

EXPLORING APPROACHES TO THE TEACHING OF LIFE SCIENCES

By

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DECLARATION

I, Thembisile Rosemary Majozi (Student Number: 962115289) do hereby declare that this dissertation, which is submitted to the University of KwaZulu-Natal for the degree of Master of Education, has not been previously submitted by me at any other university, and that all sources I have used or quoted have been indicated and acknowledged by means of complete reference.

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LIST OF ABBREVIATIONS

DoBE	Department of Basic Education
FET	Further Education and Training
KZN	KwaZulu-Natal
MAB	Man and Biosphere
MIP	Matric Intervention Programme
NCS	National Curriculum Statement
RNCS	Revise National Curriculum Statement
SBA	School-Based Assessment

ABSTRACT

There is a national outcry on poor performance of learners in Grade 12 Life Sciences in KwaZulu-Natal secondary schools. The focus of this research is to find out which teaching approaches are used by Life Sciences teachers to teach a section of environmental studies to Grade 12 learners, without making it difficult for learners to understand. The literature reveals that there are various teaching approaches (such as the executive approach, the facilitator approach, the liberationist approach, context-based approach and environmental awareness approach) which can be employed in science classrooms. The theoretical framework guiding this study is social constructivism, where Pollard's (2005) model of teaching is used to interpret the social constructivist's classroom. In light of the New Curriculum Statement (NCS) which aims to instill critical thinking in learners and learner-centred teaching approaches, I investigate this topic to explore to what extent teachers conform to the objectives of the NCS policy.

This study is guided by a qualitative research paradigm and is interpretive. The research methodology adopted is a case study, and the instruments of data collection are classroom observations which were video-recorded and semi-structured interviews which were tape-recorded and transcribed into text. Field notes and document analysis were also used as instruments for data collection. Purposive sampling of three Life Sciences teachers was undertaken.

Five major findings emerged, as follows: pedagogical concrete science, which relates to context-based teaching approaches and environmental awareness teaching; science in motion, relating to the facilitator teaching approach; teacher as knower, which relates to the transmission teaching approach; interactive science teaching, which relates to the inquiry-based teaching approach; and teacher in action, which is about the facilitation teaching approach. The study reveals that although teachers are employing a variety of teaching approaches, they are faced with contextual factors, for example, lack of science equipment, which make it difficult to carry out their role effectively. Recommendations to the Department of Education are to conduct in-service training to assist teachers in employing a variety of teaching approaches in science classrooms, and also to supply science equipment to schools.

CHAPTER ONE

RESEARCH QUESTIONS, AIM AND RATIONALE

1.1 INTRODUCTION

In the race to prepare for improved learner performance in science subjects in secondary schools, learners are losing out on instructional practices which foster meaningful learning. This is evident from the national outcry on poor performance of Grade 12 Life Sciences learners in KwaZulu-Natal (KZN) secondary schools. Poor performance could be influenced by the way in which teachers approach lessons in the classroom and lack of resources, for example, lack of science equipment or textbooks. A teacher may approach a lesson in a manner that does not clarify science concepts to learners.

In the South African context, more factors contribute towards poor performance in schools, such as teaching large classrooms, negative attitude of learners towards science subjects leading to bunking classes. Peer pressure, involvement in drugs and ‘gangsterism’ in schools, lead to lack of motivation towards learning. Learners involved in drugs lose concentration in the classroom and therefore perform poorly. Child-headed homes increases absenteeism and learners lose out in contact time. Some homes are headed by grandparents, there is lack of discipline, and home-work is not done therefore learners perform poorly. Poor socio-economic status of some learners whereby learners come to school hungry, contributes to lack of concentration during lessons thus performance is affected negatively.

This study therefore explores the teaching approaches employed by Life Sciences teachers when teaching a section of environmental studies in different contexts in Kwa-Zulu Natal schools. The study also seeks to find out why teachers use the teaching approaches they choose. As I explore the teaching approaches which teachers employ in the classroom I will observe whether these teaching approaches are employed according to the National Curriculum Statement (NCS) (Department of Basic Education (DoBE), 2003) which guides the teaching practice. The Revised NCS (RNCS) policy document (DoBE, 2005) stipulates that teachers should employ different teaching approaches in the classroom in order to improve learner performance.

South Africa has gone through a complex process of transformation in education since abandoning apartheid (National Education Policy Act 27, 1996 (Republic of South Africa, 1996)). Despite drastic educational reforms, South Africa is still rated the lowest in learner performance in science subjects globally. This is evident from the national statistics in Life Sciences for 2011, where most passes ranged between 30% and 39% (Department of Basic Education, 2011). In 2011 the number of learners who wrote Grade 12 Life Sciences was 264 819. Learners who passed at 30 - 39% were 193 946 (73.24%) and those who passed at 40% and above were 70 873 (26.76%) (Department of Basic Education, 2011). The number of passes from 50% and above is far less; therefore these results do not represent quality performance. It is this kind of situation that stimulated my interest in exploring which teaching approaches are used by Life Sciences teachers, and as to why they use these approaches.

The DoBE in KZN is concerned with the general poor performance of learners in science subjects in the Further Education and Training (FET) band, especially Grade 12. The KZN Provincial Minister of Education initiated Matric Intervention Programme (MIP) workshops in 2011 in order to assist Grade 12 teachers to improve the quality of teaching by employing a variety of teaching approaches in the classroom. For example, teachers who attended the MIP workshops were taught to use simulations for practical investigations. Life Sciences was among the subjects that were targeted in the MIP, which was conducted in May and July 2011.

In 2012 the DoE conducted another programme called Winter School - Matric Intervention. The latter programme was conducted during the June-July holidays in 2012. The MIP is indicative of a crisis in science education and it is urgent that the situation be addressed so as to bring about improvement. In view of the KZN Minister of Education's concern, I conducted this study to explore the teaching approaches which Life Sciences teachers employ in the classroom.

1.2 RATIONALE

My own interest in doing this study arose within my role as a teacher of Life Sciences in Grade 12 for the past 16 years. As the only Life Sciences teacher in the school where I teach, I find it challenging to teach Grade 12 due to contextual factors such as lack of resources, medium of instruction, and lack of motivation to science subjects and socio-economic background of learners. Life Sciences teachers from other schools also find it difficult to

teach the subject. This is revealed at our cluster moderation meetings for school-based assessment (SBA), which are held every three months. The cluster comprises eight neighbouring schools around Edendale area in KZN. In these cluster moderation meetings teachers coming from different schools in the cluster exchange learners' work and mark, schedule and moderate it. It is in these cluster moderation meetings where I observed that learners achieve very low marks in most schools. In my cluster, I have analysed the final examination results for 2011. The statistics reveal that out of eight high schools, the total number of learners who wrote Life Sciences is 254. The number of learners who passed below 30% was 42 (16.54%), at 30%-39% was 53 (20.87%), 40%-49% was 57 (22.44%), 50%-59% was 68 (26.77%), 60%-69% was 30 (11.81%), 70%-79% was 03 (01.18%), 80%-89% was 01 (0.39%) and 90%-100% was 00. These statistics reveal that most passes in Life Sciences range 30%-59%, hence indicating that the number of quality passes is very low. By quality passes I mean passes ranging from 60%-90%.

Based on the poor performance of learners that I observed in our cluster moderation meetings and from the statistics above, I therefore became interested in finding out how teachers teach and why they teach in the way that they do. In order to make teachers aware that the way they conduct their lessons has an impact on learner performance, I decided to explore how teachers approach their lessons and why they employ the approaches that they do. However, I do not exclude other contextual factors mentioned above which also contribute to poor performance of learners in South African schools.

As an experienced teacher I am fully aware that when teachers teach, they address the lesson using particular teaching approach/es. For the purpose of this study I will define the terms 'teaching' and 'approaches' respectively. Teaching is a set of activities which is designed and performed to achieve certain objectives in terms of changes in behaviour. Teaching is the process of helping others to achieve knowledge, skills and attitudes. Approaches can be described as how teaching is done; for example, does the teacher give notes to learners all the time, is time allowed for questions, or does the teacher go with the flow of content taught or teach straight from the book. Teaching approaches therefore refer to the actions that a teacher uses with the intent to deal with a situation or a problem in the classroom during teaching.

1.3 FOCUS AND PURPOSE OF THE STUDY

For the purpose of being practical I decided to select a section of environmental studies to explore the teaching approaches used by Life Sciences teachers. The study focuses on an

exploration of teaching approaches that teachers employ when teaching this section in Life Sciences, and why they choose those approaches. The focal group is Grade 12 Life Sciences teachers at secondary schools. The purpose of this research is to make a contribution to elevating the standards in the teaching of Life Sciences in order to improve learner performance. Finding out what teachers do in the classroom when they teach will make me to have a deeper understanding as to why teachers use those approaches.

In exploring the teaching approaches, I will be exploring the role of the teacher in the classroom during teaching. According to the National Education Policy, Act 27 of 1996, which prescribes the norms and standards for educators, a teacher, has seven roles. Of these seven roles of the teacher stated in the National Education Policy, Act 27 of 1996, the seventh role is most important for the purposes of this study, because it relates to practical teaching in the classroom. The seventh role stipulates that “the educator will know about *different approaches to teaching* and learning (and where appropriate, research and management) and how these may be used in ways which are appropriate to the learners and the context”. Conducting this research will make a contribution towards making Life Sciences teachers aware of all the teachers’ roles, especially the seventh role, and thus able to adopt a variety of teaching approaches related to the learners’ context in order to enhance teaching and learning.

Through this study I intend to contribute towards the development of teachers’ pedagogical practice, specifically in Life Sciences, in the sense that the study serves as a reflection of their practice. Since poor performance is a subject of national concern, it is important that any aim to improve approaches to the teaching of Life Sciences be investigated.

1.4 CRITICAL RESEARCH QUESTIONS

To address the research problems identified above, I investigated two major questions:

1. Which teaching approaches are used by Grade 12 Life Sciences teachers to teach a section of environmental studies?
2. Why do Grade 12 Life Sciences teachers use those approaches?

1.5 THEORETICAL FRAMEWORK

The study is guided by the social constructivist theoretical lens. Some teaching approaches are socially constructive in nature. For example, Brooks and Brooks (1999) report that the use of social constructivist teaching approaches relate to the improvement of learner performance

when teachers, in their teaching, apply the following: structure lessons to challenge students' suppositions, for example, introducing lessons by asking what students already know; structuring lessons around big ideas, for example, exposing students to the whole to help students determine the relevant parts. Constructivist-based teaching approaches allow learners to demonstrate their knowledge in a variety of ways. Pollard's (2005) constructivist model of teaching is discussed in detail in Chapter two. Context and background of the study is discussed in the following paragraph.

1.6 CONTEXT AND BACKGROUND

The study is located at three secondary schools, one situated at rural area, the second at semi-rural and the third one at the city of Pietermaritzburg. I have chosen institutions from different backgrounds with the hope that it would provide 'rich data' and thick descriptions on the way teachers approach lessons in Life Sciences classrooms. The three schools fall under Umgungundlovu district but belong to different Circuits. The schools belong to Sweetwaters Circuit, Edendale Circuit and Pietermaritzburg Central Circuit respectively. One grade 12 Life Sciences teacher was selected from each school. The pre-selected unit of study that they all taught was video-recorded. These teachers were then interviewed using a semi-structured interview schedule. I observed one lesson per teacher per school. The unit of study comprised of one hour lessons. These lessons enabled me to observe, explore describe and explain the approaches that the teachers used during the delivery of their Life Sciences lessons. During semi-structured interviews, teachers were able to answer the questions directly as they have been reminded of their teaching at a particular point in time.

1.7 OVERVIEW OF THE STUDY

This thesis consists of five chapters. A reference list and appropriate appendices relevant to the study are included.

Chapter one presents the contextual and personal imperatives that motivated my undertaking of this study. The rationale, focus and purpose and critical research questions are described. The research questions correspond with information given to support and motivate the aim of this study. I also discuss the theoretical framework that underpins this study, in which social constructivism is favoured as a theoretical framework particularly Pollard's (2005) teaching model. The research methodology selected for this study is briefly introduced in this chapter.

Chapter two provides a concise literature review that describes how science teachers approach lessons in the classroom and why. Reviewed literature is based on the different teaching approaches and theoretical framework that relates to the study. From literature on teaching approaches, the following teaching approaches are described: *context-based teaching*, *experiential teaching*, *facilitator teaching*, *executive teaching* and *environmental awareness teaching*. Literature that describes the theoretical framework underpinning the study, which is social constructivism, is discussed in this chapter. I selected Pollard's (2005) social constructivist model of teaching as my theoretical framework, which depicts the roles of teachers in teaching as first engaging with children's conceptual understanding before planning activities.

Chapter three describes the research design and methodology used in this study. Since the study is about exploring approaches to teaching a section of environmental studies in Life Sciences and why these approaches are chosen, and answering the two critical research questions it involves interacting with Life Sciences teachers. I therefore selected to situate my study in a qualitative research design, underpinned by the interpretive paradigm. A case study research method was used. The sampling method, data collection methods which were lesson observations followed by semi-structured interviews, plus documents and field notes were described. Finally the related ethical considerations are discussed.

Chapter four presents and analyses the data gathered to capture the main argument of this study. I first section describes the biographies of the three teacher participants. Recorded data from the lesson observations and interviews were transcribed into text, and these data are analysed in this chapter. From the data analyses five themes were established, which are outlined in this chapter.

Chapter five provides a description of the five themes conceptualized as the main findings of the study. These were: *pedagogical concrete science*; *science in motion*; *teacher as knower*; *interactive science*; and *teacher in action*. The findings are discussed around each of the two research questions, with reference to related literature reviewed and the theoretical framework. Suggested recommendations to the DoBE are outlined, and the overall conclusion of the study is provided.

1.8 CONCLUSION

It was clear from observations that I made in the school-based cluster moderation sessions that learners were achieving low marks in Life Sciences. Besides other contextual factors mentioned earlier, the way that teachers conduct their lessons in Life Sciences might have an influence on learners obtaining low marks. I therefore conducted this qualitative research study to find out which teaching approaches teachers employed in science classrooms and why they did so.

Literature reviewed in this study provides evidence that if teachers employ a variety of teaching approaches and methods in science classrooms (for example, base their teaching on the learners' context, arrange learners in groups), quality teaching may result.

An overview of the study was discussed in this chapter. I presented the purpose, rationale and two critical research questions. This was followed by a description of the methodology, data collection methods (lesson observations and interviews), the theoretical framework of social constructivist theory, and finally an overview of the study.

A review of the literature that relates to teaching approaches and the theoretical framework of this study follow in chapter two.

CHAPTER TWO

REVIEW OF LITERATURE ON TEACHING APPROACHES AND THEORETICAL FRAMEWORK

2.1 LITERATURE REVIEW ON TEACHING APPROACHES

2.1.1 INTRODUCTION

In this chapter I review the extant literature that relates to the teaching approaches and teaching methods employed by science teachers. I am using the phrase “teaching approach” with reference to educational actions intended to engage with a situation or problem in the context of the Life Sciences syllabus. An example of a teaching approach is the following: when action is taken by the teacher in order to unpack science concepts by using simple language. In doing so, the teacher enhances learners’ understanding and may improve their performance. Hence teaching methods refer to the way of doing something systematically in an orderly and logical arrangement, usually in steps. As an example of the aforementioned a teacher may organise learners into whole-class teaching, group work, pair work or individualized teaching. Literature on the National Curriculum Statement (NCS) Grade 10-12 (DoE, 2005) policy document to find out whether the teaching approaches that teachers employ in the classroom are in line with it has been explored. I have reviewed the following literature that describes teaching approaches: *context-based teaching approaches in which relating, cooperating and transferring teaching strategies are discussed; experiential teaching approach; facilitating teaching approach; the executive teaching approach; the liberationist teaching approach; and the environmental awareness teaching approach.*

I explored literature by the authors outlined below. Crawford (2001) and Bennet, Lubben and Hogarth (2006), who support context-based teaching approaches as the starting-point for the development of science ideas; and Reigeluth and Carr-Chellman (2009), Trigwell, Prosser and Taylor (1994), who view experiential teaching as learner-centred and as the necessary basis for meaningful skills acquisition and human development. Fenstermacher and Soltis (2004), Gamora, Secada, and Marret (1998) and Gibbs (1992), who all advocate that teachers who employ the facilitator teaching approach help learners build their understanding,

knowledge and skills in science classrooms. Studies by Bartosh (2003), Loubser (2005) and Littledyke (2008), who opine that environmental teaching awareness teaching approaches will make learners value their environment. I reviewed studies by Hativa (2000) and Farmery (2002), who refer to teaching approaches as how teachers organise learners during teaching, for example, in pairs or in groups.

Reviewed literature from the South African context provided background to the two critical research questions of this study. The literature identified various teaching approaches and provided the advantages of using that approach. For example, Jerrier (2009) argues that the teacher has a task to find out learners' prior conceptions, identify misconceptions, and allow them to learn through various methods that get them involved actively in a lesson. Jerrier (2009) therefore emphasises that the success of a lesson will depend on starting the lesson by identifying what learners know and challenging learners' ideas with various activities. Motshegoa (2006), on the other hand, conducted a study on the implementation of Environmental Policy in schools; however, his interest was in the implementation of a variety of teaching approaches and teaching methods in the classroom.

What follows is a discussion of the different teaching approaches identified from reviewed literature, namely the context-based teaching approach, experiential teaching approach, facilitator teaching approach, executive teaching approach and environmental awareness teaching approach. Literature by Dorman, Fisher and Waldrup (2006), which emphasises the importance of teaching approaches where teachers provide support in science classrooms to improve teaching, was reviewed. In the following paragraphs I discuss the teaching approaches that I discovered from the reviewed literature.

2.2 TEACHING APPROACHES

As stated earlier in chapter one, teaching approach refers to the way teachers present their lessons during teaching. As part of teaching approaches are the lesson plans preparations, lesson introduction, activities given to learners and assessment strategies implemented during lesson presentation. The following factors play a major role when teachers approach lessons especially in Life Sciences classrooms; the context in which lesson is presented, teachers previous experience in relation to the subject, facilitation during teaching, development of teaching materials/ resources/teaching aids for the lesson and making learners aware of environmental issues and how these issues affect them in their daily lives. It is from these

factors that I have reviewed literature that describes the five teaching approaches that are commonly employed by Life Sciences teachers when they teach. I then discuss the five teaching approaches reviewed from literature in the following paragraph starting with context-based teaching approach.

2.2.1 Context-based teaching approach

Context-based teaching refers to consideration of the situation or type of the environment in which teaching is to take place. The teacher then plans the lesson to fit the type of context to present the lesson. Teaching learners to relate previous knowledge to new content, teaching learners to take initiatives, and transferring knowledge while introducing the subject forms the basis of context-based teaching approach. Studies conducted by Bennet et al. (2006) on context-based teaching approaches emphasise that context and applications should be used as the *starting point* for the development of science ideas to enhance teaching. They conclude that context-based teaching approaches stimulate young people's interest in science and help them to see how it relates to their everyday lives. However, I argue that Bennet et al.'s (2006) conclusion does not always apply; some learners have lost interest in the science classroom due to contextual factors. In most schools, the medium of instruction which is English is one of the contextual factors facing learners in science classroom. The style of teaching in primary schools does not prepare learners for FET Band in Education. Most teaching is done in vernacular therefore learners find it difficult to understand teachers when they unpack science concepts.

According to Crawford (2001) teachers who start the lesson by letting learners relate the new concepts to what they already know are employing a context-based teaching approach. Crawford (2001) contends that there are five context-based teaching approaches: relating, experiencing, applying, cooperating and transferring. Of these five context-based teaching approaches, my focus is on the following three: relating, cooperating and transferring, which I found relevant to my study with reference to how Life Sciences teachers conduct their lessons.

2.2.1. Relational teaching: From the known to the known

When teachers assist learners to see the connection or similarities between the new concepts and what they already know, this is 'relational teaching' (Crawford, 2001). Relational teaching is used when teachers link a new concept to something completely familiar to

students, thus connecting what students already know to the new information. Teachers using relating contextual teaching start their lessons from what learners have experienced in their daily lives. The relational teaching approach reinforces the students' prior knowledge and enhances learning of new concepts. When teachers approach their lessons using relational teaching new science concepts are grasped by learners, and this addresses my second critical research question. As a Life Sciences teacher I have observed that if I introduce a lesson with something that learners are familiar with, learners show interest and participate during the lesson.

Farmery (2002) argues that relational teaching is used often during the introduction of the lesson in the whole-class teaching method. Whole-class teaching relies on a high level of communication and presentation skills on the part of the teacher. Whole-class presentation of a lesson requires the teacher to have good exposition skills in order to explain concepts in different ways, thus challenging the best-performing and poor-performing learners. Eventually learners develop an interest in the lesson and are able to relate the unknown concept to what they already know.

Farmery (2002) emphasises that teachers conducting whole-class teaching method must possess skills which will engage all of pupils' attention during a lesson. From my experience I have realised that teachers in large classes are struggling to engage the learners' attention during whole-class teaching. The struggle is partially eased if learners are taught in groups; I say 'partially' because in large classes, while a teacher is attending to one group the other groups may not be attentive. Capturing learners' attention is vested in the teacher having interest and enthusiasm in the lesson and possessing the ability to motivate learners. When a teacher has gained learners' attention during whole-class teaching, the relational teaching strategy becomes possible.

2.2.1.2 Cooperative teaching: Teaching learners to take initiative

The cooperative contextual teaching approach refers to the teaching where teachers organise learners in groups or pairs in order to work together and assist one another (Crawford, 2001). When groups are formed learners are then assigned activities in their groups. It is in the group activities that learners will display cooperation as they discuss the activity. For my study the focus is how teachers form groups in order to approach their lessons effectively.

Farmery (2002) identifies various ways in which groups can be formed. For example, best-performing learners can be mixed with poor-performing learners (mixed ability), or they can be grouped by age, by friendship, and by interest/enthusiasm. When a teacher gives learners problem-solving exercises which involve realistic situations, the exercises become complex (Crawford, 2001, p.11). When learners work in small groups they can handle complex problems with little outside help.

The teacher employing a cooperating contextual teaching approach should be skilled in forming effective groups, assign appropriate tasks, be keenly observant during group activities, diagnose problems quickly, and supply information or direction necessary to keep all groups moving forward. If this is the case, then teaching will be effective. For quality teaching the teacher needs to understand the group dynamics and ensure that each learner understands his/her role in the group, thus reducing withdrawal from the task either physically or mentally, in order to enhance the cooperating teaching strategy.

Teachers incorporating cooperative teaching should thus be skilled in forming groups, and also know why they use group teaching methods. In connection with group work, Reigeluth and Carr-Chellman (2009) hold the view that action teaching is associated with group learning which takes place under work-based instruction. The teacher gives instructions to learners on a particular item of work to complete in their groups. Approaching lessons using group work has become a trend since the new education policy dispensation in South Africa post-1994.

When learners are organised into groups, teaching becomes active and learner-centred. This is evident in Barraket's (2005) teaching, where he developed a more student-centred approach and focused specifically on the role of small group activities. Student-centred instructional methods include discussion, group work, role-playing, experiential learning, problem-based learning and group method teaching (Hativa, 2000).

Learner-centred teaching represents teaching in action. Action teaching is discussed in Reigeluth and Carr-Chellman (2009) under work-based instruction. Action teaching is an approach in which a teacher assigns work to groups, and the groups convene to develop solutions to specific problems and create a plan to carry out their solutions. For instance, a teacher who employs the group method gives learners an opportunity to find solutions to their problems in the classroom.

The Commonwealth of Learning (2000) argues that group work allows for individual differences, so the learner learns more effectively. The teacher can attend to learners who need more attention, and learners can share skills and work cooperatively. Group work can be organised as follows: all groups working on the same task, each group working on a separate task which contributes to the lesson objective, each group rotating around different activities, or each group working on areas chosen by the group.

2.2.1. 3 Transmission teaching: Transferring knowledge contextually

Transferring is a teaching approach that is defined as “using knowledge in a new context or novel situation – one that has not been covered in class” (Crawford, 2001). Teachers employing a transmission teaching approach use whole-class teaching method. Transferring knowledge is a traditional teaching approach which Life Sciences teachers cannot do away with, as they have to unpack new Life Sciences concepts to learners. Transferring knowledge relates to my study, because a section of environmental studies in Life Sciences is one of the topics in the syllabus with specific terminology that teachers need to explain to learners.

Teachers should be skilled to use transferring contextual teaching. According to Crawford (2001), teachers should have a natural ability to introduce novel ideas that motivate students intrinsically by invoking curiosity or emotions. Although teachers are expected to gain learners’ curiosity when introducing new concepts in Life Sciences, it is not always the case. In some instances learners lose concentration when they are exposed to unfamiliar situations. However, most teachers prefer to use a contextual teaching approach when introducing new terminology in science.

2.2.2 Experiential approach to instruction

According to Trigwell and Prosser (1997) the experiential teaching approach to instruction refers to teaching where a teacher uses previous experiences and new experiences, and allows learners to experience the natural environment, especially in Life Sciences. Through experience a teacher will approach a lesson in a way so that learners become involved and participate in a lesson.

Since Life Sciences is one of the practical subjects, in schools where resources are lacking and teachers use their experience to improvise for these. Teachers using experiential teaching allow learners to move out of the classroom to explore and experience the natural

environment, thus providing experiential teaching and a positive learning environment. Trigwell and Prosser (1997) contend that teachers whose perceptions about their teaching environment are positive will employ experiential teaching approaches that benefit the learner, and those teaching approaches will be learner-centred. Learner-centred teaching approaches are in line with the NCS policy of the DoE.

2.2.3 Facilitative teaching approach

Fenstermacher and Soltis' (2004) study states that a teacher who uses a facilitator approach in teaching "helps learners to grow personally and reach self-actualization and understanding". Through the facilitative teaching approach individuals make meaning through interactions with each other and with the environment they live in. Students then investigate the concepts about the environment on their own or in small groups, with the teacher present to keep students on track and to answer questions.

Through my experience of teaching Life Sciences I support Fenstermacher and Soltis' (2004) findings help learners to grow personally. Teachers employing facilitation teaching approaches usually arrange learners into groups. For example, as learners participate in the classroom, they become part of teaching, ask questions and request clarification on certain concepts while the teacher moves around the groups and provides assistance. Therefore a teacher who uses a facilitator teaching approach is employing a learner-centred teaching approach.

A facilitator displays a different set of skills compared to the teacher. Gibbs (1992) compares a facilitator to the teacher as follows: a teacher tells; a teacher lectures from the front, while a facilitator supports from the back; a teacher gives answers according to a set curriculum, a facilitator provides guidance; a facilitator defines and creates the environment for the learner to arrive at his or her own conclusions; a teacher mostly gives a monologue, a facilitator is in continuous dialogue with the learners. The NCS (DoE, 2005) stipulates that teachers should adopt facilitation teaching approaches as they are learner-centred. In support of the aforementioned literature, I also hold the view that facilitation teaching is representative of quality teaching, especially in science classes.

According to Gibbs (1992) a learner-centred approach gives learners greater control over their learning process and pace of study. Gibbs (1992) further argues that in facilitation teaching approach the teacher uses individual learners' experiences, interests, capabilities and

needs to help learners build their understanding, knowledge and skills. Therefore teachers who employ facilitation teaching approach assist learners to build their understanding, knowledge and skills. In this way teachers contribute to quality teaching and improve learner performance.

2.2.4 Executive teaching approach

In the executive teaching approach a teacher is viewed as a manager who carefully develops curriculum materials and uses methods of teaching such as group work and pair work which are backed by research (Fenstermacher & Soltis, 2004). In this regard a teacher will develop her or his own resources for the teaching informed by the curriculum. The United Nations Educational, Scientific and Cultural Organization's Man and the Biosphere (MAB) Programme is currently developing two teaching resource kits for environmental education (Website Teach/Centre for Eco-literacy, 2012). These kits (resources) are intended for primary and secondary school teachers worldwide. A teacher who uses resources will assist learners to use their senses as he/she demonstrates science procedures. In Life Sciences some schools in rural areas are lacking science resources; teachers in these schools become executive teachers as they develop resources to use in science lessons thus enhancing interest for science lessons in learners.

According to Fenstermacher and Soltis (2004) teachers who use resources when teaching will enhance learning and this will lead to improvement of results. As a Life Sciences teacher I argue that it is not always the case that using resources (the executive approach) will lead a teacher to produce good results. This depends on other factors to do with teaching and learning, for example other teaching approaches employed with the executive approach and the attitude of learners towards science subjects. It therefore remains the duty of science teachers to instill to learners the motive that science is not abstract so that learners can change their attitude and this may have a positive impact towards learner performance. I also argue that a teacher who uses only one teaching approach in a lesson cannot improve his/her teaching.

2.2.5 Environmental awareness teaching approaches

A teacher, who uses the natural environment as a resource for teaching, by assigning activities that give learners opportunities to interact with the environment, makes learners aware of the importance of the environment during lessons (Marcinkowski, 1993). Such an

approach to teaching is said to be environmental awareness teaching. In this teaching approach environmental awareness issues are brought into the classroom. Once learners are aware of environmental issues they can regulate their behaviour in relation to their environment. Environmental awareness teaching approach is the only one that emphasises environmental issues.

Literature that supports environmental awareness teaching approaches emphasises that a number of instructional teaching approaches are necessary in environmental teaching to maximise instructional effectiveness. Marcinkowski (1993) concludes that teachers cannot become effective environmental educators if they are prepared to use only lecture discussion approaches in the teaching/learning.

Bartosh's (2003) study on how nature can be used in environmental studies highlights that education through the environment sees nature as a tool and resource of the learning process in order to research the activities of a child, form the individual experience and develop a wide range of skills of investigation and communication. Bartosh (2003) further argues that education about the environment is usually a part of formal education and has an empirical character, where the senses of touch, smell and vision can be used.

Loubser (2005) supports Bartosh (2003) in that the main focus on environmental education should be on environmental issues. The state of the environment affects every individual both directly and indirectly (Loubser, 2005). Loubser (2005, p.135) emphasises that once a good curriculum (environmental) is in place, teachers and facilitators will have to choose the strategies and methods to utilise in their teaching contexts.

In view of this literature, it is clear that teaching contexts play an important role in teaching approaches which should be adopted in environmental teaching. Loubser (2005) emphasises that it is important that learners should be made aware of environmental issues to sensitise them to aspects that may directly affect them, for example air pollution from sources such as coal burning.

Littledyke (2008) supports Loubser (2005) on the inclusion of environmental awareness teaching approaches in the classroom. According to Littledyke (2008), in science education environmental issues are often brought into the classroom in order to bring about an awareness that society needs to regulate their behaviour in relation to the environment. His findings bring to light that in environmental education learners should be encouraged to

develop a sense of relationship with the environment, so that the learner will translate into environmental behaviour that follows through into adulthood. Science topics can be addressed in a way that incorporates cognitive and affective domains (Littledyke, 2008). In light of the above, sensation experiences through plant investigations involving smell, vision, taste and touch can be used as a teaching method to identify adaptive features, thus promoting aesthetic appreciation. Littledyke (2008) concludes that teachers must use environmental awareness teaching approaches that will make learners value their environment.

Finally, I reviewed studies by Dorman, Fisher and Waldrup et al. (2006), whose findings were that teachers who provide support demonstrate equity in the classroom and ensure that quality teaching is enforced. Teachers also have a profound effect on learning environment in their classrooms, in how they manipulate the environment in order to develop the teaching approaches that will improve teaching. Dorman et al.'s (2006) conclusion is that successful implementation of teaching approaches to teach science is likely to result in the establishment and maintenance of positive student attitudes to science, and consequently achievement. From this perspective teachers who employ a variety of teaching approaches in science classrooms improve the quality of teaching. In the following paragraph I discuss literature reviewed on the theoretical framework that underpins this study.

2.3 THEORETICAL FRAMEWORK

The theoretical framework that guides the interpretation of my study is social constructivism. Social constructivism refers to how teachers interacts with the (physical) and social environment and learners in order to approach lessons to achieve quality teaching which is interesting to learners. By 'quality teaching' I refer to teaching that involves learners in the classroom, for example the facilitation teaching approach. Since my study seeks to explore the teaching approaches which teachers employ in science classrooms, I explored literature that identifies the common teaching approaches in science classrooms.

In this regard, I have favoured literature by Pollard (2005), who depicts a social constructivists' model of teaching and how teachers negotiate meaning and provide support to learners in connection with the activities they give to learners in the classroom. I have further reviewed the following: Brooks and Brooks' study (1999) on the use of constructivist teaching in the classroom; Gray (1997) who emphasises that learners may be aided by encouraging them to ask questions and therefore making them active learners; Robertson (2008) who state that a constructivist teacher promotes critical thinking; Wolmarans (2000)

who supports Brooks and Brooks (1999) in the creation of authentic teaching environments by a constructivist teacher; Khalid & Azeem (2012) who state the importance of past experiences and cultural factors to knowledge construction; Cey (2001) who contends that past experiences and cultural factors are important to knowledge construction; Mvududu (2005) who concludes that a constructivist teacher must be skilled in structuring the social climate of the classroom; Yager (1991) emphasises the questioning approach in teaching and Jarvinen (1998) who points out that the process of allowing interaction amongst learners plays major role in constructivist teaching.

Brooks and Brooks (1999) report that the use of constructivist teaching approaches relates to the improvement of learner performance when teachers, in their teaching, apply the following: structuring lessons to challenge students' suppositions; for example, introducing lessons by asking what students already know (context-based teaching approach); and/or structuring lessons around big ideas, for example, and allowing learners to interact with the natural environment (environmental awareness teaching approach). In constructivist based-teaching approaches, teachers strive to demonstrate their knowledge in a variety of ways by giving learners' activities that occupy them during lessons. Teachers then guide learners as they move around the groups, discover whether learners understand the activity and give assistance where learners are experiencing problems. The research method I used for data collection was lesson observation where I found that teachers engage learners by organising them into smaller groups throughout the lesson.

Brooks and Brooks (1999) suggest twelve strategies for teachers to exercise in order to move towards a more constructivist teaching approach. The strategies are as follows;

Encourage and accept student autonomy and initiative; teachers have to ask questions when introducing a lesson and give learners some tasks to do so as to encourage learners to take initiatives. Learners may also be given an opportunity to lead lessons by letting them come to the front of the class and lead discussions. When learners are given such opportunities, they are able to take initiatives in lessons without being pointed at to do so. According to Gray (1997) empowerment and autonomy may be aided by encouraging learners to ask questions and therefore making them active learners. Actively and interactively involved learners negotiate curriculum and redistribution of power control and responsibility. All this contributes to a relationship between learners and teachers that promotes a situation where learning occurs. When teachers adopt a constructivist approach in teaching, they are able to

create a classroom environment within which learners become autonomous learners. I argue that in some instances learners may ask questions irrelevant to the topic so as to distort content based on the lesson. It is therefore the responsibility of the constructivist teacher channel learners towards asking questions relevant to the topic.

Use raw data and primary sources, along with manipulative, interactive, and physical materials; teachers in science classes may use raw data and primary sources to explain science concepts. When teachers bring science equipment to the classroom and give learners an opportunity to touch and work with that equipment, as learners handle science apparatus and physical materials they acquire manipulative skills which may lead to concretization of abstract science concepts. Wolmarans (2000) supports Brooks and Brooks (1999) that authentic teaching environments promote teaching and learning; Khalid & Azeem (2012) who state the importance of past experiences and cultural factors to a construct knowledge;

Use cognitive terminology such as “classify”, “analyse”, “predict”, and “create”; science teaching goes hand in hand with science technology. In using cognitive terminology, a constructivist teacher would ensure that learners encounter science concepts in a variety of ways and situations in order for the learner to become competent in the generation of and transfer of constructed knowledge.

Allow student responses to drive lessons, shift instructional strategies, and alter content; according to Robertson (2008) a constructivist teacher sets up problems and monitors student exploration, guides student inquiry and promotes critical thinking. When using this strategy, a constructivist teacher will drive a lesson from the responses of learners hence content that the teacher had planned will be altered. In this respect learners will view their responses as forming the basis of content and will be motivated to contribute during lessons most of the time.

Inquire about students’ understanding of concepts before sharing their own understandings of those concepts; in this perspective constructivist teachers find out by asking questions whether learners understand science concepts before explaining those concepts. This is termed teaching from the known to bring the unknown concepts to learners’ attention. Constructivists argued that a learner is not a blank slate (*tabula rasa*) but brings past experiences and cultural factors to a construct of new knowledge in a situation (Khalid & Azeem, 2012).

Encourage students to engage in dialogue, both with the teacher and with one another; in this perspective, a constructivist teacher develops rapport (understanding) with learners by asking questions. As learners answer questions asked by the teacher, they are engaging in dialogue with the teacher. A constructivist teacher also gives learners tasks that will encourage learners to talk to each other in group discussions. In groups, as they talk to one another, they engage in dialogue and they find out about science concepts on their own. Cey (2001) suggests that collaboration work allows for classrooms to be more cooperative than competitive. Cey (2001) further states that students engaging in group work begin to view one another as resources rather than sources of ridicule. Learners therefore come to view their peers as resources not as competitors. I therefore argue that encouraging learners to engage in dialogue with one another promotes learners to elaborate on their own ideas as well as those of their peers. Cooperative teaching promotes learners taking initiative in science classrooms (Crawford, 2001). In his study, Mvududu (2005) concludes that a constructivist teacher must be skilled in structuring the social climate of the classroom such that students discuss, reflect on and make sense of statistics tasks.

Encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other; constructivist teachers confront learners with problems from multiple perspectives so as to stimulate inquiry. Teachers also ask thought provoking questions to promote applicability of learners' knowledge across varying situations. Constructivist teachers have to ask questions that are open-ended to stimulate learner involvement in the classroom. The constructivist teacher will then enable learners to play an active role in their lessons. In constructivist teaching, a teacher poses a question to learners, who then work together in small groups to discover one or more solutions (Yager, 1991). As Yager (1991) argues that posing open-ended questions stimulates learners to provide explanations of their answers which benefits other learners.

Engage students in experiences that might engender contradictions to their initial hypothesis and then encourage discussion; this strategy requires the constructivist teacher to give learners challenging questions so that learners' initial hypothesis are challenged and the teacher drives learners towards right direction concerning their initial hypothesis.

Seek elaboration of students' initial responses; a teacher who allows learners to expatiate on their initial responses stimulates learners to be actively involved in a lesson. According to Gray (1997) constructivist teaching fosters critical thinking and creates active and motivated

learners. As the teacher seeks elaboration of learners' initial responses, critical thinking is stimulated when learners elaborate on their responses. In this strategy, learners negotiate meaning about the content that is taught.

Allow wait time after posing a question; constructivist teaching is based on the belief that learning occurs as learners are actively involved in a lesson. Learners need to be given an opportunity to think about a question asked by the teacher, i.e. waiting time after posing a question. According to Brooks and Brooks (1999) when a constructivist teacher asks questions in the classroom, he or she must not expect answers immediately from learners. A teacher must give learners some time to think about the question asked before learners respond to the question.

Provide time for students to construct relationships and create metaphor; learners have to be given time to get used to one another so that when they are given tasks in groups or in pairs they already understand each other and are able to work together. In such cases a constructivist teacher would have been assisted learners in constructing relationships and creating metaphor.

Constructivist teachers must create opportunities for peer scaffolding and teacher-directed scaffolding which is the process of allowing interaction that stimulates knowledge building, and therefore bridges differences of knowledge levels within a classroom situation. A constructivist teacher is not "the one" who is knowledgeable but has to provide each learner with an opportunity to learn how to learn (Jarvinen, 1998). In this perspective, Jarvinen (1998) points out that the process of allowing interaction amongst learners and between the teacher and learners reinforces knowledge building to learners which then stimulates interest in science classrooms. According to Mvududu (2005) scaffolding in constructivist teaching refers to the intersectional support that instructors or more skilled peers offer learners to bridge the gap between their current skill and the desired skill level. Ultimately learners can learn to complete the tasks on their own. Therefore scaffolding aims to cultivate independent and self-directed learners. The scaffolding provides a strategy to direct teaching towards a constructivist perspective hence benefits the learner.

2.3.1 Pedagogies of Constructivism

In light of the critical research questions that I sought to answer in this study, and having adopted the theoretical framework of social constructivism, I referred to studies that highlight

the pedagogies based on constructivist teaching and learning environments. Pedagogy refers to teaching a child so that there is change in behaviour. In order to teach a child a teacher will apply the teaching approaches and designs and assign activities to learners. The pedagogies that are designed according to the constructivist teaching are discussed and the relationship between constructivism and the philosophy of the NCS Life Sciences document is also explained.

Literature on the theoretical framework of social constructivism as it relates to the teaching approaches employed by Life Sciences teachers to teaching environmental studies to Grade 12 learners has been reviewed. According to the social constructivist teaching approach, teachers are to become facilitators (Fenstermacher & Soltis 2004). According to Fenstermacher and Solti (2004) teachers give a didactic lecture that covers subject matter, whereas a facilitator helps the learner to get to his own understanding of the content.

Colburn (2000) argues that educators must determine how to make the transition from classic instruction to instruction that makes good use of constructivist ideas. Making changes slowly, taking time to develop new skills, and giving students time to adapt to new ways of being taught help to ensure transition (Colburn, 2000).

Constructivist theory implies that science teachers should: provide laboratory activities before discussing the results students are expected to find; discuss laboratory investigations before lecturing on their topics; remove laboratory data tables so that students generate or organise information; change tests to require more concept application by students; use a questioning strategy that encourages students to reveal what they are thinking; have students invent procedures to answer a laboratory question; and put students where groups debate, discuss, research and share (Colburn, 2000).

Constructivism's implications for how teachers teach and learn to teach are enormous (Mvududu, 2005). In many cases educators in South Africa are victims of their previous education and generally teach in the manner in which they were taught. Furthermore, many educators were neither exposed to nor did they learn large chunks of content knowledge during their schooling. Irrespective of the challenges the constructivist teacher may be facing, in the classroom the teacher has to become the facilitator of each individual's personal and social construction processes by establishing classroom interaction patterns that promote each individual's exploration and resolution of ideas within the social-cultural context. A

constructivist teacher will have created a positive learning environment where learners feel free to explore, hypothesise and brainstorm.

I adopted constructivist theory for my study as it guides many teachers in the teaching approaches they decide to employ in the classroom. Pollard's model of teaching (Figure 1) is useful to interpret social constructivists' classrooms. Below I describe Pollard's (2005) social constructivist model which depicts the roles of teachers in the teaching-learning process.

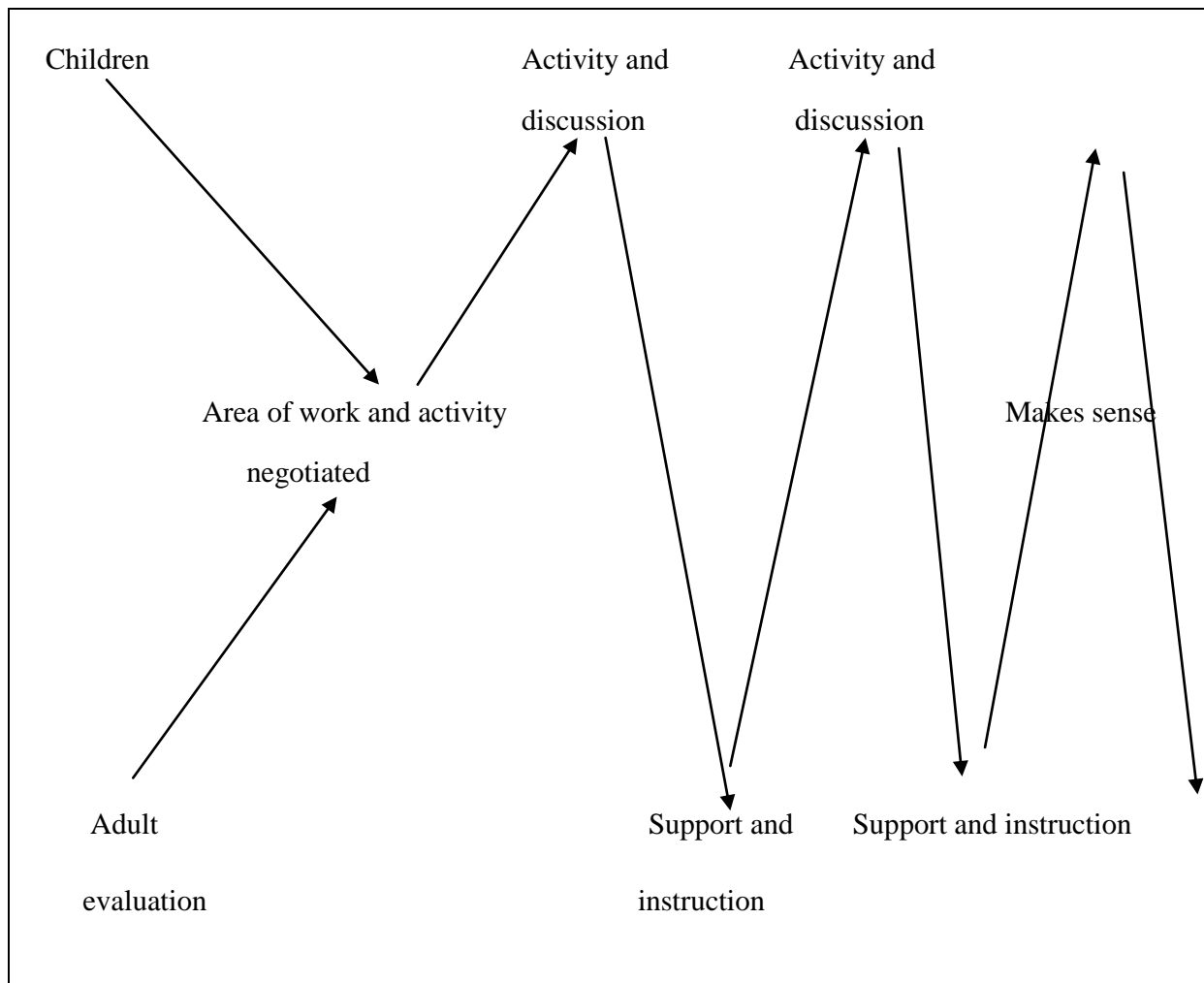


Figure 1: A social constructivist model of roles in the teaching-learning process (Pollard, 2005)

According to social constructivists' teaching principles, teachers should provide rich and varied activities that are stimulating, hands-on, and inquiry-based, which will stimulate thinking (Pollard, 2005). For Pollard's (2005) teaching model, social constructivists' teaching approaches emphasise that teachers will have to provide support as they engage with their

lessons. This intervention must connect with the understandings and purposes of the learners so that their thinking is extended (Pollard, 2005).

Looking at Pollard's (2005) model (Figure 1) of social constructivism in the roles of the teaching-learning process, it shows that the science teacher will have to plan and prepare many different types of activities in which the learner must be actively involved, both cognitively and physically or hands-on, in order for learning to take place. It is through a series of activities in a group that learners can engage in the dialogue of science to make sense of the concepts that are being taught. In this way the activities set by the teacher become more learner-centred.

Baviskar, Hartle and Whitney (2009) hold the view that there are specific teaching methodologies that are strongly constructivist, such as the inquiry-based method. It is this kind of constructivist teaching that this study seeks to investigate, with reference to the teaching approaches that science teachers employ in the classroom. For example, I have selected to explore the constructivist theory of teaching to find out whether Life Sciences teachers employ inquiry-based teaching methods in their lessons.

During classroom observations I will discover whether teachers follow the criteria for constructivist teaching, and I will analyse whether the teaching methods employed are constructivist in nature (for instance, eliciting prior knowledge of learners). Khalid and Azeem (2012) share the same view as Baviskar et al. (2009) that the constructivist teacher helps the students through problem-solving and inquiry-based learning activities where students formulate and test their ideas, draw conclusions and inferences, and pool and convey their knowledge in a collaborative learning environment.

The three learning outcomes that learners should achieve in Life Sciences are Scientific Inquiry and Problem-solving Skills; Construction and Application of Life Sciences Knowledge; and Life Sciences, Technology, Environment and Society (NCS Grade 10-12, (DoE, 2005)). This document supports constructivist theory as it emphasises inquiry-based and problem-solving teaching methods.

According to Khalid and Azeem (2012) the task of the instructor is to translate information to be learned into a format appropriate to the learners' current state of understanding. In this way teachers assist the students in developing new insights and connect them with previous knowledge. Khalid and Azeem (2012) cite Scheurman (1998), who stated that many teachers

are hesitant to try the constructivist model because it requires additional planning and relaxation of the grip of the traditional teaching method.

Constructivist teaching approaches provide opportunities to question the material being presented and explore various topics as interest is piqued. In this respect teachers can help students in using discovery-based learning opportunities by providing them with manipulative and primary resources to enhance and guide them in their learning.

Mvududu (2005) argues that a constructivist-oriented teacher must be skilled in structuring the social climate in the classroom such that students discuss, reflect on and make sense of statistics tasks. The teaching approaches highlighted earlier reveal that facilitation teaching, experiential teaching and environmental awareness teaching allow the teacher to engage with the environment and therefore emerge with improved teaching.

A teacher who promotes students' interaction in the classroom is a facilitator (Gamoran, Secada & Marret, 1998). Constructivist theorists support facilitator approach to teaching, which is learner-centred. In this regard, I selected constructivist theory to answer my first critical research question about which teaching approaches Life Sciences teachers use in the classroom (for example, a didactic teaching approach, facilitator teaching approach or enquiry-based teaching approach) to improve learner performance. Social constructivism as a broad theoretical lens for my study has led me to review literature on theories of teaching. Hence I will use this theoretical frame during the analysis of data to answer my critical questions.

Khalid and Azeem (2012) support the social constructivist paradigm since they argue that it results in the negotiation of meaning among all role-players in the school community. Environmental education in schools therefore forms the constructivist curriculum, as the NCS Grades 10-12 (DoE, 2005) document states that learners must achieve the skill of construction and use of concepts to explain phenomena in Life Sciences. Whether Life Sciences teachers use social constructivist teaching approaches remains to be established by this study, which will be possible when I analyse the data.

2.4 CONCLUSION

In this chapter I reviewed literature on different teaching approaches and social constructivist theory. From the literature I identified five teaching approaches, namely the context-based

teaching approach, experiential teaching approach, facilitative teaching approach, executive teaching approach and environmental awareness teaching approach. I have also presented the theoretical framework that will be employed to guide the interpretation of this study. I found out how social constructivism can be used in science classrooms to improve learner performance, for example through facilitative teaching and inquiry-based teaching approaches.

The connection that I identified between this study and constructivist theory is that facilitative teaching, which is favoured throughout this literature, makes the teacher become active during teaching as she moves around groups, guides learners on assigned tasks and gives clarity in areas of misunderstanding. In constructivist teaching there is a belief that the use of a variety of teaching approaches brings quality teaching to the classroom, and therefore learners are put at an advantage (Khalid & Azeem, 2012). This connection is strengthened by Baviskar et al. (2009). In this regard Khalid and Azeem (2012) assert that teachers employing constructivist theory are able to stimulate the mind of the learner through quality teaching.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the research design that I used to achieve the aims and goals of this study. It attempts to clarify the methodological perspective and describes and justifies the research methods I have chosen for my study. It explains how these choices relate to the research questions and literature I presented in Chapter two. The research procedures, the sample and how it was chosen, are discussed. It also describes the methods I used to collect the data, which were lesson observations and interviews. How these data were analysed, and how I dealt with the related ethical issues are also dealt with.

I describe my role as a qualitative researcher, the strategies I used for collection of data and how these were used to answer my critical research questions. According to McMillan and Schumacher (2006) a researcher using qualitative methods gives a detailed description about the situation, events, attitudes, and thoughts of the participants. This research methodology enabled me to answer my research questions, namely:

1. Which teaching approaches are employed by Grade 12 Life Sciences teachers when a section of environmental studies is being taught?

The answer to this question will be obtained through lesson observations.

2. Why do teachers use those teaching approaches?

The answer to this question will be obtained from the responses to the semi-structured interviews.

I chose to use a qualitative research methodology underpinned by an interpretive paradigm to provide a detailed description about the teaching approaches used to teach a section of environmental studies in the grade 12 Life sciences syllabus.

3.2 QUALITATIVE RESEARCH

According to Opie (2004), during qualitative research studies collection of data occurs in natural settings through observations and in the form of written accounts or pictures. Qualitative research is concerned with processes as opposed to products.

The researcher explored how people make sense of their practices and emphasises interpreting patterns and identifying themes that emerge from data as opposed to numbers (Opie, 2004). De Villiers (2005) describes qualitative research as a naturalistic, interpretive science which involves the use of methods such as case studies, interviews, observation and textual analysis which provide insights into cultural aspects, organisational practices and human interactions. Connole (1998), on the other hand, explains qualitative research as human actions taking place within a structure of social rules wherein which they have meaning. In my study 'a structure of social rules' refers to the classroom where teaching is taking place.

I collected data in the form of field notes during the classroom observations and video-recorded the way in which the teachers approached their lessons. Interviews were conducted and tape-recorded after lesson observations. Recorded data were transcribed into text and analysed to find out which teaching approaches teachers use in science classrooms and why they use them.

According to Janse van Rensburg (2001) qualitative research requires rich, detailed information of a qualitative nature. In this regard I selected a case study methodology for data collection, which enabled me to work closely with my participants to find out which teaching approaches they use when they teach and why they do so. I describe case study research in the next paragraph.

3.3 CASE STUDY

A case study is defined as "the study of a singularity conducted in depth in natural settings" (Bassey, 1999, p.47). In Bassey's (1999) view, key features of the case study are that it must be conducted mainly within its natural context and that sufficient data must be collected for the researcher to be able to understand significant features of the case, and propose interpretations for what has been observed. I selected a case study approach so that I would be able to obtain data about the teaching approaches which science teachers use in the classroom and why those approaches are used.

Loubser (2005) contends that a case study is a holistic research method that uses multiple sources of evidence to analyse or evaluate a specific phenomenon or instance. Lichtman (2008) argues that case studies focus on intensive examination of a particular group, project or programme. Most researchers put emphasis on the fact that case study focuses on one

phenomenon (Motshegoa, 2006; Jerrier, 2009). Davies and Beaumont (2007) also hold the view that a case study method in research involves detailed and holistic investigations. Data can be collected over a period of time and it is contextual (Davies & Beaumont, 2007). For instance, in my study I used multiple sources of evidence (lesson observations and interviews).

In order to probe why teachers in the case study used the teaching approaches they chose, I needed to generate ‘thick descriptions’ of the reality of teachers’ practice by conducting interviews. Thick descriptions are “meaningful descriptions of data” (Maxwell, 1992, p.288) and are generated by drawing on the participants’ own meanings, largely from the words they themselves have used. Maxwell (1992) further claims that in the end, accounts of participants’ meanings are ultimately constructed by the researcher. The case study approach provides an appropriate method with which to generate such data.

According to Zainal (2007) a case study allows the exploration and understanding of complex issues by the researcher. A case study can be considered a robust research method, particularly when a holistic, in-depth investigation is required (Zainal, 2007). Zainal (2007) further argues that the case study research method enables the researcher to closely examine the data within a specific context. I therefore selected the case study method to collect data from three Life Sciences teachers, so as to be able to closely examine the teaching approaches they use in the classroom.

Rowly (2002) opines that case studies are useful in providing answers to ‘How?’ and ‘Why?’ questions, and this can be used for exploratory, descriptive or explanatory research. In this regard I used a case study to explore the teaching approaches that Grade 12 Life Sciences teachers use in the classroom, and the impact these approaches have on the quality of teaching. This method enabled me to answer my research questions.

Case study research uses a variety of evidence from different sources, such as documents, artifacts, interviews and observations (Rowly, 2002). In my use of the case study research method I used the following research instruments to collect data and answer my research questions: document analysis, lesson observations which were video-taped, and tape-recorded semi-structured interviews.

Davies and Beaumont (2007) state that in case studies data must be purposefully collected through sampling. This is discussed in the following paragraph.

3.3.1 Sampling

According to McMillan and Schumacher (2006) a group of subjects or participants from whom the data are collected is referred to as the sample. The sample is selected from a larger group of persons, identified as the population. From the population of Life Sciences teachers in Pietermaritzburg secondary schools, I selected three Grade 12 Life Sciences teachers from three different schools (one teacher per school). These three teachers form the sample for my study. The sample or key informants come from rural, semi-rural and urban locations respectively.

The sample for my study is purposive, which represents a feature of qualitative research. McMillan and Schumacher (2006) describe purposive sampling as a type of sampling that allows choosing small groups or individuals who are likely to be knowledgeable and informative about the phenomena/subject of interest. In purposive sampling researchers hand-pick the cases to be included in the sample on the basis of their judgments of their typicality or possession of particular characteristic being sought (Cohen, Manion & Morrison, 2011). In this regard I purposefully selected three Grade 12 Life Sciences teachers as knowledgeable informants in Grade 12 environmental studies for my sample. These teachers satisfied the criteria for sampling for my study as they are currently teaching Grade 12 Life Sciences. The three teachers also teach the same section of environmental studies at the time of collection of data for my study. Moreover they belong to the same District of Umgungundlovu. This enabled me to observe the teaching approaches they employ when they teach a section of environmental studies in the classroom.

One may argue that the sample size is too small, but I think this is a reasonable sample because the study is not a survey, which would require a large sample size. I also do not intend generating broad generalizations which require large samples. A qualitative case study requires information rich and in depth and description, and in context, about this aspect of education (teaching approaches) which is the intention of my study.

3.4 DATA COLLECTION

My data collection plan included various methods to obtain information from the research sites, namely non-participatory classroom observations, tape-recorded interviews post-classroom observations, lesson plans of the teachers and departmental documents. I chose

various methods of data collection so that information received from the various sources could be used for analysis of results.

I used the technique of non-participatory observation during my interactions with the teachers. I constantly had the sense of being an outsider who was looking in, catching a glimpse of a different world. I chose a non-participatory data collection style because I didn't want to interfere with the data or compromise my objectivity, as this would have tampered with my data validity and reliability.

I chose to conduct my study in the third term of the school year because during this time of the year most Grade 12 teachers teach environmental studies. I visited the schools that form the sample of my study on three different days in the month of August 2012. I had made arrangements with the teacher participants to visit their schools on those particular days. I was able to collect data on a section of environmental studies. Consent letters for parents of the learners in these teachers' classes (Appendix C) were delivered two weeks before the day of data collection at each school.

The methods of data collection, as mentioned earlier, were classroom observations, semi-structured interviews, field notes and document analysis. These instruments are mostly used in qualitative research. This gave me confidence as a qualitative researcher that the research was credible and justifiable as 'research'. Next I discuss the methods of data collection, starting with document analysis.

3.4.1 Document analysis and field notes

Before lesson observations I requested the participants to show me their lesson plans, mark schedules and resources (for example, textbooks, hand-outs) that they would be using during lesson presentation. Copies of the documents mentioned above were handed to me by teacher participants (Appendices H-K) before conducting the lesson. I looked at the documents before lesson presentation. In the natural setting of my research (the classroom) I made notes on the physical layout of the classroom, for instance adequacy of learning space and lighting.

3.4.2 Classroom observations

Classroom observation was selected as the first method for collecting data in this study. According to Opie (2004) classroom observations provide the researcher with first-hand information, and Denscombe (2007) concurs with (Opie, 2004). Classroom observations

enabled me to explore the different teaching approaches used by Grade 12 Life Sciences teachers. Good and Brophy (2000) suggest that research using observational methods has yielded important information that has practical implications for the improvement of teaching practices. I selected lesson observations as one of the methods of data collection that I use to argue my case. As I am a Grade 12 Life Sciences teacher and conversant with Life Sciences content during lesson observation, I will be able to deduce teacher knowledge on Life Sciences content. This I can do without being overtly judgmental. I will also observe how teachers manipulate the environment and resources as they approach science lessons.

Classroom observation is more than just looking (Cohen et al., 2011). Cohen et al. (2011) further explain that the distinctive feature of observation is that it offers the investigator the opportunity to gather live data from naturally occurring social situations, which in this study is lesson presentation in the classroom. Cohen et al. (2011) contends that observational data should enable the researcher to enter and understand the situation that is being described.

I observed one lesson per teacher per school for all three teacher participants. For lesson observations I developed an observation schedule to answer my first critical research question (Appendix D). I used the guidelines on the observation schedule to investigate different teaching approaches used by teachers as they were teaching learners during lesson presentation.

The data from lessons observed provided me with three different sets of data to analyse. Data collected from the sample of the study, the three teacher participants, were analysed and generalisations made about the phenomena. The data collected was stored in the video-tape recorder and voice recorder and referenced; patterns of information are clear in the presentation and analysis of results in the next chapter.

Cooper and Schindler (2001) provide important information on the forms of observations in educational research; they may be direct or indirect, with the presence of the observer known or unknown, and with the researcher as participant or non-participant. From this perspective I am a direct lesson presentation observer and also a known observer to my participants, Grade 12 Life Sciences teachers.

Savenye and Robinson (1996) offered a useful explanation on the non-participant observer's role in case studies. Non-participant observation is often used to study focused aspects of a setting, to answer specific questions within a study (Savenye & Robinson, 1996 p.1053).

Savenye and Robinson (1996) further argue that non-participant observation can yield extensive data and patterns. In this study, being a non-participant observer and using multiple tools to collect data enabled me to yield extensive data.

I made field notes using my observation guide, and the data collected during classroom observations were video-recorded. The video-recorded data were then transcribed into text. Video-recordings are being used more and more in educational research (Pirie, 1996). Pirie (1996) further explains that video-recording is used as a way to capture everything that is taking place in the classroom. I selected video as a tool to record data so that at a later stage of this study, I could view data and transcribe it into text. I had sufficient time to view video-recordings during data transcription.

3.4.3 Semi-structured interviews

An interview is a data collection method that involves an interchange of views between the researcher and the respondent (Opie, 2004). Interviews enable the participants to express their opinion on issues that are researched. According to Opie (2004) an interview is used due to its ability to enable the researchers to collect rich, in-depth data from the respondents. Cohen et al. (2011) concur with Opie (2004) that an interview is a constructed and usually a specifically planned event rather than a naturally occurring situation, and this renders it different from an everyday conversation. In this study interviews enabled me to obtain teachers' reasons for employing their particular teaching approaches during teaching.

There are different types of interviews: they can be structured, semi-structured and unstructured. The structured interview has a predetermined agenda, is controlled by the interviewer and has less flexibility; the unstructured interview has an unpredictable direction and is very flexible and open-ended; while semi-structured interviews are less controlled, more flexible and not completely determined by the interviewer (Opie, 2004). Kajornboon (2005) describes semi-structured interviews as non-standardised ways of talking and listening to participants.

In this research semi-structured interviews were conducted with each of the three teacher participants in the study, individually and in a place free of disturbances for confidentiality purposes. During the interview each teacher's own ideas, feelings, insights and reasons for the different teaching approaches which they employed in the classroom during lesson observations were discussed. The semi-structured interview is adaptable because it would

allow me to follow up ideas raised by teachers, probe responses for clarity and investigate motives and feelings as the interview progressed. An interview schedule was established to guide the process of the interview (Appendix F).

The interview schedule consisted of a list of questions that was asked to ensure that the interview attained its intended purpose. I conducted the in-depth interviews with Grade 12 teachers as my participants. McMillan and Schumacher (2006) define in-depth interviews as open-response questions on participant meanings of how individuals conceive of, explain and make sense of the important events of their lives. Interviewing teachers is described as in-depth interviews of individuals with special knowledge, status, or communication skill that they were willing to share with me for my study.

According to Knox and Burkard (2009), before any interview can occur consideration must be given to the questions that will be asked, because at the root of interviewing is an interest in understanding the experience of other people and the meaning they make of that experience. I employed the stimulated recall approach to elicit data. I designed my interview questions such that they were open-ended to allow participants to speak freely. Open-ended questions also allowed me to clear up misunderstandings by rephrasing the question. I used the same interview schedule for each participant. Interviews were tape-recorded so as to allow me to play back the tape-recorder as data were analysed and transcribed into text. Since interviews were conducted after lessons were observed, some of the interview questions for each teacher corresponded with the data gathered during lesson observations.

3.5 ETHICAL CONSIDERATIONS

I first sought ethical clearance from the university, which the university's Ethical Clearance Committee granted. I then sought permission from the DoBE to conduct my research, and ethical clearance was granted by the DoBE for me to conduct research at the three secondary schools that I had chosen.

According to Sikes (2004), research ethics deals with the application of moral principles to avoid harming and affecting other people's lives in the process of doing research. This research was qualitative research which tends to be more intrusive into personal lives than quantitative research.

The ethics of doing the research was considered by honouring the three aspects of conducting research in schools, as given by Setati (2005): negotiating access, providing feedback, and exploring the nature of teachers' involvement in the study. Ethical guidelines regarding issues such as informed consent, confidentiality, anonymity and privacy were adhered to (McMillan & Schumacher, 2006) (Appendices A- C).

3.6 CONCLUSION

In this chapter I discussed in detail the research methodology that I selected and implemented in this study. This chapter unfolds with an explanation of the use of the qualitative case study approach and why I used an outsider perspective within the interpretive paradigm. I then discussed the recorded data on lesson observations, which enabled me to explore how teachers approached their lessons in the classroom and hence to answer my first critical question. I also discussed how the responses to the semi-structured interviews enabled me to answer my second critical question. Finally I explained the ethical clearance procedure that I had to follow in order to continue with my research. In the next chapter I present the results of this study and an analysis of the data.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

In this chapter I present data collected from the three teacher participants. To maintain confidentiality I assigned the teacher participants with pseudonyms, naming them Zodwa, Ruth and Lihle. I first provide a short biography of Zodwa, Ruth and Lihle, and then present data collected from the three teacher participants. I present data which I viewed in the video-recorded lesson observation and listened to from the tape-recorded responses of the teacher participants during semi-structured interviews. The video-recorder and tape-recorder are the two instruments that I used to record the collected data from the three teachers Zodwa, Ruth and Lihle, which I then transcribed into text.

The transcribed data were then analysed. Analysis of data involved reading and re-reading of the text of the transcribed data. As the transcripts of data were read, similarities and differences that arose were identified. Colour-coding of similarities as they formed patterns of how the participants conducted lessons on a section of environmental studies for Grade 12 learners in Life Sciences was carried out. Five themes emerged from the coded patterns in the data. Differences in lesson presentations were also identified and colour-coded.

The transcribed video-recorded data on lesson observations enabled me to arrive at the answer to research question one of this study. The participants' responses in the tape-recorded transcribed data from the semi-structured interviews enabled me to arrive at an answer to the second research question, as to why teachers used the approaches which they chose to teach environmental studies to Grade 12 learners in Life Sciences. Next follow short biographical profiles of each of the three teacher participants.

4.2 TEACHER BIOGRAPHIES

4.2.1 Zodwa

Zodwa is a Head of Department for Mathematics and Science subjects. She is a qualified Life Sciences teacher as she has an Advanced Certificate in Education (Biological Science).

Zodwa has 12 years' experience teaching the subject. The school at which she teaches is situated in a semi-rural area at Edendale in Pietermaritzburg, and Life Sciences lessons are conducted in the classroom.

4.2.2 Ruth

Ruth is a Head of Department in Mathematics and Science. Her qualifications are B.Paed.Sc. and B.Ed. Hons (Natural Sciences). She has taught Life Sciences in the same school since 1990. The school is situated in the Pietermaritzburg city centre and is homogenous, meaning that it enrolls girls only. Ruth's school is therefore situated in an urban area. The school has only one Grade 12 Life Sciences teacher, who is Ruth. In this school Life Sciences classes are conducted in the science laboratory, which is where the lesson was observed.

4.2.3 Lihle

Lihle is a post-level one educator who has taught the subject for the past 23 years. Her professional qualification is a Senior Teachers Diploma with specialisation in Geography and English. Lihle is the only Life Sciences teacher in the school at which she teaches; hence she also teaches Life Sciences in Grades 10 and 11. The school is situated in a rural area in Pietermaritzburg, and science lessons are conducted in the classroom.

What is common among all three of the teacher participants is that they all have long experience in teaching Life Sciences. Where they differ is that Zodwa and Ruth possess qualifications in the subject, whereas Lihle has only an academic and professional certificate.

Presentation of data on lesson observation is described next.

4.3 DATA FROM LESSON OBSERVATIONS

The three teacher participants presented their lessons on a selected topic on environmental studies in Grade 12 Life Sciences. Although the teacher participants had a choice to select any topic in environmental studies, both Ruth and Lihle selected the same subtopic, namely the mark-recapture technique used to calculate an estimation of population size in a particular habitat. Zodwa chose a different subtopic, namely terminology used in environmental studies. I will start by describing teacher Zodwa's lesson.

4.3.1 Lesson observation 1: Teacher Zodwa

Zodwa conducted her lesson in the classroom. As I entered the classroom with her, I observed the classroom set-up, following my observation schedule (Appendix D), in order to compile my field notes. There were many desks in Zodwa's classroom and little space in front; desks were too close to the chalkboard, and thus learner space was inadequate. There was no science equipment, since it was just an ordinary classroom. Lighting was adequate.

Zodwa introduced the lesson, explaining to the class that she will divide learners into groups. All groups were to move out of the classroom and choose a spot to observe nature in relation to what she had already taught in the classroom on environmental studies. She explained that learners will take only 10 minutes observing nature and discussing terminology and processes previously discussed in environmental studies. She also told learners that they will come and report back on their observations. Zodwa divided learners into five groups with five members each, plus two groups of six members each.

4.3.1.1 Outside the classroom

Learners moved outside to the backyard of the school with the teacher. The groups scattered at different points in the backyard of the school grounds. Some parts of the ground were covered with green grass, and there were tall and short trees. Another part of the backyard of the school was covered with papers, plastic, tins and old food. Some parts had no vegetation at all, just smaller and larger stones. Some insects and birds were flying over the area.

Far away from the school premises we could see some cows and goats grazing in the fields. The school is surrounded by forests and mountains. There are also houses around the school and some livestock feeding on grass and trees on the mountain.

The teacher attended each group for about two minutes. I collected data (which I video-recorded) from two groups during their discussions outside the classroom. After 10 minutes Zodwa asked learners to report back to the classroom on what they had observed outside.

4.3.1.2 Back in the classroom

Before group presentation started, Zodwa mentioned to the groups that while they were presenting she would write down all the terms on population ecology that the groups would come up with.

Zodwa employed the teaching approach whereby she gave learners an opportunity to explore the natural environment. She used group work, which made learners share information as they discussed their observations of the natural environment. In employing this approach she allowed learners to relate the content knowledge that she had already taught in the classroom on terminology in environmental studies with the natural environment. For example, Zodwa had previously taught learners about the different terms used in population ecology in environmental studies.

In employing this approach Zodwa as a teacher tried to reinforce putting theory into practice.

4.3.2 Lesson Observation 2: Teacher Ruth

In Ruth's school Life Sciences lessons are conducted in the laboratory, as I mentioned earlier. The science laboratory was well equipped, with light microscopes, a torso, skeleton, Life Sciences charts, etc. Learner space was adequate as the science laboratory was big enough to accommodate 40 learners.

Ruth had 30 learners for her lesson. She grouped the learners into seven groups with four members each, plus two groups with five members each. Ruth introduced the lesson while learners were seated as a class, stating that the lesson will be on the estimation of population size using the mark-recapture technique. She also explained that she will give learners containers with bean seeds. She indicated that she had already marked 20 bean seeds in each container, which was the first step of the activity. The containers had more than 20 bean seeds in them. Ruth gave learners all of the required equipment for the activity.

Ruth assigned each group the area to work on and requested that one member from each group comes to the front to collect the apparatus for the investigation. When learners were settled in their respective groups, she handed out a worksheet to each member in all the groups. Each group member had to complete his/her own worksheet after they had done the practical on the mark-recapture technique as a group.

The practical investigation began when learners in their groups started shaking the containers with marked and unmarked bean seeds and counting the bean seeds. Ruth moved around the groups as learners carried out their investigation, providing clarity where needed. After all groups had finished the activity learners returned to the whole-class seating plan to complete their individual activity.

Ruth explained the procedure about mark-recapture technique to learners, and precautions taken when estimating population size using this technique. As she explained the mark-recapture technique she kept asking questions. Although few learners responded to her questions, learners displayed some understanding of the procedure on how to estimate population size using the mark-recapture technique. Ruth made closing remarks about the lesson, saying that as they had revised this section of environmental studies, they should not experience problems on graphs and tables and the methods of estimating population size. She did not give the learners any homework.

4.3.3 Lesson observation 3: Teacher Lihle

Life Sciences lessons are conducted in the classroom in teacher Lihle's school. The desks in the classroom were arranged into a group seating plan, and learners were seated in groups. Lighting in the classroom where the lesson I observed took place was very poor, and no science resources were displayed in the classroom.

Lihle introduced the lesson, saying that the last lesson she had had with the learners was on estimation of population size. She also mentioned that the method of estimating the population size is an indirect method, unlike the Census which is a direct method of calculating the population. Lihle stated that there are two indirect methods of estimating the population size, the mark-recapture method (Peterson Index method) and the quadrant method (simple sampling).

Lihle started her lesson by using an example of the distribution of oranges to learners. She asked learners what factors she must know in order to be able to distribute the oranges to the learners. This kind of introduction stimulated the learners' interest, because they related what they know about in their daily lives with what is taught in the classroom in environmental studies

Lihle briefly explained the procedure on how to conduct the mark-recapture method. She also told learners the precautions taken when conducting that investigation. Although learners were seated in groups, Lihle started her lesson by using a lecture method of teaching, whereas Zodwa and Ruth started their lessons using group work. In doing so, Lihle employed the transmission teaching approach initially in her lesson.

Lihle told learners that they were going to conduct a simulation activity that would give them an idea as to how to calculate the mark-recapture method. Lihle distributed one container per group with samp seeds, one marking pen per group to mark the samp seeds, and one worksheet per group which had guidelines for carrying out the investigation. She then gave instructions on what to be done in this activity.

Lihle instructed groups to conduct the investigation, and went around groups to provide guidance to those experiencing problems and also checking whether learners in groups were following instructions. Learners started their investigations as instructed by Lihle. When groups had finished their calculations, Lihle then wrote on the board and pointed out which information groups should have as results of their calculations.

Lihle asked some questions about the steps followed when learners were conducting the mark-recapture method; however, most learners were inactive in answering the questions and she ended up answering most of them herself.

Lihle handed out worksheets to each learner in their groups to complete individually. She read the questions on the worksheet and explained the questions to the learners. Lihle gave learners 15 minutes to complete that activity, after which she answered the questions together with the whole class. Each learner marked her or his own worksheet. When Lihle had finished answering questions with the learners, she consolidated the lesson by asking learners what they have learnt that day. Learners were able to answer questions that she asked. Lihle did not give the learners any homework.

The three teacher participants used the group method and whole-class teaching method in the observed lessons. Zodwa and Ruth started by grouping the learners and later used the whole-class teaching method, whereas Lihle started with whole-class teaching and later used the group method.

In the following paragraph I provide a summary of the interviews with the teacher participants.

4.4 INTERVIEW SUMMARIES

Semi-structured interviews with each teacher participant were conducted after lesson presentations. Responses of teacher participants in the semi-structured interviews enabled me to answer the second critical research question of the study. The three teacher participants' responses to the interview questions indicated that they involved learners when they teach because learners are the ones who will be writing examinations, therefore learners must do most of the talking during lesson presentations (Appendix F). The themes that emerged during lesson observations, which answered the first critical question of this study, were strengthened by the teacher participants' responses to the semi-structured interviews. As teacher participants responded to the interview questions they highlighted the reasons why they chose particular teaching approaches.

Next I discuss the data analysis, preliminary findings, and how the themes were established in this study.

4.5 DATA ANALYSIS AND PRELIMINARY FINDINGS

After one-to-one interviews I transcribed data collected from each participant. I read and re-read the transcripts of data in order to establish preliminary themes and patterns which began to emerge from the data. I used the transcribed data from the lessons that I observed and transcribed the responses from the interview questions. I then established patterns from the transcribed data. From the patterns established from the transcribed data, I generated *five themes*. For example, participants' responses for the first question were grouped together to give an idea of the first theme. I started to fit the data according to the relevant themes by cutting and pasting the data in order to construct themes. This enabled me to interrogate the data and start writing the text of the teachers' narratives. I used the information that I recorded using the video-camera and tape-recorded interviews to identify the teaching approaches used in Life Sciences classrooms, and why these teaching approaches were used. The themes that I discuss in the following paragraph were generated by me having grouped the responses of each participant from the semi-structured interviews, and how each participant have taught in the classroom when I observed the lessons. The themes I generated

in this chapter relate to the different teaching approaches employed by teachers in the classroom. The teaching approaches which I have identified in literature review in chapter two of my study relate to the themes I generated.

The responses to question seven which is about the teaching approaches employed by teachers in the classroom reveals that teachers employed different teaching approaches in each lesson respectively as follows;

Zodwa's response to question seven of observation schedule;

I think every school will have some form of environment, there will be some surroundings, so I honestly thought it's just application now since all the schools do have environment. So it's better in environmental studies to get into contact with reality.

Zodwa's response to question seven of observation schedule shows that Zodwa used context-based teaching where she selected *relational teaching approach*. Zodwa wanted learners to relate the environment which they know to new science concepts. Zodwa terms the natural environment 'reality' hence she wanted learners to get into contact with reality. Zodwa also mentioned that every school will have some form of environment therefore if learners are given the opportunity to interact with it, they will apply knowledge learnt in the classroom in the real environment.

Ruth's response to question seven is as follows;

...so I just thought that thinking about different learners style like letting them discussing and then write it down, so that there is something practicably and tangibly so I thought about catering for all their learning styles. So as much as possible with all my learners I like to incorporate privilege of learning.

Ruth realised that learners learn in different styles for example some learn by listening some by doing and others by talking. She then used different teaching approaches to cater for the diversity of learning styles of learners. The approaches that Ruth used in the classroom are *cooperative teaching, relational teaching and facilitation teaching*.

Lihle's response to question seven is as follows;

...because the task that I gave, it was a practical task, they needed to do something practically, so it's not just to theorise about the content, they had to do some hands on, so I thought the approach that I used, goes in line with type of content that I was dealing with".

Lihle's response to question seven reveals that learners learn better if they touch materials in science subjects. Lihle then brought apparatus for learners to handle in the classroom. As learners handle apparatus, which Lihle terms 'hands on', learners get into contact with science concepts which promote learning.

Emergence of the first theme, '*pedagogical concrete science*'; this theme relies on context-based teaching approaches. Context-based teaching approaches emphasise that context and applications should be used as the *starting point* for the development of science ideas to enhance teaching. Teaching science is concretised when learners are given opportunities to relate new knowledge to the known, allowed to be involved in cooperative learning and lastly transferring knowledge, which is done by the teacher (pedagogy). This theme was evident when Zodwa asked learners to go outside the classroom and explore the natural environment. By 'pedagogical concrete science' I mean that science can be taught to learners and learners can feel, touch hear and even taste it in some instances. By taking learners outside to explore the natural environment, Zodwa implied to learners that science is a practical subject. Zodwa wanted to remove the belief that science is abstract and therefore she gave learners the opportunity to use their senses by feeling, touching, seeing and smelling the natural environment. This is evident from transcribed data from teacher Zodwa's observed lesson (Appendix E), where she said:

In this lesson we are going to be moving out of the classroom. We are going to form groups of five in each group. Each group will choose a spot, that means we'll go out of the classroom, we'll use that side [she pointed at the side which learners will use outside the classroom], where we will be observing nature or the environment or the surroundings. You'll observe everything or anything and then you will come back into the classroom to discuss your observations.

In connection with the first theme that emerged from this data analysis, Zodwa employed contextual teaching approach. She used *relational teaching approach* in that she allowed learners to relate the known to the unknown or new concepts. Learners know their environment; they then relate the known environment to new environmental concepts. She also employed *cooperative teaching approach*. In cooperative approach teaching, learners take initiatives in their learning. Learners in Zodwa's classroom took initiatives when groups reported back therefore leading discussions about their findings. Zodwa wanted learners to relate new concepts she had taught in the classroom to the natural environment which learners are familiar with. Learners related the known (the natural environment) to the new concepts (environmental studies terms). Zodwa also used nature as a tool and a resource, and

therefore also employed the *environmental awareness teaching approach*. As environmental awareness teaching approach also involves the interaction of biotic and abiotic and relationship between biotic and biotic. What Zodwa's learners discovered when they turned stones, was the relationship between ants and the soil and stones (biotic and abiotic), cows feeding on grass (biotic and biotic) and egret feeding on ticks on the skin of cows (mutualistic relationship whereby both organisms benefit). Through activities that Zodwa assigned to learners, they discovered that science is not abstract but concrete.

On the other hand, Ruth gave learners the activity of counting the bean seeds when estimating population size. In approaching lesson in that way, learners were given the opportunity to touch seeds and do the actual counting of seeds which represented the population. The data from Ruth's lesson observations (Appendix E) and the way Ruth handled her lesson, revealed the emergence of the theme '*pedagogical concrete science*', that is showing learners that they can see and touch objects used to arrive at a conclusion in science activities. Ruth introduced her lesson as follows:

What we are going to be doing is the practical simulation of mark-recapture, we've done the theory regarding that, so we just going to now go through the practical aspect of it. In your groups you're going to be given your apparatus that you'll need; each one of you please must have the time to carry out the investigation. When we're doing mark-recapture you'll be given all materials that you need, your bean seeds, your container with your bean seeds, your marker, and *er ...* textbook. OK we leave out the marker because I've already marked the bean seed for you. So the 20 bean seeds have already been marked for you, so you don't need to go through that process, what you will need is just your containers.

In this instance Teacher Ruth used the *executive teaching approach* as she developed her own resources for teaching informed by the curriculum. Although Ruth gave learners the opportunity to handle apparatus, she deprived learners the opportunity to mark the bean seeds on their own. When learners do not mark the seeds themselves, this step in mark-recapture technique may be forgotten and learners may perform poorly when this question is asked in the examination. I therefore conclude that Ruth's action in not allowing learners to mark bean seeds themselves might have a negative impact in learners recalling this step of the procedure or method of mark-recapture technique. Moreover, the marking process forms the basis of this method of estimating the population size, hence termed '*mark-recapture technique*'.

The evidence of the emergence of theme '*pedagogical concrete science*' also arises from the introduction and the activity that Lihle gave to her learners. Lihle taught her learners the same section of environmental studies as Ruth namely, mark-recapture technique. She employed

the *executive teaching approach* because she also, like Ruth, developed her teaching resources when she brought the apparatus ('samp seeds') into the classroom. Lihle said to her learners (Appendix E). The following is how Lihle explained the activity to her learners:

You are going to do the activity; I'm going to read the instructions and make sure that you understand the instructions when you do the activity. That is activity 4.3.1. It's the simulation on mark-recapture method. When you are doing an activity, a practical activity, there are apparatus that you need to have. In front of you we have got a bottle, right, we have got samp, we have got pen markers, right – those are the apparatus that we are going to use. Er, there is a method that we have to prove. Firstly, within a group, one person – you're going to do it together – but only one person is going to manipulate with the apparatus. You remove 30 beads from the bottle, or 30 seeds of samp from the bottle, and mark each one with the marker. You remove 30, let's be quick guys, you remove 30...

Lihle, unlike Ruth, allowed learners to conduct all the steps of mark-recapture technique. For instance Lihle's learners marked the seeds on their own and followed all the other steps. Allowing learners to mark the bean seeds enabled learners to recall what they actually did in the classroom in connection with the task given.

Although teachers Ruth and Lihle did not take their learners outside to the environment, they gave learners bean seeds and samp seeds to manipulate as they counted, in an attempt to estimate the population size using the mark-recapture technique. The emergence of the theme 'pedagogical' concrete science, which connects with executive teaching approach is crucial in the South African context schools where most schools lack resources and the class sizes are large. When a teacher creates resources, as the executive teaching approach specifies, science lessons become interesting to learners and performance improves.

The second theme that emerged from the transcribed data on lesson observations from the three teacher participants is '*science in motion*'. The theme science in motion refers to the activities that are given to learners before discussing the results students are expected to find; discuss laboratory investigations before lecturing on their topics; remove laboratory data tables so that students generate or organise information on their own; change tests to require more concept application by students; use a questioning strategy that encourages students to reveal what they are thinking; have students invent procedures to answer a laboratory question; and put students where groups debate, discuss, research and share information. The theme science in motion has emerged because the three teachers gave learners activities so that learners arrive at conclusions before they are lectured or there is intervention by the teacher towards the given task. The observed lessons of the three teacher participants all

involved teaching of practical work in science classrooms; this was a similarity that I identified during analysis of the data.

Teachers Ruth and Lihle used the bean seeds and samp seeds and marking pens as materials for the practical. Ruth marked the bean seeds for learners, which is a crucial step for the practical mark-recapture technique, whereas on the other hand Lihle gave learners the opportunity to mark the samp seeds on their own. Although Zodwa differed in the subtopic of environmental studies that she chose, she also exposed learners to the practical lesson as she took learners outside the classroom to explore the natural environment.

The theme ‘science in motion’ connects with the *facilitator teaching approach* because the three teacher participants organised learners in groups, ensured that learners were engaged in activities, and went around the groups identifying problems and giving clarity. Science was in motion because all stakeholders in the teaching and learning process were actively involved.

The three teacher participants’ responses to interview question number 7 enabled me to answer my second critical research question.

Highlighting emergence of the second theme, ‘science in motion’, teacher Zodwa gave learners the opportunity to explore the natural environment, for example, to turn the stones over and identify processes taking place in the natural environment. Zodwa’s response to question seven was as follows;

I think every school will have some form of environment, there will be some surroundings, so I honestly thought it’s just application now since all the schools do have environment. So it’s better in environmental studies to get into contact with reality.

When I asked Ruth why she used a particular approach for her lesson (question seven of the interview schedule), she responded as follows;

Er, sometimes you find that some learners like to do, and I’m giving them something to do, and I find that some learners learn by doing, some learn by listening, and some people learn by like they think cognitively when they writing down. So I just thought that thinking about different learners’ style, like letting them discuss and then write it down, so that there is something practicably and tangibly, so I thought about catering for all their learning styles. So as much as possible with all my learners I like to incorporate the privilege of learning. Then I like to take them outside of the classroom so that they touch the plants and flowers, so that they have the feel of the natural environment.

To strengthen the emergence of the theme science in motion, from analysis of the transcribed data, teacher Lihle responded as follows to question seven of the interview schedule:

Eh ..., the topics that we are dealing with are not the same, and the topics that we are dealing they... they need different approaches to teach them. So the approach that I used I think the... the...the..., because the task that I gave, it was a practical task, they needed to do something practically, so it's not just to theorise about the content, they had to do some hands-on. So I thought the approach that I used goes in line with the type of content that I was dealing with.

The third theme that emerged from lesson observations is '**teacher as knower**'. During lesson observations all three teacher participants displayed knowledge of content, as they were not referring to or reading from the book or study guide during lesson presentation. For example, when Zodwa discovered that learners lacked knowledge on what ants feed on, she displayed knowledge of content as she explained:

They are eating the remains of dead plants which will be humus, and what about ants? What do ants eat? Because it seems that your ants are now becoming herbivores. As I'm listening to some presentations, I can feel that some ants are collecting leaves.

Zodwa incorporated the *instructional teaching approach*, which involves *transferring knowledge contextually*. For instance transferring known environmental knowledge to the new science concepts.

In her lesson Ruth displayed content knowledge when learners were unable to answer the question as to why the different groups obtained different results in the activity of calculating the population size. She explained:

So some of us may have counted incorrectly, because we tried as well to see the marks on it, so the mark could have bypassed us, so that we could have not counted it, counted it as a marked one or as an unmarked one. So the physical process of counting the seeds could have been incorrect, so therefore it could lead to incorrect results ... and then the groups forwarded, each one of them forwarded the given formula were given two limits. Still you had some problems coming to your common population size, isn't that so, so you could ... so if we have to look at the worksheets, let's just go through it, and then you will have an understanding as well. Let us look at the questions, read it, direct or indirect?

Evidence that teacher Lihle is also knowledgeable of the content in Life Sciences, which contributed to the emergence of theme three, is the way in which she introduced her lesson. She started her lesson from what learners already know (about the 'Census' or head count of people), so that learners could relate it to the unknown, estimation of population size using the mark-recapture method. She therefore employed a whole-class method and thus used an

instructional teaching approach. She displayed content knowledge as she explained the term ‘Census’ to learners as follows:

Counting of people ... We are looking at different types of operations, which means it's not only the counting of people, it's the counting of the organisms within a population – the actual counting of individuals within a population – which means, if we are here in the class, if we count ourselves, we count each and every individual direct, so Census is like that. In our homes Census is done, people come and visit our homes and ask us many questions about the number of people that live in the house, their age groups, their gender, all that stuff, that is Census. And with Census it's easy to do it if the individuals of a population are not moving around, ... if they remain in the population or organisms that move slowly, because if they move slowly then you are able to count each and every individual.

The fourth theme that emerged from the data on observed lessons is ‘*interactive science teaching*’. This theme refers to the teacher engaging with learners in their groups and also engagement with learner to learner. During engagement learners negotiate meaning of science concepts amongst themselves and the teacher negotiates meaning with learners. During negotiation of meaning reciprocally, there is interaction amongst all the stakeholders in science classroom. Interaction therefore facilitates learner understanding of concepts, enables learners to remember what they were taught and enables the teacher to determine whether learning has occurred.

The teaching approaches that teacher participants employed in the classroom showed that teachers wanted to impart skills through inquiry teaching. The three teacher participants asked questions to learners. Asking questions enabled the teacher participants to interact with learners in the class. Inquiry-based teaching was used as teachers asked questions of the learners. Inquiry-based teaching method is supported by the constructivist teaching and the *facilitation teaching approach*. Zodwa promoted interaction with learners by asking questions, as follows (Appendix E):

What do ants eat, what do snails eat? In your observation, what type of food, because right now you cannot tell whether snails are herbivores or carnivores or omnivores, that is why I wanted to ask learners what do snails eat? What do they feed on themselves, the snails? The problem here is with the snails, the other problem is with the ants, from what I was listening to.

The theme ‘interactive science teaching’ involves engagement with the environment and resources in order to arrive at a particular teaching approach. It also involves engaging learners by asking them questions to give them an opportunity to engage with the topic that is being taught. Allowing learners to report back, as teacher Zodwa did, enabled learners to

interact among themselves in a group and also with other groups. In so doing, Zodwa instilled some skills in the learners. During an interview, zodwa responded as follows to Question 9.2 of the interview schedule (Appendix G) as follows:

Question 9.2

Why did you engage learners during your lesson, because your learners were more than 70% engaged in the lesson?

Response from Zodwa:

I think the learners are the ones that are learning. What the educator has to do is just to give a direction because in the end the people who are going to write the exams are going to be the learners, so if they are hands-on it will be easier, they will recall easily the things that they have touched, that they have seen, that they have heard, unlike listening to the educator most of the time.

The response of Ruth to Question 9.2 which relates to theme four on interactive teaching was as follows:

Just to make sure that they were comfortable with what they were doing, they understood what they were doing, and if there was any misconception to be cleared up so that they were going to be guided at the right time, so that they were not going to go all the way down the line and find that they were doing the wrong thing, so I just needed feedback on the lesson.

Although teachers Ruth and Lihle chose the same topic during lesson observation, their responses to Question 9.2 of the interview schedule were not similar. Lihle's response to Question 9.2 was as follows:

I believe that when teaching learners, it's very easy for them to understand clearly that, what they are doing practically than that which they listen to. So involving them, I think it's the best way because they usually not forget that have been done with their hands.

The responses of the three teacher participants therefore further deepened understanding of theme four. Emergence of theme four brings to light the understanding that the three teacher participants employed the constructivist teaching approach in their lessons.

The fifth theme, '***teacher in action***', emerged from the data collected on what teachers were doing during lesson observations. To unpack this theme, I would say it refers to all the activities done by teacher during the lesson. From the time the teacher introduces a lesson, assigns tasks to learners in their groups, discusses the tasks with learners, identifies problems experienced by learners and clarifies them, up to the time the teacher winds up the lesson.

The teacher cannot perform the above mentioned tasks motionless; she has to take some action in order to fulfill her duty of teaching. The teaching approach that the three teacher participants used, which led to the emergence of theme five (*teacher in action*), was realised when the teachers organised learners into groups. As learners were organised into groups the teacher participants had to facilitate group work and see whether learners were participating and cooperating in their groups. To achieve this, teachers had to move around the groups and assist learners where they could not follow instructions; therefore the teacher participants were in action during lesson observations. Evidence on the emergence of theme five is also displayed in the use of the chalkboard, which the three teacher participants used during the lesson. The teaching approach 'facilitation teaching' corresponds with the emergence of theme five.

Zodwa indicated to the class that she would use chalkboard, as follows (Appendix F):

As the groups are reporting back, I will write on the chalkboard all the terms those groups will highlight and those terms that may still be a problem to each group, so that at the end of the lesson we have a list of terms that are used in environmental studies.

Zodwa started her lesson by taking her learners outside the classroom to engage with the environment. While learners were outside in their groups, Zodwa went to all groups checking what learners were doing and guiding learners on how to carry out their task. In this perspective, Zodwa was in action thus the emergence of the theme '*teacher in action*'.

When Zodwa's learners went back to the classroom to report back, Zodwa kept on interrupting groups that were presenting if some terms were defined incorrectly. She involved the whole class for clarity of those terms by asking members of the class to assist in defining those terms. She would then explain the terms to the whole class if there is a need (refer Appendix E). She also wrote on the chalkboard all the terms that groups highlighted as they reported back. From the above activities, it is therefore evident that Zodwa was in action during lesson presentation hence the emergence of theme five (teacher in action.)

Ruth also moved around to all groups, facilitating group work and checking whether learners were engaging with the activity she had handed out for individual learner to complete.

Although in Lihle's observed lesson most of the time was spent on the instructional teaching approach, doing whole-class teaching, she also handed out activities to be completed by the learners and used the chalkboard to explain concepts on the mark-recapture technique of

estimating the population size. She then moved around the groups, assisting them where problems were experienced. This strengthened the emergence of theme five.

4.6 CONCLUSION

In this chapter I presented the data collected from the lesson observations and semi-structured interviews. The video-recorded and tape-recorded data were transcribed into text and then analysed. Through this analysis of the transcribed data, five themes have emerged. The first theme that had emerged was ‘pedagogically concrete science’, which reflects that science can be visible and manipulated, for example in the way that Zodwa allowed learners to interact with the natural environment outside the classroom. In this perspective, Zodwa approached her lessons contextually and environmentally.

The second theme that emerged was ‘science in motion’, which involved giving learners some activities to complete so that they were in motion and not just passive. The third theme that emerged was ‘teacher as knower’, and the three teacher participants displayed content knowledge of the subject. This theme led teacher Lihle to approach her lesson as whole-class teaching, employing the instructional teaching approach.

The emergence of the fourth theme which is ‘interactive science teaching’, emanated from the constructivist teaching approach and facilitation teaching approach, in which group methods were used the most. The fifth and last theme dealt with ‘teacher in motion’, which reflects the fact that the teacher participants moved around the groups facilitating group work in the classroom.

It became evident from my observations that the approaches that the teachers employed were mainly context-based and promoted environmental awareness teaching. Other teaching approaches which the teacher participants used were executive teaching, facilitation teaching and instructional teaching.

Chapter five seeks to offer recommendations which emerged from the data in this research study, as well as recommendations for further research. I also present a summary of my findings and their implications, with reflection on the research process and the conclusion of the study.

CHAPTER 5

INTERPRETATION OF FINDINGS AND CONCLUSION

5.1 INTRODUCTION

In this chapter I present the findings that emerged as themes from the transcribed data based on the lesson observations and interviews analysed in Chapter four. The five themes are as follow:

- pedagogical concrete science, which eliminates the belief that science is abstract;
- science in motion, which refers to movements taking place during science lessons in the classroom by the teacher and learners;
- teacher as knower, which denotes teacher content knowledge of the subject;
- interactive science teaching, which involves inquiry-based teaching; and
- teacher in action, which describes practical activities discussed in the classroom.

I review these themes below using the constructivist theoretical framework as explained in chapter two. Theories of Brooks & Brooks (1999) and Pollard (2005) assert that employing a variety of teaching approaches enhances learning and potentially improves performance. The discussion on how the teaching approaches were used to answer my two critical research questions then follows. I also discuss the weaknesses and limitations of the study. Recommendations to the Department of Basic Education are suggested, and finally the overall conclusion of the study is presented.

5.2 DISCUSSION OF FINDINGS

Discussion of each of the findings that emerged from the themes follows, starting with pedagogical concrete science.

5.2.1 Finding 1: Pedagogical concrete science – context-based teaching approach and environmental awareness teaching

This finding refers to the teaching approach which questions the notion that science is abstract. There are similarities and differences in the three teachers employing teaching approaches. One of the teachers indicated that she wanted the lesson to make abstract knowledge concrete. The teacher meant that she wanted to make science lessons concrete, as

she stated that she wanted to remove the belief that science is abstract by taking learners outside of the classroom to explore the natural environment. She also wanted learners to apply their knowledge and to see science in reality.

The teaching approaches that this teacher used are referred to as context-based teaching and the environmental awareness teaching approach. In using these two methods, there was collaboration with the constructivist's theory of teaching which emphasises that teaching should provide rich and varied activities that are stimulating and hands-on (Pollard, 2005). Pollard (2005) further argues that in social constructivist teaching approaches teachers will have to engage with learners' existing conceptual knowledge before planning activities for the class as a group or for smaller groups within a class.

The two teachers who selected the same section of environmental studies for their lessons gave learners bean seeds and samp seeds to manipulate as they estimated the population size as an activity. Both teachers organised the learners into groups during the activity. Constructivist theorists believe that group problem-solving activities should be used in the science classroom to promote learners' interaction and to concretise science. Lihle and Ruth therefore used the constructivist's teaching approach as they assigned group work to learners (problem solving approach).

The finding 'concrete science' emerged from the context-based teaching approach. According to Crawford (2001) the context-based teaching approach involves relating new concepts to what learners already know. They start their lessons from what learners have experienced in their daily lives. Although the three teacher participants employed context-based teaching approaches during lesson observations, Lihle applied this approach in a different way when she started her lesson using oranges as an example. Zodwa, on the other hand, took learners outside the classroom and gave them the opportunity to apply what was taught in the classroom in practice.

The finding 'concrete science' therefore emerged from the transcribed lesson observations. In taking learners outside to manipulate the natural environment, teacher Zodwa employed environmental awareness teaching approach. Littledyke's (2008) study on environmental teaching stated that in environmental teaching learners should be encouraged to develop a sense of relationship with the environment, so that this could translate into environmental behaviour that follows through into adulthood.

5.2.2 Finding 2: Science in motion – facilitative teaching approach

Motion refers to all the activities taking place during the lesson the lesson. When teachers Ruth and Zodwa organised their learners into groups, there was movement of learners into their respective groups. When I analyse the data on groups work and observed learners engaging in tasks, I refer to it as ‘science in motion’.

Movement also took place during practical activities assigned to learners from the lessons of the three teacher participants. In this instance, my finding was that movement in practical activities took place among both the teachers and learners. When learners followed the instructions by conducting the practical activity, there was movement in the classroom. In science classrooms teachers are expected to assist learners during practical activity; the teacher therefore has to move from group to group clarifying where learners experience problems with the activity. The movements that took place during practical activities strengthened the theme ‘science in motion’. Such teaching in science classrooms is favoured by constructivist theorists, who term this kind of teaching ‘facilitation teaching approach’.

The finding ‘science in motion’ forms part of the facilitation teaching approach. Practical teaching approaches and group work dominated the lessons I observed. As the three teachers used those methods they strengthened the theme of science in motion. There was consistency in using constructivists’ theory during teaching and learning in the classroom by all teacher participants since they employed practical teaching.

Practicality in science emerged when teacher Ruth gave learners beans to calculate the population size and a worksheet to be completed. Although teacher Ruth and Lihle taught the same topic during the lesson observations, Lihle differed in that she taught both content and a practical investigation on that day.

5.2.3 Finding 3: Teacher as knower – transmission teaching approach

The three teacher participants delivered the subject matter in the classroom with confidence. Through lesson observation I discovered that the three teacher participants did not depend on the textbook when teaching. The finding ‘teacher as knower’ emerged from my observations mentioned above and on how teacher participants delivered the subject content. Teaching approaches that the three teacher participants employed during lesson observations revealed that they were knowledgeable on the content they taught. Teachers showed competence in

conducting lessons such that they were not reading from the textbook or study guide. All content taught came from the teacher participants spontaneously.

Although Ruth and Lihle taught the same subtopic in environmental studies, Lihle displayed more competence in the introduction of the lesson when she used oranges as an example. In view of the enormous content knowledge that teachers possess, they tend to switch to the transmission teaching approach. The transmission teaching approach took place when teachers found that learners did not understand some concepts taught. In this respect the teacher participants became content-oriented. Trigwell et al. (1994) argue that teachers using the transmission teaching approach tend to emphasise the reproduction of correct information.

Teacher knowledge influenced the selection of teaching resources; for example, Zodwa selected the natural environment as a resource while Ruth and Lihle selected bean and samp seeds respectively. Although Fenstermacher and Soltis (2004) state that teachers who use resources when teaching enhance learning and lead to the improvement of results, this is not always the case in South African schools. There are other factors that influence the results in science subjects, for instance lack of resources and facilities (such as lack of electricity, as I discovered in one school). In respect of knowledge of content among participant teachers, they tended to employ the didactic-lecture teaching approach which covers the subject matter.

5.2.4 Finding 4: Interactive science teaching – inquiry-based teaching approach

The finding ‘interactive science teaching’ refers to interaction between the teacher and the learners during the teaching process where the teacher asks questions. The teacher interacts with the surroundings in order to create resources to use in a selected teaching approach. Findings from analysis of data on lesson observations reflected that teacher participants in this study employed inquiry-based teaching approach. In social constructivism inquiry-based teaching is favoured as it promotes interaction during the teaching process in the classroom (Baviskar et al., 2009).

This fourth finding reflects the inquiry-based teaching approach. Lihle started her lesson by asking learners questions which inform the inquiry-based teaching method, which is one of the principles of social constructivist teaching methods. Although Zodwa and Ruth did not introduce the lesson by asking questions of learners, they did ask questions in the middle of the lesson. By asking questions they conformed to the principles of social constructivism.

Baviskar et al. (2009) are of the view that a constructivist teacher helps student through problem-solving and inquiry-based activities in the teaching approaches they choose for their lessons.

5.2.5 Finding 5: Teacher in action – facilitative teaching approach

The fifth and last finding, ‘teacher in action’, means that the teacher in the classroom is active during teaching. The three teacher participants used group teaching during the lesson observations. My findings from data analysis were that the three teacher participants employed the facilitation teaching approach in their lessons as they went to each group and provided assistance to those that experienced problems with the activity.

The teaching approach employed by the three teacher participants, the group method, allowed the teacher to intervene in each group as she moved around the groups, and therefore the teachers were in action. When teachers were going around looking at what the groups were doing, they were facilitating group work. From the data analysed in Chapter four I find that Ruth and Lihle were facilitators during lesson observations and therefore employed the facilitator teaching approach. Fenstermacher and Soltis (2004) explain that a facilitator helps the learner to obtain his own understanding of the content. According to Gamora and Secada (1998) group work promotes student interaction and hands-on problem-solving experiences.

During interviews teacher Ruth mentioned that group work promotes interaction among learners, and learners are not shy to ask questions from the teacher or other group members. In group work learners get the opportunity to handle equipment; Ruth and Lihle gave learners that opportunity. Ruth and Lihle were in action as they handed out worksheets to be completed by each learner.

The three teacher participants in the study displayed the implementation of social constructivist principles in their teaching. They provided rich and varied activities that were stimulating, hands-on and inquiry-based and stimulated thinking (Pollard, 2005). According to Pollard (2005), in social constructivist teaching approaches the role of the teacher is to provide support and instruction. This intervention must connect with the understandings and purposes of the learners so that their thinking is extended (Pollard, 2005). As the three teacher participants were moving from group to group they provided support and instruction on how to conduct the activity, and this action represented facilitation teaching.

5.3 LIMITATIONS OF THE STUDY

This research study was limited to three teachers who teach Life Sciences to Grade 12 learners in three different secondary schools. Although the study is a qualitative case study, and a sample is usually selected from one natural setting, I selected my sample of participants from three different schools. Since in most schools there is only one Grade 12 Life Sciences teacher, the small sample of my study which represents the population of study – Life Sciences teachers in the Umgungundlovu District of Pietermaritzburg – may have an influence on the provision of systematic generalisations about the findings to the wider population. Nevertheless, I do hope that this study will help other Life Sciences teachers to develop their own understanding of the use of a variety of teaching approaches in Life Sciences.

5.4 RECOMMENDATIONS

The study revealed that multiple teaching approaches are used by teachers in science classrooms. The different approaches employed by teachers in the classroom have an influence in learner performance. When teachers employ multiple approaches to the teaching of science, learners have a better understanding that science is not an abstract subject. Although teachers use multiple teaching approaches to make learners understand science concept, there are other contextual factors that contribute to learner performance. For example, learners' negative attitudes towards science and their belief that science is a difficult subject is a contributory factor to poor performance. Another contextual factor is lack of science resources, especially in rural schools. Learners' socio-economic background and upbringing, whereby some homes are child-headed, headed by grandparents. In such contexts, learners lack external motivation especially in science subjects.

With reference to the findings of this study, I would like to suggest the following recommendations to the DoBE:

- The DoBE should develop programmes that will enable current teachers in the system to be continuously trained and developed in accordance with the NCS on the different teaching approaches that can be used by Grade 12 Life Sciences teachers. The quality may improve.
- The Teaching and Learning Services should encourage Life Sciences teachers to form teacher support groups so as to improve teaching. In these teacher support groups

teachers must discuss how to approach different topics in Life Sciences, and share information about the subject they teach so as to improve quality of teaching and therefore learner performance.

- In order to ensure that practical work is accessible to learners, the DoE should assist by supplying laboratory science kits to schools.
- The teaching programmes in universities and educational universities of technology should be NCS-based, and the training and development that the student teachers gain should enable them to cope with the different teaching approaches employed in the classroom.

Universities or college lecturers and tutors should be given the task to train and follow up on the implementation process by groups of teachers. Mentorship programmes should be designed in such a way that individuals are given practical experience, because in Life Sciences the content knowledge that teachers teach should be reinforced with practical activities.

5.5 CONCLUSION

This study showed that there is an attempt to use a variety of teaching approaches in the science classroom. For example, it showed that the most used teaching approaches in environmental studies are the context-based approach, facilitation approach and environmental teaching approach. Since the study is guided by the social constructivism theory of teaching, the teaching approaches which teachers used correlate to the social constructivism principles which emphasise learner-centred teaching. The study is therefore informed by facilitation strategies to implement learner-centred teaching and learning in the classroom.

Stoffels (2005) indicated that teachers need their confidence to be boosted in order for them to operate competently. This study has shown that there is a need for proper training and development in order to boost teacher confidence.

How the results of the study best represent the majority of Life Sciences teachers is debatable, but the findings can provoke the understanding of the teaching approaches and facilitation strategies that Life Sciences educators use to implement learner-centred teaching and learning in the classroom. The study has shown that there is a need for a link between the

understanding of the teaching approaches and teacher practice in order for the enquiry approach, facilitation approach and context-based teaching approach to be successful. Hence it calls into question the current methods that are used to inform Life Sciences teachers on how to use a variety of teaching approaches in a lesson to improve quality of teaching.

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APPENDIX

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T.R. Majozi

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09 July 2012

The Principal

Smero Secondary School

For Attention: Mr T.N. Ngobese

REQUEST FOR PERMISSION TO VIDEO-RECORD LIFE SCIENCES LESSONS FOR MY RESEARCH PROJECT:

Project Title

EXPLORING APPROACHES TO THE TEACHING OF LIFE SCIENCES TO GRADE 12 LEARNERS.

I am currently pursuing a Master's Degree in Education at the University of KwaZulu-Natal.
My details are as follows:

1.1. Full Name & Surname	Thembisile Rosemary Majozi
1.2. Title	Ms.
1.3. Student Number	962115289
1.4. Discipline	Curriculum
1.5. School	Curriculum Studies
1.6. Faculty	Education
1.7. Campus	Edgewood
1.8. Existing Qualification	Bed Hons. (School Management)
2 CONTACT DETAILS	
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The purpose of my study is to explore, describe and explain the teaching of a selected section of environmental studies in grade 12 Life Sciences. The study seeks to explore the various teaching approaches that teachers use in the teaching of Life Sciences and the choices the teachers make with regards to the methods and strategies that they employ. There is a national outcry on poor performance in Life Sciences. The strategies that teachers use to teach Life Sciences have an impact on learner performance.

My study will be an interpretive study which will be conducted within a qualitative research paradigm. The study will concentrate on participant teachers and their teaching methods and strategies. Teachers who participate in this study will do so, on a voluntary basis and will be selected purposively because they are grade 12 Life Sciences teachers. I will select three schools and one grade 12 Life Sciences teacher and observe two lessons per school.

The first stage of my data collection will consist of the video recordings of the teacher's lesson. I have chosen to video tape the lessons so that the unexpected and evolving aspects of teaching and learning will be captured and that rich descriptions and explanations can be revealed. After viewing the vide-recordings of the observed lesson, I will design a semi-structured interview schedule.

The second stage of my data collection will be the semi-structured interview within which I will employ the stimulated recall approach to elicit data.

The data will be stored in a secure place during data collection and upon submission of the will be stored in the School of Education, UKZN for a period of five years after which it will be disposed of.

The confidentiality of the participants will be guaranteed and respected. A copy of the findings will be lodged with the Regional Senior manager on regards to completion of my studies. No individual will be forced to participate and all ethical considerations governing research will be strictly adhered to by the researcher and the respondents.

I hereby apply for permission to conduct the research.

I thank you in anticipation of a favorable response.

Yours faithfully

Researcher: T.R. Majozi

Date

APPENDIX B

T.R Majozi

Student No. 962115289

University of KwaZulu-Natal

Edgewood Campus

Private Bag x03

Ashwood

3605

09 July 2012

Date: _____

Dear parent/ guardian: _____ Parent/guardian of

REQUEST FOR PARENTAL CONSENT:

Project Title

EXPLORING APPROACHES TO THE TEACHING OF LIFE SCIENCES TO GRADE 12 LEARNERS.

. I am an educator at Ingqwangele High School. I am also pursuing a Master's Degree at the University of KwaZulu-Natal. This requires me to conduct research.

The research that I will be undertaking, involves video-recording Life Sciences lessons in the grade 12 classes. Your child may appear in the video recording. The purpose of the video-recording is to:

1. Explore how teachers teach particular lessons.
2. The methods they use to teach.
3. To later view the recordings in order to analyze the lessons.

The focus of the video-recording is not your child but the teacher's lessons. The data will be stored in a secure place during data collection and upon submission of the thesis will be stored in the School of Education, UKZN for a period of five years after which it will be disposed of.

The confidentiality of the participants will be guaranteed and respected. A copy of the findings will be lodged with the Regional Senior manager on completion of my studies. No individual will be forced to participate and all ethical considerations governing research will be strictly adhered to by the researcher and the respondents

Yours faithfully

APPENDIX C

T. R. Majozi

Student No. 962115289

University of KwaZulu-Natal

Edgewood Campus

Private Bag x03

Ashwood

09 July 2012

Usuku _____

Igama nesibongo ko-Mzali/Mbheki _____ womfundi
u_____

ISICELO SEMVUME YOKWENZA UNCWANINGO KUTHISHA WE LIFE SCIENCES (IBANGA LE-12) EFUNDISA UMTWANA WAKHO:

Isihloko Socwaningo

UKUHLAZIYA IZINDLELA EZISENTSHENZISWA UTHISHA KWISIFUNDO SE-LIFE SCIENCES KUBAFUNDI BEBANGA LE-12.

Mina nginguthisha, ngifundisa e-Ingqwangele High School. Ngifunda e Nyuvesi yaKwaZulu-Natal. Ngifundela iziqu ze Mastazi Kwezobuthishela. Lezifundo zidinga ngenze unwaningo kwezemfundo.

Uncwaningo engizobe ngilwenza ludinga luphathelene nokuthatha izithombe ze-vidiyo ngesikhathi uthisha efundisa I Life Sciences emagumbini okufunda ibanga le-12. Kuyokwenzeka ukuba umtwana wakho avele kulezithombe ze-vidiyo. Izinhloso zokuthatha izithombe ze-vidiyo yilezi:

1. Ukucwaninga ukuthi othisha basifundisa kanjani lesisifundo.
2. Izindlela abazisebenzisayo uma befundisa.
3. Kuyothi emva kwalokho bese ngibuke i-video ngihlaziye isifundo leso.

Ingqikithi yevidio akusiko ukuhlola umfundi, kodwa ukuhlaziya indlela uthisha afundisa ngayo. Lonke ulwazi oluyoqoqwa kusentshenziswa i-vidiyo luyigcinwa endaweni ephephile. Kuyothi uma sengiwaphothulile wonke umsebenzi ngiwuthumele e-Nyuvesi yaKwaZulu-Natal ophikweni lwemfundo. Lapho iyiphinda igcinwe ngokuphephile ize ilahlwe ngokucophelela emva kweminyaka emihlanu.

Appendix D

Classroom observation schedule

Guidelines for observations

Context and environment

1. Is learning space adequate?
2. What learning and teaching support materials are brought to the classroom?
3. How available, visible, accessible are resources to learners?

Lesson topic

1. What was the topic taught in environmental studies?

Lesson planning

1. Is the lesson plan prepared according to the Revised National Curriculum Statement?
2. Did the teacher practice according to the lesson planning?

Subject matter

How well did the teacher seem to know the subject matter at hand? (That could be seen from teacher's stated goals, explanations used, questions asked, and responses given).

Teaching approaches and teaching methods used

Did the teacher use one teaching approach and one teaching method or a variety of both or one?

Involvement of learners

1. How were learners involved in a lesson?
2. Did the learners investigate or research or complete a worksheet etc.

Questions

What kind of questions did the teacher ask?

Homework

Was homework given to learners, if yes, what was the volume of homework given?

APPENDIX E

LESSON OBSERVATIONS

Lesson observation 1: Teacher Zodwa

I came to the school an hour before the lesson started. The lesson for observation commenced at the first period after break. The siren rang at 12h30. We left the office immediately after the siren had rung to the classroom. We met learners on the verandah on the way to the classroom. The teacher asked learners to move faster and quietly to the classroom. When we reached the classroom the teacher greeted the class and introduced me. As I entered the classroom I observed the classroom set up following my observation schedule and field notes (see appendix D).

Teacher Zodwa introduced the lesson. She said;

“In this lesson we are going to be moving out of the classroom. we are going to form groups of five in each group. Each group will choose a sport, that means we’ll go out of the classroom, we’ll use that side (she pointed at the side which learners will use outside the classroom), where we will be observing nature or the environment or the surroundings. You’ll observe everything or anything and then you will come back into the classroom to discuss your observations”.

She further said;

“In each group you’re going to carry your exercise books, so that you note the things that you have observed. Once we come back to the classroom then each group will take turns as to discussing what they observed. We’re going to be using the terminology that we’ve already studied, we’re going to be applying the knowledge that we’ve seen. Please feel free to go to the extension, but mainly do not limit yourselves to do an observation of smaller or a particular area, you are free to look at a close by range and you are also free to look at the things that are present at a far range”.

Teacher Zodwa also warned learners not to touch dangerous things outside the classroom and not to make noise as they walk on the veranda. Learners were also told to take their belongings away if they felt it was unsafe in the classroom.

Teacher Zodwa then divided learners into groups. She said;

“The very five people will come and stand here so that it’s easy for the people to know where they belong. Let’s take 1, 2, 3, 4, 5 come and stand here” (she pointed at five learners in front of her). Learners stood up and moved to the front. *“From (she pointed at learners at the front and called the first learner by name) it will be group A,B,C,D and then E. So I’m going to divide you and then you follow people standing here, right”*. Teacher A then pointed at each learner giving them letter A, B, C, D and E respectively.

Learners moved outside to the backyard of the school with the teacher. The groups scattered at different points at the backyard of school grounds. The teacher attended each group for about two minutes. The school is surrounded by forests and mountains. There are also houses around the school and there was some livestock feeding on grass and trees on the mountain. I managed to record two groups during their discussion outside.

The task outside the classroom took about 10 minutes (i.e. learners’ observed nature outside the classroom). After 10 minutes teacher A asked learners to report back in the classroom on what they have observed outside.

Data collected from group 1 outside the classroom

This group discussed terminology, habitat, species, community and population

Data collected from group 2 outside the classroom

This group discussed intra-specific competition-organisms competing for the same resource, also mentioned co-dominance looking at the colour of cattles with spotted. They also mentioned feeding of cattles which they used the Zulu name (izinkomo), needing fresh food,

After ten minutes outside the classroom, teacher Zodwa announced that time for observations outside the classroom is over, learners must go back to the classroom to report back. Learners followed instructions and walked back to the classroom. Learners made some noise as they walked back, teacher Zodwa asked them not to disturb other classes, and learners reduced the level of noise.

Back to the classroom

Teacher Zodwa asked the groups which group should do its report back first. The agreement was group A must do presentation first. Teacher Zodwa then said;

“While they’re talking I will be noting if there are any terms that are still giving you problems right... most of the terms here are closely related, so as they are talking, I’ll be standing here, I’ll be writing those terms”.

As group A moved to the front, teacher Zodwa said to learners that were sitting down;

“Let us pay attention”.

The first speaker in group A greeted everyone in the classroom. the first speaker spoke about that they turned the rock and saw different species and different communities. The first speaker also spoke about Lamarck and he said that another member of the group will expatiate on Lamarck. Another group member mentioned resource partitioning and ecological niche. Teacher Zodwa asked the class;

“What do you understand by this particular biological term resource partitioning”?

The learner answered the question correctly but, he mentioned ecological niche mistaking it for nectar. Teacher A corrected the learner and said;

“The nectar”.

Teacher Zodwa then added the term on the chalkboard and said;

“You talked about ecological niche, what’s the meaning of this one”?

A learner from the class answered the question correctly. Group A finished its discussion. Teacher Zodwa said;

“Next group will therefore be group er... B, who’s group B”?

Group B came to the front. There was some noise in the classroom as group B moved up to the front.

Group B mentioned that they saw a plant with thorns and another one with bad smell. They also mentioned that they saw commensalism.

Teacher Zodwa wrote the term commensalism on the chalkboard and said to the presenter;

“Please repeat your definition on commensalism”.

The presenter from group B said;

“Commensalism is a relationship where one partner benefits...”

Teacher Zodwa interrupted;

“Why are you calling them partners”?

The presenter corrected himself and said;

“Oh , a relationship whereby one organism benefits and the other one is not harmed”.

Teacher Zodwa said;

“I told you guys if you are explaining a term it’s always better to go on and give examples, right. Like right now he is calling organisms partners, it’s not partners, are we clear”.

The whole class responded;

“Yes”

The next presenter in group B mentioned the following terms; forest ecosystem, canopy, mid-canopy and undergrowth. The presenter explained the terms he mentioned above. The third presenter from group B mentioned inter-specific competition where different organisms were competing for the same resource. The presenter gave the examples of competing organisms i.e. snails and earthworms.

Teacher Zodwa asked;

“What were they competing for”?

The presenter answered;

“They were competing for food underground, like minerals”.

The fourth presenter from group B further explained about competition between ants and black ants.

Teacher Zodwa asked the whole class;

“What do ants eat and what do snails eat”? In your observe...what type of food, because right now you cannot tell whether snails are herbivores or carnivores or omnivores, so that’s why I want to ask you, what do snails eat? What do they feed themselves on, the snails? The problem here is it the snails, the other problem is it the ants, from what I was listening to. Yes (pointing at one learner from the group B, whose hand was up)”.

Learner response;

“Snails feed on mud like soil”.

Teacher Zodwa interrupted;

“Can you survive on mud”?

All learners laughed.

Teacher carried on and asked;

“Guys, can you honestly survive on mud”?

The whole class answered;

“No”.

Teacher Zodwa carried on and said;

“So they don’t eat mud, they don’t eat mud.”

One learner from group B said that they eat minerals and the remains of dead animals and plants. Teacher Zodwa explained that the remains of dead plants and animals is called humus. Teacher Zodwa clarified that ants are not herbivores but are omnivores because they eat both plants and animals.

Group C came up to the floor as group B took their seats. This group mentioned division of labour amongst organisms in the population of ants. The first presenter in group C had a problem in pronouncing ‘ants’, he called them ‘aunts’.

Teacher Zodwa corrected the learner that they are not called ‘aunts’ but ‘ants’. Teacher A asked the presenter to use the correct pronunciation so that we are all on the same page. Most of the terms group C discussed were already mentioned by group A and group C and teacher Zodwa had already written them on the board.

Teacher Zodwa commented and asked;

“Then you talked about division of labour. When one ant drops the load the other one picks it up. Why do you think its competition, weren’t they assisting each other, weren’t they sharing the work because they are singles, what do you think? He talked about the fact that they are sharing, right, division of labour, now he is saying one ant will drop the load and another ant will pick it up, right, why do you think its competition? Weren’t they assisting each other, weren’t they helping each other so that they can share, they’ve got roles. They understand themselves better they know who’s doing what. Maybe they know that the first ant will collect the load from that particular point and drop it at that particular point and they leave it there and the next group takes over, isn’t that going to be division of labour”?

Presenter from group B mentioned ‘competitive exclusion’. Teacher Zodwa said;

“What is competitive exclusion? He mentioned competitive exclusion. What is competitive exclusion (she wrote the term on the board)”? Members of the presenting group raised their hands as well but teacher Zodwa said;

“No I’m not directing this one to you; I’m directing it to the class”. Teacher Zodwa pointed at one learner from the class. The learner explained what competitive exclusion is. Teacher Zodwa said to the learner answering the question;

“Give us an example; there are gaps in your explanation”. The learner gave relevant examples.

The siren rang and teacher A requested group C to sit down. Group C was eager to say more but Teacher Zodwa insisted that they sit down. Teacher Zodwa then gave learners some home

work to do from a booklet called matric intervention to study page 23 to page 27 on environmental studies

Description of teacher Ruth

Teacher B is a Head of Department in Mathematics and Science. She has taught Life Sciences since 1990 as it was then called Biology. The school is situated in the city center at Pietermaritzburg. This is a homogenous school for girls only. In the school there is only one grade 12 Life Sciences teacher. In this school Life Sciences class is taught in the science laboratory.

Lesson observation for teacher Ruth

Teacher Ruth entered the classroom at 08h40. Learners also came into the classroom a few minutes had entered the classroom. Learners took their places and remained standing. Teacher Ruth introduced me to the class. The class greeted me and I also greeted the class. Learner sat down.

Teacher Ruth introduced the lesson to the class as follows;

“Let me check how many of you are here, right I need groups of four since there are thirty of you. I need seven groups, one group will have five and all the other groups will have four. So what we’re going to do we’ll give ourselves a number one to seven, we’ll start from this side (pointing at the left side of the classroom), so please could you give yourself a number so we can be in groups”.

Each learner gave herself a number, starting from the side the teacher pointed at, counting from one to seven.

Teacher Ruth then said;

“Ok, so all the ones will get into one group, all the twos, all the threes etc. what we are going to be doing is the practical simulation of mark-recapture, we’ve done the theory regarding that, so we just going to now go through the practical aspect of it, so in your groups you’re going to be given you’re apparatus that you’ll need, each one of you please must have the time to carry out the investigation, when we’re doing mark recapture you’ll be given all materials that you need, your bean seed, your container with your bean seeds, your marker,

and err... textbook, ok we leave out the marker because I've already marked the bean seed for you. So the twenty bean seeds have already been marked for you, so you don't need to go through that process, what you will need is just your containers (bending down picking up the containers of bean seeds and putting the containers on the desk), ok, and you'll need your spoons, what I want to do, group there..." (Teacher Ruth showed all the group specific areas where to work).

Teacher Ruth said;

"All the number ones to your area, number (movement to allocated groups according to numbers started, and there was noise due to talking and movement of chairs in the classroom, all groups moved to their respective places).

Teacher Ruth asked;

"Are we all in our groups, sh... , (some learners were still moving to their respective groups).

Teacher Ruth then asked one member per group to come to the front to collect their apparatus.

"Ok, I'm going to give you your worksheet then you're going to complete (teacher handed out the worksheets to each group, each member in the group had her worksheet to complete).

The classroom became noisy as learners were shaking the bean seeds in the containers.

When teacher Ruth had finished handing over worksheets, she said;

"Ok just hold on, if you look at the method the first one has been done for you, isn't that so"?

Learners' response;

"Yes".

Teacher Ruth carried on;

"so we've done step one, step two, we're going to put our bean seeds back into the container now, you going to actually add all the bean seeds all in the container now because we already done step one, what you're going to do you going to give your containers a big shake, why you giving them a shake"?

Some learners responded, but it was not clear what they were saying.

Teacher Ruth said;

“ok to mix the beans so that the marked ones will blend with the unmarked ones ok... we don’t want all the marked ones at one side or the unmarked ones on the other side so that is why we’re going to put them back in the container and we’re going to put up a lid and we’re going to close up, now what are the containers serving as, ladies”?

Response from one learner;

“Habitat”.

Teacher Ruth restated the answer;

“As your habitat, ok..., which your bean seed will be free to roam around, ok..., then you are going to use your tablespoon and remove a sample of your bean seeds, each one of you must have a chance to use a tablespoon, ok..., and then we have a formula there and then you are going to determine the population size, ok..., now, your formula has been given to you, please make use of that formula, ok..., you have a table, you will fill in your table as you do your experiment, and if you look over your questions, your questions you answer individually, although you work in the group, you can still answer that individually, question four, please you need to share this information, because question four is going to help you with question six, and question six then leads us to question eight..., understood”?

Learners responded simultaneously;

“Yes”

The teacher then said;

“So if you would please start with your investigations as quickly as possible so that we could hear answers”.

Learners started to shake their bean seed containers, the class became noisy because all groups were shaking their seed containers and were also talking. Teacher Ruth moved around groups as they carried out their investigations and made clarity about the investigation. She

discussed with some groups which needed clarity on what to do to carry out the investigation as she moved around each group.

After about five minutes teacher Ruth asked if any of the groups have finished. There was no response, but learners carried on shaking their bean seed containers and discussing their activity. Teacher Ruth then gave learners more time to finish their investigation. She then started collecting bean seed containers from the groups that had finished their calculations and put them on her desk at the front.

Ten minutes later Teacher Ruth said;

“Ok ..., some of the groups have already worked out their population size”.

Teacher Ruth then asked the groups to give her their results and she wrote them on the chalkboard. Group 2 got 201, group 7 got 269, and group 3 got 236.

The teacher asked;

“Any other groups worked out the population size”?

The following groups gave their results of population size; group 6 got 307, group 5 got 424. Teacher Ruth asked group one and four to give their results. These groups reported that they are still busy with their calculations. She waited in the front for few minutes for the groups that were still calculating. One learner handed over to the teacher the bean seed container at the front. Teacher B then said;

“Right, come ladies...”

One learner raised her hand and asked;

“Miss, didn’t you say when we finish we must go back to our places”?

The teacher responded;

“Ya, when you finish because you only need to be in group when doing the work, the answering of questions you will need to do it on your own. So as soon as you finish go back to your places and try to answer it quickly.”

Teacher B asked one group member whether they have finished. She also said;

“And group four, where is group four? Your population size”?

Group one member gave back their population size which was 430.

Teacher Ruth said;

“There’s a space for group four...”

A learner from group four gave their population size of 282.2. Teacher Ruth asked them to round off to the nearest decimal point. Group four then said that their population size is 282.

Teacher Ruth said;

“Ok, let’s just go through some of the things over here, right, you will find that in that little container ... we actually have 300 bean seeds. Ok, because there is 300 of these bean seeds so if you look at the groups there, which groups are the closest to 300”?

Some learners responded that group 6 is the closest to 300 because it got 307.

Teacher Ruth carried on and said carried on explaining the procedure of mark recapture technique to learners. She explained the precautions taken when estimating population size using mark recapture technique. As she explained the mark recapture technique she kept asking questions about the mark recapture method. Few learners responded to the questions asked by the teacher.

The bell rang to end the period for the lesson. Teacher Ruth made closing remarks about the lesson that as they have revised, learners should not experience problems on graphs and tables and the methods of were handed out to learners. Learners moved out of the classroom.

Description of Teacher Lihle

Teacher Lihle is a post level one educator. The school is situated at a rural area in Pietermaritzburg. Teacher Lihle is the only Life Sciences teacher in the school therefore she also teaches Life Sciences in Grade 12.

Lesson observation for Teacher Lihle

The lesson was conducted in the morning at 09h00. The lesson duration was one hour ten minutes. Teacher Lihle came to class at 09h05. She greeted learners and introduced the lesson as follows;

“Err...our last lesson we were busy with the size of the population. We were also looking at the organism use these resources, what happens to the size of the population and also talked about oranges, a certain number of oranges, I have got learners, I want to distribute these oranges to these learners, what is it that I need to know before I distribute the oranges to the learners”?

Teacher Lihle pointed at a learner who raised her hand, the learner responded as follows;

“We need to know the number of oranges and the number of learners”.

Teacher Lihle restated the answer;

“Very good... I need to know the number of the learners and also the number of the ... (all learners said with the teacher) oranges (the teacher carried on alone) so that I can distribute the oranges equally to all the learners. what is it that one will need to know”?

One learner answered;

“Individuals”.

Teacher Lihle;

“We need to know the number of the individuals within the population and also...and also”?

Learner response;

“Resources”

Teacher Lihle restated the answer. Teacher Lihle carried on and asked;

“The example of a direct method that we are talking about is the census, anybody who knows about census, what is it”?

Learner response;

“Counting of people”.

Teacher Lihle further explained about how census is performed and why. She then explained about the indirect method of estimating the population size. Teacher Lihle said;

“Then with indirect method we have got two examples that we’re going to talk about, the first one we refer to it as a mark-recapture technique, the second one we refer it as the quadrant technique but today we are only going to deal with the mark-recapture method”.

“There is an activity that we are going to do. This activity, the simulation activity, that will give you an idea as to count the mark recapture method”. (Teacher Lihle distributed the worksheets on the activity).

She then gave the instructions on what to do in this activity.

Teacher Lihle went round the groups checking whether learners were following instructions. Learners started the investigation, removed thirty seeds of samp from the container and marked the seeds with a marker. I could hear learners actually counting and saw the learners marking the samp seeds.

Teacher Lihle asked one group;

“Have you removed thirty okay”?

She then said to the whole class

“Let us modify our samples, A will remove sixty, so add another thirty there, as one is removing thirty, the other one is marking those seeds, one is making a mark on the seed. Make sure that your mark is clear; make sure that your mark is clear”. (Teacher Lihle went round all groups to see what the groups were doing) *“Faster...faster”.*

She then said;

“After you have marked all the sixty, you put them back into the container. Put them back into the container, don’t paint the whole seed, just make a dot (teacher Lihle carried on moving from group to group checking what learners are doing and made clarity about the procedure to some groups). Make sure that there is a mark, a visible mark. Once you have

marked all the seeds, could you please put them back". (Teacher Lihle picked up a worksheet for one learner from the floor. She carried on moving around from group to group checking).

Teacher Lihle pointed at samp seeds on the floor in one group and said;

"What about this? Finish up, finish up..., finish up, finish up, finish up".

Teacher Lihle;

"Right, all the groups are through? Right, the marked seeds are all back into the containers, right"?

"Yes".

Teacher Lihle then instructed learners to shake their samp containers well. There was noise in the classroom as learners were shaking their samp seed containers.

Teacher Lihle went to one group and said;

"You are not counting, you are not counting, divide the seeds and then each one will count and add, you take once". (The class became noisy as the learners were counting. There was some noise coming from the outside).

Teacher Lihle explained the steps once more to learners. Teacher Lihle then walked round groups checking the counting of the marked samp seeds, she then said;

"You record; you record the information that you have". (She walked round the groups checking whether learners are recording the total marked samp seeds).

She continued;

"At first you took out sixty, you marked them, secondly you record the number that you took out thirdly you record the number of those that are marked in the sample that you took out, which means at the end you are going to have three figures". (Teacher walked round the groups checking the record of the three figures).

Teacher Lihle then wrote on the board and said;

“This is the information that you should have. The first sample that was marked, the second sample that you took out, in the second sample how many you’ve marked? Teacher Lihle kept on saying; finish up, finish, Teacher Lihle went to one group and she said; finished, finished, this is a second sample, so all of this second sample, on that one how many are marked and on that one”.

Teacher Lihle went round all the groups saying that all groups should be finished counting by then. Teacher Lihle carried on and said;

“So you should have three values, can we pass on, can we pass on”?

Learners agreed to move on.

Teacher Lihle then passed on and said;

“Right, now that we have..., can you listen, (Teacher Lihle went to the board) now that we have this information, remember this is the type of method or technique that we use, we don’t count the individuals directly, these are fast moving individuals, let’s say the fish in the water, you can’t get into the water and count, count each and every fish, right...”

Teacher Lihle carried on wrote the formula on the board and explained it.

Teacher Lihle went round groups checking what the groups were doing. She then said to one group;

“At the back, at the back of your paper, at the back of your paper, or if you find it in front, its okay. That’s an easy calculation, if that question comes out of your paper you should make sure that you take it on. Usually that question, the calculation itself it’s about 3, 4 marks”.

Teacher Lihle carried on checking the groups whether they are carrying out their calculations. Teacher Lihle went to the board wiped a portion of it. She then said to the class;

“We are supposed to be through with our calculations”.

Teacher Lihle went to one group and spoke to the group softly, she assisted the group with calculations as she used the calculator. She further explained to the group about samples taken out, marked, taking marked sample back into the container, shaking, taking another

sample, counting how many marked in a second sample and so on. Teacher Lihle further explained the group;

“You separated them because I wanted to make the process faster, you have to calculate them together and add them and count how many are marked. Teacher Lihle left the group to carry on its own and went to another group, she said;

“Are you sure, 487?”

One group member said;

“Yes”

Teacher Lihle said;

“Then okay” (with a doubting tone)”.

Teacher Lihle moved to other groups and acknowledged that they are right with their calculations. Teacher Lihle then said;

“Everybody finished with their calculations”?

Response from the class;

“Yes”.

Teacher Lihle then made a full explanation about hypothesis, repeating the investigation and why should more than one sample be taken. She also said;

“Let’s say you do that three times or four times, you do that three times, four times. Right then after you’ve done three times or four times, what you do, you add all your totals, you divide, your calculations is done four times, for each calculation you have got an answer, right. You add all those answers, okay. How many answers did you have”?

Answer from the class;

“Four”.

Teacher Lihle carried on and said;

“You divide your answers by the number of investigations that you did and that will give you an average. Once you get an average, e..average ‘yakho’ (Teacher Lihle code switched to isiZulu language) is making i-results ‘zakho’ (Teacher Lihle code switched again) to be more reliable, that is how you make sure that your population size, estimation of the population size is reliable, you do your investigation a number of times and then you calculate what? You calculate your average. When you get your average, i-average ‘yakho’ (code switching) will not give you the actual number but it will be the number when you look at it, it brings you closer to the number of individuals that are inside a population, are we together..., are we together...”?

Response from the class;

“Yes”.

Teacher Lihle then said to the class that as they do this investigation on non-living things they are supposed to be doing it on living organisms. Teacher Lihle also said that it should be conducted within a short space of time and she gave the reasons for that. She further said;

“There was a time when I said take out sixty seeds, mark them, return them put them back into the container. And after that what did I say? You took out sixty; you marked them you returned them back. What did you do with them”.

There was a ‘squeaking’ sound of pulling the desk by member in one group. That sound disturbed teacher Lihle. She stopped what she was saying about the lesson and said;

“You are disturbing, leave it like that, (teacher Lihle called that learner by name and repeated), leave it like that” (that funny noise occurred for the second time). Teacher Lihle carried on;

“What did you do afterwards, immediately after you put them back, mm”?

There was no response from learners therefore teacher Lihle had answered the question’

“You shake the container, why do you shake the container?”

Learners murmured something and were not audible. Teacher Lihle had to say it clearly’

“You want them to mix well with those that were not marked, alright...”

Teacher Lihle asked;

“Any more questions”?

There were no more questions, then teacher Lihle proceeded;

“Can you do this activity quickly”, (she handed out worksheets to each learner in their groups).

Teacher Lihle then said;

“Okay, I’m going to read the questions for you and explain them; see appendix D for the questions teacher Lihle explained to learners.

Teacher Lihle gave learners 15 minutes to answer that activity. After 15 minutes teacher Lihle answered the questions together with the whole class. See memorandum which is a marking guide. Each learner marked her or his own worksheet.

When teacher Lihle had finished answering questions with the learners, she consolidated the lesson by asking learners what they have learnt today. Learners were able to answer questions that the teacher asked. End of lesson.

Appendix F

Semi-structured interview schedule post lesson observation

1. How did you feel things went in the class?-----

2. How did things, compare with what you had expected went in the classroom? Did anything surprise you?-----

3. Was there anything you were particularly pleased about? Explain.-----

4. Did anything disappoint you? If yes, explain.-----

5. Please explain your approach to introducing the lesson.-----

6. This unit of study is an interesting one. Tell me what were you intending to achieve during these lessons?-----

7. There are many approaches to teaching the same unit of study. This is also evident in the way other teachers in other schools have approached the same unit. Please explain why did you use that approach particular approach? -----

8. Viewing part of the methods e.g. explaining, demonstrating, briefly describe what learners were doing.-----

9. I noticed that you have changed your approach during your lesson.

9.1 Why did you change your teaching approach? -----

9.2 Why did you engage the learners during your lesson? -----

9.3 What skills do you think learners would have acquired when you changed your teaching approach? -----

10. In your lesson you have used many teaching approaches. There are many skills, knowledge, attitudes and values that the learners would have been exposed to.

How do you assess the learners' level of achievement in a lesson? -----

Thank you

Can you please share some thoughts, reflections, feelings on your lesson? It could be anything that you feel is important but was not covered during the interview.

APPENDIX G

RESPONSES TO INTERVIEW QUESTIONS

Teacher Zodwa

Question 5

Please explain your approach to introducing the lesson.

Response by teacher Zodwa

“My approach err..., like grouping them and taking them to the environment”?

Clarity;

Whatever, whatever which is about your approach in introducing the lesson.

Response by teacher Zodwa;

“I wanted the lesson to take the abstract knowledge that we have already dealt with mostly in the classroom to make it to be concrete. I wanted them to apply the knowledge that they already have to put it now into practice to see it in reality, that’s why they had to go to the environment so that they can take the abstract and put it to the environment so that they make it concrete”.

Question 7

There are many approaches to teaching the same unit of study. This is also evident in the way other teachers in other schools have approached the same unit. Please explain why did you approach, why did you use that approach particularly for this lesson?

Response by teacher Zodwa;

“I think every school will have some form of environment, there will be some surroundings, so I honestly thought it’s just application now since all the schools do have environment. So it’s better in environmental studies to get into contact with reality”.

Question 9

I noticed that while we were in the classroom, you sort of changed your teaching approach, that is from learners then you were taking a lead;

9.1 Why did you change your teaching approach?

Response by teacher Zodwa

“When I could feel that the terminology was not properly grasped, was properly understood, there were hiccups here and there, I had to intervene”.

9.2 Why did you engage the learners during your lesson, because your learners were more than seventy percent engaged in the lesson?

Response by teacher Zodwa

“I think the learners are the ones that are learning. What the educator has to do is just to give a direction because in the end the people who are going to write the exams, is going to be the learners so if they are hands on it will be easier, they will recall easily the things that they have touched, that they have seen that they have heard, unlike listening to the educator most of the time”.

Question 10

10. In your lesson you have used many teaching approaches. There are many skills, knowledge, attitudes and values that the learners would have been exposed to. Now what I want to know is that how do you assess the learners' level of achievement in a lesson? How do you see the achievement of a learner, what is it that you do?

Response by teacher Zodwa

“Mostly we write tests, we write examinations, we have home works, we have class works, and then we come back we mark it, they are also free to may be come back to the educator and say this particular section gave us problems before we move on its always best to do remedial work in that particular section where they had problems. As we mark again it is easier for me to detect that such learners had problems here and there. It was even easier today because they were talking among themselves, with the educator so it was easier to see that there are gaps, there are spaces between the understanding of this and that, so that's where I took my stance”.

Thank you

Teacher Ruth

Question 5

Please explain your approach to introducing the lesson.

Response by Teacher Ruth

“I just thought I get them familiar with what we are done in theory so that they don’t get lost when they have to approach the practical aspect of it so that they comfortable and that made them at ease so they able to carry on with their work so I thought sometimes to introducing them, to recap was a better”.

Question 7

There are many approaches to teaching the same unit of study. This is also evident in the way other teachers in other schools have approached the same unit. Please explain why did you approach..., why did you use that approach particularly for this lesson?

Response by Teacher Ruth

“Err, sometimes you find that some learners like to do, and I’m giving them something to do, and I find that some learners learn by doing, some learn by listening and some people learn by like they think cognitively when they writing down, so I just thought that thinking about different learners style like letting them discussing and then write it down, so that there is something practicably and tangibly so I thought about catering for all their learning styles. So as much as possible with all my learners I like to incorporate privilege of learning. Then I like to take them outside of the classroom so that they touch the plants and flowers so that they have the feel of the natural environment”.

Question 9

I noticed that you have changed your approach during the lesson. You first grouped your learners and then you were attending each group after that you put back your learners into a class and then you were in front.

9.1 Er now, why did you change your teaching approach?

Response by Teacher Ruth

“I find that when you group them and they work in smaller groups sometimes they fear to ask questions when they sitting in class as a whole group they feel a bit intimidated, so they try to be comfortable and in this way I attend to their individual needs. With regards to them coming back together as a larger group we find that they need to interact with each other so that they can share the information and by bringing the different approaches they need to work in their groups so that they are able to interact and after that a larger group so that they are able to share information as well”.

9.2 Why did you engage the learners during your lesson?

Response by teacher Ruth;

“Just to make sure that they were comfortable with what they were doing, they understood what they were doing, and if there was any misconception to be cleared up so that they were going to be guided at the right time and so that they were not going to go all the way down the line and find that they were doing the wrong thing so I just needed feedback on the lesson”.

Question 10

In your lesson you have used many teaching approaches. There are many skills, knowledge, attitudes and values that learners would have been exposed to. Now I want to know;

How do you assess the learners’ level of achievement in a lesson?

Teacher Ruth’s response’

“To be rather informal sometimes we can just reach by to the way they are responding, the way they are reacting, the way they interact with their peers, that will be a lot of reflection inside especially when you grow their potential inside, then you know whether at the end of it you have achieved what you wanted to, whether they have changed their personality and their attitude towards the peer, what they are discussing. So during the lesson and stuff, as I’m walking around each groups I’m able to know whether they are interacting with the group, basically it is more informal, I would be able to judge whether they are working”.

Thank you

Teacher Lihle

Question 5

Please explain your approach to introducing the lesson.

Response by Teacher Lihle

“The lesson that I was dealing with was on population size and, because with the population size, what I wanted to instill to them was that population size, the individuals within the population goes along with the resources that are available within that particular habitat. So the way I introduced my lesson about the oranges I wanted to make sure that they understand that there is a link or relationship between the size of the population and the resources that are available in the habitat”.

Question 7

There are many approaches to teaching the same unit of study. This is evident in the way other teachers in other schools have approached the same unit. Please explain why did you use that approach, which... which ..., the one that you used in this particular lesson?

Response by Teacher Lihle

“Eh..., the topics that we are dealing with are not the same, and the topics that we are dealing they... they need different approaches to teach them. So the approach that I used I think the... the...the..., because the task that I gave, it was a practical task, they needed to do something practically, so it's not just to theorise about the content, they had to do some hands on, so I thought the approach that I used, goes in line with type of content that I was dealing with”.

Question 9

Question 9 has three subsections. It reads thus;

I noticed that you have changed your approach during your lesson.

9.1 Why did you change your teaching approach during the lesson?

Response by Teacher Lihle

“ Eh..., when you teach er..., some of the things, they need an explanation. So within the same lesson it happens that, you don't use one approach because, one approach can be that you are allowing themselves to do thing on their own and see for themselves what is happening. The other ..., some of the things for them to understand it's wise that you explain or you change the approach and do another approach.

9.2 Why did you engage the learners during your lesson?

Response by Teacher Lihle

“I believe that when teaching learners, it's very easy for them to understand clearly that, what they are doing practically than that which they listen to. So involving them, I think it's the best way because they usually not forget that have done with their hands”.

Question 10

In your lesson you have used many teaching approaches. There are many skills, knowledge, attitudes and values that the learners would have been exposed to. How do you assess the learners' level of achievement in a lesson?

Response Teacher Lihle

“Eh..., I think the way to assess the learners' achievement is to give them, after you have taught them you give them an activity and in that activity then, you will be able to see where are their strengths and where are their weaknesses and then you start then you start from there to do the remedial.

APPENDIX H

Life Sciences - Lesson Plan Sheet - Grade 12

Teacher: N.C.T. Sibisi			Grade: 12 A, B AND D	
Date: 21 / AUGUST / 2012				
Strand:		Topic: ENVIRONMENTAL STUDIES		Sub Topic: COMMUNITY INTERACTIONS
Specific aim	1 Knowledge	2 Investigating phenomena	3 Application of LS knowledge	
Skills			APPLICATION OF THE LIFE SCIENCES TERMS GAINED IN ENVIRONMENTAL STUDIES	
Prior knowledge				
Teacher activities	Learner activities	Resources	Assessment	Time
<p>DIVIDE LEARNERS INTO GROUPS OF FIVE</p> <p>GIVE INSTRUCTIONS OF WHAT LEARNERS SHOULD DO OUTSIDE THE CLASSROOM WHILE OBSERVING THE ENVIRONMENT OUTSIDE.</p> <p>CORRECTS LEARNERS INTERPRETATION AND APPLICATION OF TERMS IF NOT APPLIED PROPERLY.</p>	<p>DISCUSS OBSERVATION OUTSIDE THE CLASS ROOM OBSERVING DISCUSS IN GROUP, APPLY THEIR KNOWLEDGE AND DO PRESENTATION OF OBSERVATION IN THE CLASS TO THE WHOLE GROUP.</p> <p>ENGAGE IN DEBATES WHERE POSSIBLE TO TEST EACH OTHERS UNDERSTANDING</p>	<p>EXERCISE BOOKS</p> <p>CHALK - BOARD</p> <p>SCHOOLS GROUND</p> <p>ADDED BACK YARD WITH DIFFERENT LIVING AND NON LIVING ORGANISMS AND HOW THEY INTERACT WITH EACH OTHER.</p>	<p>GROUP</p> <p>EDUCATION</p> <p>LEARNERS TO BE ABLE TO INDIVIDUALLY ANSWER QUESTIONS BASED ON THE INTERACTION OF PROKARYOTIC AND EUKARYOTIC ORGANISMS</p>	<p>50 MINUTES</p>
Expanded opportunities and special needs		Enrichment	<p>DEPT. OF EDUCATION SMERO SECONDARY SCHOOL</p> <p>2012 -09- 21</p> <p>P/BAG X218 - EDENDALE 3217</p> <p>TELEPHONE: 033 - 3993242</p>	
Teacher reflection		Homework		
<p>TERMS NOT CLEARLY APPLIED AND UNDERSTOOD TO BE REVISITED</p> <p>27</p>		<p>LIFE SCIENCES MATRIC INTERVENTION PROGRAMME</p> <p>GRADE 12 (2012) DOE</p>		

08 August 2012

Home Work

6. a) B - C - A - D ✓
b) Pond C ✓
c) the animal that live in water will die because the
will be no oxygen
d) Pond C ✓
e) Pond A ✓
f) the pioneer are colonise a barren area
g) to colonise a barren area ✓
h) Shrubs ✓
i) Pond D ✓

Question 7

1. Intra Specific Competition ✓
2. Interspecific Competition ✓
3. Competitive exclusion ✓
4. Commensality Symbiosis ✓
5. Mutualism ✓
6. Parasitism ✓
7. mutualism ✓
8. Commensalism ✓
9. fossils ✓
10. Population ✓
11. ✓
12. pioneers ✓
13. ✓
14. ✓
15. ✓

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LIFE SCIENCES PROGRAMME OF ASSESSMENT - MARKSHEET - GRADE 12
 NAME OF SCHOOL: SMERO SECONDARY TEACHER: SIBISI N. C. J. M. CLASS: 12 A

NAME OF TASK	TERM 1			TERM 2			TERM 3			
	ASSIGNMENT	CONTROLLED TEST 1	CONTROLLED TEST 2	PRACT 1	MID-YEAR EXAM	PRACT 2	TRIALS P1	TRIALS P2	TOTAL	CONVERTED
SEQUENCE OF TASKS	1	2	3	4	5	6	7			
DATE	25/05/2012	01/06/2012	04/06/2012	06/06/2012	06/06/2012					
MAX MARK	50	100	100	100	150	20	150	150	300	10
CONVERTED MARKS	50	20	100	100	150	20	150	150	300	10
NO.	NAMES OF LEARNERS									
1	LELE Andile	36	14	36	24	31	05	31	21	29
2	LELE G. Indisane	45	18	41	09	27	03	11	07	35
3	Mabela Selobiso	28	11	23	02	13	02	10	07	15
4	Mentim Mhlayenopho	39	16	32	03	21	04	05	03	13
5	Mhlangu Ndzilene	39	16	40	04	31	05	06	04	47
6	Kamabatsa Tembani	35	14	41	04	26	04	05	23	43
7	Kamabatsa Ndabaviso	47	19	65	04	39	07	11	07	79
8	Yeneni Esophu	28	09	39	04	22	01	06	04	49
9	Khabisa Indisakuthe	33	15	39	04	22	01	06	04	49
10	Isakson Maphane	33	13	43	04	28	04	09	06	34
11	Madisa Makhuluza	37	15	29	03	21	04	12	02	30
12	Madondo Mkhosini	44	18	27	03	14	02	07	05	25
13	Makwizisa Kintswane	38	15	47	05	20	03	08	05	36
14	Makwizisa Mkhambiso	37	15	60	06	43	07	09	06	89
15	Mkhulisa Mkhosini	34	14	29	03	0				0
16	Majuba Maphule	44	18	76	08	39	07	15	10	89

TEACHER: _____
 DATE: _____

HOD/PRINCIPAL: _____
 DATE: _____

SUBJECT ADVISOR: _____
 DATE: _____

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LIFE SCIENCE TEST (ENVIRONMENTAL STUDIES) GRADE 12

MARKS: 11 7

DATE:

NAME: [REDACTED]

Question

List 5 independent factors that result in a decline in a population.

(5)

Earth quake ✓

Volcano ✓

Drought ✓

Tornado ✓

Floods ✓

Question

Explain why each of the following factors is referred to as a density dependent factor.

a) Food

Food supply is important to individual if food is short ✓
✓
If supply all the individual will can no longer supported.

b) Disease

The weaker members will be most effected and will die first, and the stronger will survive.
Disease is more likely to spread much all individuals in population and the people will die

c) Predation

Predator will pick off the weakest members first.
Prey first to the predators

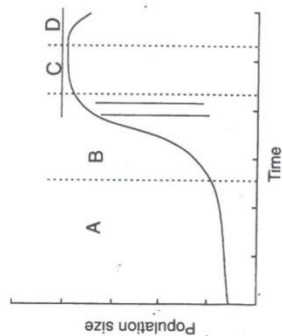
(6)

NAME: 15

DATE:

JAMIE

Study the graph of population growth and answer the questions that follow.



08/15

a) State the growth form depicted here. (2)

Logistic geometric phase.

b) Identify phases A to D. (4)

A. establishment phase C. equilibrium phase

B. geometric phase D. extinction phase

c) Explain the slow growth at 'A'. (2)

population is adapting to new its environment / no breeding partners.

d) Why does the population grow rapidly at 'B'? (2)

Survival rate is high. species realises its full reproductive potentiality of the resource.

e) Suggest a possible reason why there is a decrease in population size at 'D'? (2)

due to environmental resistance. Amount of resources population size decrease death of individual not support the population. environment

f) Briefly explain why the graph flattens at C. (3)

competition increase and environment resistance build up. population size stabilises at a particular level, population grows to the carrying capacity of the environment.

ACTIVITY 6

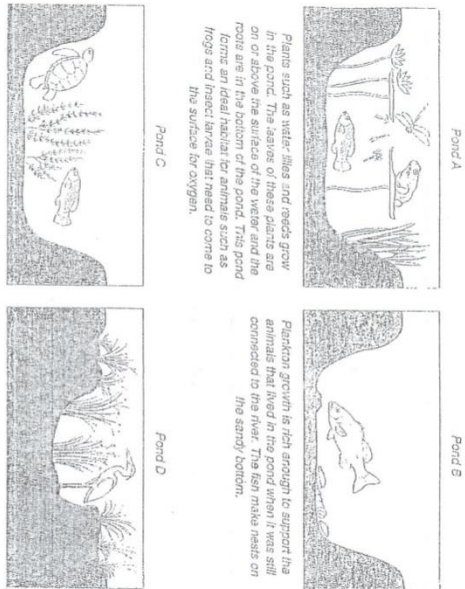
08.08.2012 Class

Activity - School-A

(21)

6.1 The succession of a body of water from a pond to a wetland can take thousands of years. During a flood, a river bend was cut off from a river to form a small pond. Some fish and micro organisms were trapped in the pond. The diagram below show the succession of this pond to wetland.

Note: The diagrams do not show the succession in the order.



Plants such as water lilies and reeds grow in the pond. The leaves of these plants are on or above the surface of the water and the roots are in the bottom of the pond. This pond forms an ideal habitat for animals such as frogs and insect larvae that need to come to the surface for oxygen.

Plants grow in the pond which is not enough to support the animals that lived in the pond when it was still connected to the river. The fish make nests on the sandy bottom.

Decomposing bodies of plants and animals form a layer of humus over the bottom of the pond. Gradually algae covers the humus. Fish that could not survive have been replaced with those that lay eggs on the algae.

The pond is filled with vegetation such as sedges and grasses. There are no large areas of open water. The water dries up in the dry winter months.

- Record your answers to the questions below. The number in brackets shows the mark that is allocated to each question.
- Write the letters of the ponds in order from the oldest to the youngest. (4)
 - Basal fish lay their eggs in nests on sandy bottoms. In which pond would you find them? (2)
 - What will happen to the bass when the bottom of the pond is covered with humus? (2)
 - In which pond would you find fish that lay eggs on algae? (2)
 - Some frogs can withstand dry conditions by burying themselves in mud. (2)
 - In which pond are ponds would they survive? (2)
 - Which producers are pioneers in the succession of the pond ecosystem? (2)
 - What is the role of these pioneer plants? (2)
 - Which plants follow the pioneers? (2)
 - Which pond has the most developed plants that show that it is near its climax? (2)

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ACTIVITY 7: TERMINOLOGY

Description	Community structure	Correct term
1. The competition between organisms of the same species depending on the same resources like food, space, shelter, water and access to mates.		
2. The competition between organisms of different species depending on the same resources e.g. light, space, water, shelter, food		
3. The competition in which one of the two competing species is much more successful than the other such that the successful species survives and the other species disappears.		
4. The kind of competition situation in which competing species coexist in the same habitat since they use the resources slightly differently		
5. The close association of two organisms such that one or both benefit from the association		
6. A relationship in which one of the species benefits and the other is harmed by the relationship		
7. The symbiotic relationship in which both of the species benefit from the association		
8. Two species living together where one species benefits and the other neither benefits nor suffers disadvantage		
9. A species of plant or animals that does not exist any more as all the individuals have died.		
10. The variety of different kinds of living organisms (species) that exist on earth.		
11. The sequence of organisms that occupy a new habitat.		
12. A plant that can colonise bare soil and that is part of the community that forms the first stage in the process of succession		
13. The sequence of organisms that occupy a disturbed habitat or when an established community has been disturbed in a catastrophic manner.		
14. The final stage in the process of succession that refers to a mature community of plants that will remain stable with few, if any, changes over time		
15. A sample that is not deliberately selected but is selected by a process of random chance. The population being sampled has an equal probability of being selected		

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LIFE SCIENCES LESSON PLAN SHEET

Teacher : Diani NH					Grade : 12
Date : 04 September 2012					
Learning outcomes and Assessment standards	LO 1 ✓	AS 1 ✓	AS 2 ✓	AS 3 ✓	Focus learning outcome Constructing Life Sciences knowledge
	LO 2 ✓	AS 1	AS 2 ✓	AS 3 ✓	
	LO 3	AS 1	AS 2	AS 3	
Knowledge Area	Environmental Studies				Topic : Population Ecology
Prior knowledge	Population Growth Trends				Sub-topic : Estimating population size
Teacher's activity	Learner activities	Resources	Assessment	Time	
Activity 1: Introduction	Respond to questions			5 min	
Asks the learners to give two things to be known to determine whether the resources are enough for a group of individuals					
Explains the two methods used to determine the population size and giving examples : 1Direct method e.g. census 2indirect method e.g. -mark-recapture method -Quadrat method	Listen and take notes	Chalkboard		10 min	
Activity 2	Do as instructed				
Explains census as the actual counting of individuals in a population		Samp or beans Marker Large containers	Informal Practical task	35 min	
Distributes material and instructs learners to do a simulation activity on mark-recapture method. Explains the following: -Precautions to ensure greater accuracy. -Peterson index or Lincoln index					
Activity 3	Complete the worksheet	Worksheet		15 min	
Distributes worksheets to learners and instructs them to complete it.			Informal Classwork Peer Memorandum		
Homework : Homework on mark-recapture method given to learners					

Enrichment/Expanded Opportunities : learners who experience problems will be given extra activity on mark-recapture method

Teacher Reflections:

LIFE SCIENCES LESSON PLAN SHEET

Teacher : Diami NH					Grade : 12
Date : 04 September 2012					
Learning outcomes and Assessment standards	LO 1 ✓	AS 1 ✓	AS 2 ✓	AS 3 ✓	Focus learning outcome Constructing Life Sciences knowledge
	LO 2 ✓	AS 1	AS 2 ✓	AS 3 ✓	
	LO 3	AS 1	AS 2	AS 3	
Knowledge Area	Environmental Studies				Topic : Population Ecology
Prior knowledge	Population Growth Trends				Sub-topic : Estimating population size
Teacher's activity	Learner activities	Resources	Assessment	Time	
Activity 1: Introduction	Respond to questions			5 min	
Asks the learners to give two things to be known to determine whether the resources are enough for a group of individuals					
Explains the two methods used to determine the population size and giving examples :	Listen and take notes	Chalkboard		10 min	
1Direct method e.g. census					
2indirect method e.g. -mark-recapture method					
-Quadrat method					
Activity 2	Do as instructed			35 min	
Explains census as the actual counting of individuals in a population		Samp or beans	Informal		
Distributes material and instructs learners to do a simulation activity on mark-recapture method.		Marker	Practical task		
Explains the following: -Precautions to ensure greater accuracy. -Peterson index or Lincoln index		Large containers			
Activity 3	Complete the worksheet	Worksheet		15 min	
Distributes worksheets to learners and instructs them to complete it.			Informal Classwork Peer Memorandum		
Homework : Homework on mark-recapture method given to learners					

Enrichment/Expanded Opportunities : learners who experience problems will be given extra activity on mark-recapture method

Teacher Reflections:

LIFE SCIENCES PROGRAMME OF ASSESSMENT - MARKSHEET - GRADE 12
 NAME OF SCHOOL: THS/KA SECONDARY TEACHER: DAMINI NH CLASS: 12

NAME OF SCHOOL: <u>ZINSA SECONDARY</u>		TERM 1				TERM 2				TERM 3						
NAME OF TASK	ASSIGNMENT	CONTROLLED TEST 1	CONTROLLED TEST 2	PRACT 1	MID-YEAR EXAM	PRACT 2	TRIALS P1	TRIALS P2	TOTAL	CONVERTED	TOTAL SBA MARK	MODERATED MARK				
SEQUENCE OF TASKS	1	2	3	4	5	6	7	8	9	10	11	12				
DATE	60	20	100	100	60	30	20	150	10	20	150	150	300	10	100	100
MAX MARK																
CONVERTED MARKS																
NAMES OF LEARNERS																
1	BHENDU SINEHEMBO	20	07	16	02	01	01	06	04	08	01					
2	DAMINI LONDUSE	17	06	16	02	04	01									
3	HELEA NOMPHELE	34	11	11	01	06	01	13	07	14	01					
4	KHUMALO WENDY	21	07	17	02	06	01	05	03	05	01					
5	MADONDO HELEN GIDE	14	05	12	01			05	03	11	01					
6	MAGUBO LILLIAN	22	07	17	02	11	02	04	03	11	01					
7	MATOLA ZAMOTSHANE	21	07	20	02	12	02	06	04	10	01					
8	MAKATHI LINDOKHULE	16	05	34	02	04	01	08	05	23	02					
9	MAKATHI ZANA	19	06	45	05	09	02	09	06	29	02					
10	MAKATHI NOMAONTO	26	09	26	03			05	03	17	01					
11	MAKATHI NONTSHULEKO	22	07	31	03			10	07	51	03					
12	MPULO NDUMISO	24	08	19	02			06	04	12	01					
13	MPULO MHLANTHA	15	05	21	02	12	02	05	03	12	01					
14	MTHATHANE MASENTHA	13	04	23	02	10	02	09	06	22	02					
15	MTHATHANE PHILE	22	07	21	02			07	05	07	01					
16	MTHATHANE PRAISE-GOD	17	06	14	02	13	02			08	01					

TEACHER: _____

DATE: _____

HOD/PRINCIPAL: _____

DATE: 08/05/12

SUBJECT ADVISOR: _____

DATE: _____

INSISA SEC SCHOOL

STAMP

Four pages only

TEACHER: _____
 DATE: _____

HOD/PRINCIPAL: DAMINI
 DATE: 08/05/12

26

SUBJECT ADVISOR: _____
 DATE: _____

KZN DEPT. OF EDUCATION
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 DATE: _____

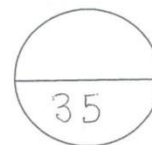
Name : _____ Grade: _____

Practical Assessment – Grade 12

Simulation : Mark – Recapture

Apparatus:

- 1) Bean seeds
- 2) Container with lid
- 3) Marker
- 4) Tablespoon



Method:

- 1) Count out 20 bean seeds and mark them with your marker.
- 2) Put the seeds back into the container and close with the lid.
- 3) Give the container a good shake.
- 4) Use your tablespoon and remove a "sample" of bean seeds.
- 5) Using the following formula, determine the "population" sizes .

FORMULA : $P = F \times S / m$ where;

P = estimated population size

F = total number of "beans" captured and marked in 1st sample

S = total number of "beans" captured in 2nd sample

m = number of marked "individuals" in 2nd sample

- 6) Repeat steps (2) through to (5) **THREE** more times and complete the following table.

Sample number	No of beans captured	No of marked beans	"Population" size

(8)

Questions:

1) Is the above a direct or indirect technique to determine the "population" size? (1)

2) Provide a reason for your answer. (1)

3) Why did we use a tablespoon to remove the beans from the container? (1)

4) Determine the "population" size of your sample. Show ALL working. (4)

5) Why did you repeat steps (2) through to (5)? (2)

6) Record the "population" size of the different groups in the form of a table. (5)

7) Explain TWO ways in which the results of your experiment could have been affected. (4)

- i) _____

- ii) _____

8) Draw a line graph to represent the "population" sizes of the different groups. (7)

9) List TWO other methods of determining the size of a population. (2)

7) Explain TWO ways in which the results of your experiment could have been affected. (4)

i) _____

ii) _____

8) Draw a line graph to represent the "population" sizes of the different groups. (7)

9) List TWO other methods of determining the size of a population. (2)

