teachers engage learners in active participation.</td>
<td></td>
</tr>
</tbody>
</table>
ANNEXURE: A5

LETTER OF REQUEST TO CONDUCT RESEARCH
The District Senior Manager
Department of Education
Vhembe District
P/Bag x2250
SIBASA
0979

Dear Sir

REQUEST FOR THE PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

My name is Tshiredo Litshani Lizer, and I am student at the University of South Africa, currently doing a master’s degree in education specializing in natural sciences.

The research I wish to conduct for my masters’ dissertation involves “The Impact of the curriculum change in the teaching and learning of science: A case study in under-resourced schools in Vhembe District”. The research main objective is to investigate how changes in curriculum are affecting teaching and learning of science subject in Vhembe district (Sibasa circuit). The research could improve the effectiveness of changes in curriculum in teaching and learning of science subject in under-resourced schools. It will also investigate the factors that might be affecting the effectiveness of changes in science curriculum. The duration of research will take plus or minus six weeks. People expected to participate in the research are the science teachers of Sibasa circuit school who will answer questionnaires, science curriculum advisors and principals who will answer the interview questions. The researcher will also use observation as a research instrument in all the schools under the study. Confidentiality and anonymity of information is guaranteed. Participants have got the right not to participate or withdraw. All the information gathered during the process will be dealt with as highly confidential as possible. The researcher would ask to conduct a research at the following schools: Raledzile High School, Gxhubukvhu High School, Pheswana High School, Mphaphuli High School, William Themeli High School and Nhetelelelele High School at Sibasa Circuit. The research is under supervision of Dr. A Mothabeane.

I hereby seek your consent to conduct a research in secondary schools mentioned above, under the jurisdiction of Sibasa Circuit and curriculum advisors responsible for science subjects. The schools will be selected using purposive sampling. The schools are known to the researcher as science schools. The researcher will use questionnaires, observation of teachers and learners during class activities and interview questions for principals and curriculum advisors.

Upon completion of the study, I undertake to provide the Department of Education with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me @ 072 374 6340.

Thank you for your time and consideration in this matter.

Yours faithfully,

Tshiredo L.L.

[Signature of researcher]

[17/3/2012]

[Date]

[Signature of District Manager]

[Date]

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ANNEXURE: A6

LETTER OF PERMISSION TO CONDUCT RESEARCH
APPLICATION FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS IN SIBASA CIRCUIT

1. Permission is hereby granted to you to conduct research in schools in Sibasa Circuit as requested.

2. You are advised to conduct your research with the consent of the Circuit Manager of Sibasa Circuit and the Principals of the identified schools.

3. The process of researching should at no stage, disrupt the normal teaching and learning time.

4. Wishing you all the best.

DISTRICT SENIOR MANAGER

18/05/2012

DATE