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The facilitation strategies used by three life science teachers to implement learner-centred teaching and learning.

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CHAPTER 1: RESEARCH QUESTIONS, AIM AND RATIONALE

1.1 INTRODUCTION

This study investigates the facilitation strategies that three Life Science teachers used to implement learner-centred teaching and learning in the classroom. There are a number of challenges that affect the implementation of learner-centred teaching and learning in South Africa. The National Curriculum Statement requires the teachers to act as facilitators, in order to teach in a learner-centred environment. The emphasis is on active learner participation and using learners' experiences in delivering this curriculum. This study was a qualitative case study of three Further Education and Training (FET) teachers at the same school. Data was collected through lesson observations and teacher interviews. I used an interview schedule to collect information on teachers' understanding of facilitation as a teaching role in learner-centred teaching and learning, an observation guide to record the ways in which three FET Life Science teachers facilitate learner-centred teaching and learning in the classroom. In this study three teachers in one of the secondary schools in Gauteng were observed and interviewed.

This chapter covers the background of the study; rationale; the purpose of the study and research questions.

1.2 CONTEXT

In this report, the facilitation strategies that the three FET Life Science teachers use to implement learner-centred teaching and learning were investigated. This study revealed how the three teachers in a high school in Gauteng facilitate their classroom teaching and learning. This high school was situated in a township amongst the squatter camps and old houses, and consists of 2250 learners and 53 teachers. There was lack of resources in this school, even though the renewal project was trying to improve the standard of living in the area. The renewal project was trying to equip the schools around the area with teaching and learning materials.

1. 3 BACKGROUND OF THE STUDY

The Republic of South Africa has introduced the National Curriculum Statement (NCS) in all grades to replace the post-apartheid curriculum. The NCS is based on a number of principles. One of the principles is outcomes-based education; which aims to produce learners with knowledge and skills that can help them participate in the changing world (Department of Education, 2003; Department of Education, 2006). Outcomes-based education (OBE) forms the foundation for the curriculum in South Africa (Department of Education, 2003; Department of Education, 2006), and it encourages a learner-centred and activity-based approach to education. The NCS requires the teacher to change from teacher-centred approaches of teaching to learner-centred approaches (Department of Education, 2003; Department of Education, 2006).

The concept of learner-centredness has evolved as a counter to the traditional teacher-centred approach to education which has been authoritative in nature. Schreuder (1998) shows that there is now a shift in focus to the learner which in part has grown out of teachers' dissatisfaction with traditional approaches that are based on the notion of giving a predetermined body of knowledge to the learner who was treated as an object. The shift reflects a need for teachers to explore ways of making teaching responsive to learner needs and interests and allowing learners to play a more active and participatory role in the day-to-day teaching and learning processes (Schreuder, 1998).

Gibbs (1992) offered a useful explanation of learner-centred approaches. He suggested that the learner-centred approach gives learners greater control over their learning process and pace of study. According to Gibbs, the teacher uses individual learner's experiences, interests, capabilities and needs to help learners build their understanding, knowledge and skills. This helps learners to understand the subject content better than if their experiences and interests are not considered during learning. In other words, the new curriculum is encouraging teachers to use the constructivist approach of teaching and learning.

The focus of teaching and learning has shifted from teacher-centred to learner-centred and the teacher serves as a facilitator (Department of Education, 2003). This change in educational approach involves change in teachers as well as learners. In a constructivist

learner-centred environment, the teacher can no longer assume the traditional role of knowledge transmitter; he/she has to act as a knowledge facilitator now. According to the Department of Education (2003), the teacher has to be sensitive towards the process of learning and be willing to provide encouragement and help whenever needed by the learner. The Department of Education further indicates that the new environment requires extra input and planning on the part of a teacher and the teacher would be better served by thinking of teaching as designing learning environments. The teacher has to carefully consider each process in order to help the learner to realize learning objectives.

The Department of Education (2003; 2006) indicated that when the teacher designs learning experiences emphasizing learner-centredness, the objectives should be to ensure that learners take action and make changes before they need to be made. This helps in creating self-directed learning, and making resource-based learning more flexible. Other objectives include enhancing learner motivation, providing opportunities for learning founded on collaboration, group or social approaches, and providing individual enrichment via resource and learning extension (Department of Education, 2006). The Department of Education also indicates that other objectives should capitalize on situated and work place learning opportunities, promote learning situations which support constructivist orientation to knowledge acquisition, stimulate self-awareness of learning processes and encourage meta-cognitive activities (Department of Education, 2003; 2006). In this research project, I was looking for objectives such as proactive, self-directed learning, making resource-based learning more flexible, enhancing learner motivation, promoting learning situations which allow learner to acquire new knowledge, and stimulating self-awareness of learning processes.

During the process of teaching and learning, the roles of teachers are to guide, support, facilitate and give the direction, while learners must be more involved in their learning process; discuss in groups and perform activities designed and planned carefully and clearly by the teacher (Department of Education, 2003; Department of Education, 2006). In other words the facilitator, who is the trained teacher, sits with the learners, helping learners to follow the lesson the teacher is giving. Learners are to be assessed formally with tests and exams, and informally with pieces of work such as homework, class work, assignment, research, projects. Vygotsky (1978) also indicated that the role of the

teacher includes planning a lesson in advance which is relevant to learners socially and culturally, and contextually.

Outcome-based education requires the teachers to use existing knowledge and ideas obtained from their society and cultural background in order to help learners to understand during the learning process (Department of Education, 2003). The influence of learners' culture and society should be taken into account during teaching and learning science. Prior knowledge needs to be considered by the teacher during planning, organising and preparing the activities (Department of Education, 2003; 2006). Learners' existing knowledge and ideas play a role in solving problems in the classroom. The Department of Education in South Africa also encourages the use of indigenous knowledge system (IKS) to build up new knowledge (Department of Education, 2006).

1.4 RATIONALE

In this study I investigated the facilitation strategies that the three FET life science teachers use to implement learner-centred teaching and learning. In outcomes based education one of the teachers' roles is to facilitate the learning process. During the process of teaching and learning, teachers are supposed to guide, support, facilitate and give the direction, while learners must be active participants, discuss in groups and perform activities designed and planned carefully and clearly by the teacher (Schreuder, 1998; Department of Education, 2003; Department of Education, 2006). Schreuder further reports that some educators in schools are still applying the teacher-centred approach of teaching and learning and, are not applying their role as facilitators during teaching and learning.

In schools, the majority of teachers are faced with a challenge to implement Outcome-based education. Outcome-based education encourages learners to reflect on what they know; and construct their own understanding of the world they live in. Educators plan lessons taking into account learner's ideas and select the appropriate teaching strategies and activities which will promote conceptual development. Therefore, the outcomes-based education encourages a constructivist perspective of teaching and learning in the classroom.

Inadequate training may have affected the teachers' ability to implement outcomes-based education properly. The Gauteng Department of Education offered training for six days, training teachers about Outcomes-based education. This approach needs to be taught formally at college or university. The training was conducted mainly to inform the teachers of the NCS in 2006, and not to show the appropriate teaching strategies. From my experience, the type of training which was conducted in my district in Gauteng for schools in townships was mainly to inform educators of the topics and possible activities that can be given to the learners. The training was not to inform the educator as to how to facilitate the learning process. Time used for training educators was minimal and educators who were serving as facilitators were rushing through the teacher training manual. From my observation, formal teacher-training of outcomes-based education requires sufficient time. The majority of educators are still implementing teacher-centred approaches of teaching and learning, as they are failing to implement outcomes-based education where teaching and learning is learner-centred.

1. 5 PURPOSE OF THE STUDY

The purpose of this study was to investigate the facilitation strategies that the three FET Life Science educators use to implement learner-centred teaching and learning. The following questions were addressed:

- How do FET Life Science teachers interpret and understand their role as facilitators in the classroom?
- What facilitation strategies do three FET Life Science teachers use to implement learner-centred approaches to teaching and learning?

1.6 SCOPE

The research project was conducted in one high school in a township in Gauteng. Three teachers and three FET classes, grade 10-12 were involved during the research. Different methods were used to collect data; that includes observations and interviews. I

observed 9 lessons from different educators, 3 lessons from each teacher. A further 6 lessons were recorded and transcribed.

1.7 LIMITATION OF THE STUDY

This research study was limited to a total of three teachers who were teaching Life Sciences to about 46 learners in grade 10, 11 and 12 classes (boys and girls) in the selected high school. Each class was a manageable size as compared to other classes of about 65 learners in a class. It was therefore, easier to investigate the facilitation strategies that the three FET Life Science teachers used to implement learner-centred approaches to teaching and learning. This report is a case study in one high school.

1.8 PROGRAMME OF STUDY

This report consists of five chapters (chapter one to chapter five). Each chapter consists of specific information that links with the previous chapter or with the next chapter. A full reference list and appendices of all materials referred to and used in the report are included in this research report.

Chapter One

Chapter one covered introduction, context, rationale, and research questions. The research questions correspond with information given to support and motivate the aim of this report.

Chapter Two

Chapter two is a theoretical background of the report, and includes literature review, and literature related to research questions. It also covers the literature and research question related to theoretical framework. There is a critical and conceptual analysis of the scientific content and theoretical concepts of study.

Chapter Three

This chapter shows the research design, methodology and data collection. The methodology section provides a conceptual analysis, description of research design and its justification, assumptions inherent in the research design, and an identification of and justification of target population.

Chapter Four

This section covers the results, analysis, reflection and conclusion of the results obtained. Results are presented in tables.

Chapter Five

In this chapter I present the conclusion and recommendations wherein I attempt to answer the research questions. The implications of the findings of the study for the curriculum, and lessons learnt from the study and shortcomings of the study are discussed. I also present a summary of the study's critical reflection on the research process and suggestions for future research.

1.9 CONCLUSION

In this chapter, the contents of the whole research report have been explained and summarized to cover the sections that are going to be researched. This includes the background of the study; rationale; the purpose of the study; research questions; scope, limitation of study, and programme of study. In the next chapter I briefly reflect on the theoretical framework, literature review, and literature of other researchers who have researched about extent at which teachers facilitate teaching and learning.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

This research investigates the facilitation strategies used by three FET Life Science teachers to promote teaching and learning. This chapter covers the theoretical framework and literature that was relevant to my research topic on facilitation strategies. In order to make sense of the views and understanding of teachers on the facilitation process, I reviewed the literature defining facilitation, types of facilitation, purpose of facilitation, and historical perspectives on facilitation strategies. The Department of Education policy documents and guidelines were also reviewed to understand the facilitation process in the context of the NCS.

2.2 UNDERSTANDING OF FACILITATION

The term 'facilitation' means different things to different people. Facilitation is viewed by some people as a process of enabling groups to work cooperatively and effectively (Spangler, 2003). Spangler shows that it is important in circumstances where people of diverse backgrounds, interests and capabilities work together. According to Spangler, facilitation is generally considered to be a process in which a neutral person helps a group work together effectively. According to Cambourne (1990), facilitation in teaching and learning refers to the process whereby the teachers manage the teaching and learning. However, in line with changes in the meaning of teaching, more emphasis is on student activity. Kemshal-Bell (2001) and Cambourne (1990) also indicated the understanding of teacher as a facilitator during teaching and learning. Kemshal-Bell (2001) define facilitation as a pedagogical term that applies to student-centred approaches to teaching opposed to teacher-driven approaches, where the teacher moves from being expert to one of facilitation or vice versa.

2.3 THE BENEFITS OF FACILITATION

Benefits to using facilitation skills in group settings differ from one environment to the other within a cooperative structure. According to Spangler (2003), there are a number of benefits to using facilitation skills in group settings. Some of the benefits are: Group members are often more motivated to support the decisions made because of their investment in the process. The best efforts of the group usually produce better results than individual efforts. Increased participation within the group increases productivity. It is possible for managers and leaders to draw more on their staff as resources, which contributes to overall organizational success. Everyone involved has a chance to contribute and feels they are an integral part of the team. People realize and respect that responsibility for implementing decisions lies with everyone. Innovation and problem-solving skills are built. People are encouraged to think and act for the overall benefit of the group. Higher-quality decisions normally results. A forum for constructively resolving conflicts and clarifying misunderstandings is created. Negative attitudes, low morale, low involvement, and withholding of information are less likely because everyone is involved in a joint process.

According to Cambourne (1989), the benefits of facilitation in an educational context are: students take a full part in every learning activity, what is learned is useful and practical, students have the opportunity to fully utilize the knowledge and skills in enough time, and learning can be adjusted to consider the experience and resources previously sought by students. He further indicates that there is mutual understanding, both between students and teachers, and students with students (Cambourne, 1989).

2.4 TEACHER AS FACILITATOR

Cambourne (1990) suggested that the teacher as facilitator assesses the students; plans the learning; implements the plan; and evaluates the process. Kemshal-Bell (2001) suggests that when the teacher facilitates during the teaching and learning process, the following facilitation skills should be attained:

- engaging learners in the learning process, particularly at the beginning

- appropriate questioning, listening and feedback skills
- ability to provide directions and support to learners
- skills of managing discussions
- ability to build groups and teams
- capacity for relationship building
- motivational skills

Spangler (2003) suggested that all learners should be aware of, and agree with, the purpose of the lesson particularly at the beginning. The purpose should be worded clearly and simply, and should be visible at all times so that learners can be reminded of it if necessary. Spangler indicated that engaging learners in the learning process, particularly at the beginning, helps to keep learners' focus on the work at hand, and also helps the teacher to enforce timekeeping (Kemshal-Bell, 2001; Spangler, 2003). Kemshal-Bell and Spangler further indicates that all learners must know each other by names.

According to Spangler (2003), the facilitator should have strong verbal and analytical skills that can help to know what questions to ask, when to ask them, and how questions should be structured to get good answers without defensiveness. Spangler further indicates that the facilitators should know how to probe for more information when initial answers are not sufficient. The facilitators should have nonverbal techniques such as eye contact, attentiveness, facial expressions, body language, and enthusiasm to ensure that all learners participate during the lesson. They should develop the ability to read and analyze group dynamics on the spot in order to guide the groups towards expected learning outcomes (Spangler, 2003).

Kemshal-Bell (2001) shows that the facilitators should write sets of ground rules and ensures that all learners agree to them in order to manage discussions. For example: all ideas are valid, have your say, and listen to others; all learners are equal, and one meeting at a time. He further indicates that groups work better when individuals are made to feel comfortable when expressing their ideas. According to Spangler (2003), facilitators should encourage all learners to listen to what others are saying, and if the lesson is splintering into separate discussion groups, halt them politely and ask them to deal with one discussion at a time.

Kemshal-Bell and Spangler shows that during teaching and learning all learners should be involved and participating. The facilitator should watch out for signs that learners are not involved, and be aware of any learner keeping their head down or showing lack of engagement. During teaching and learning, the teacher should engage and encourage learners by asking them for their opinion and comments. According to Spangler (2003), the teacher should motivate and support the learning process.

2.5 THEORETICAL FRAMEWORK

The current education policy of South Africa requires learners to use their prior knowledge to construct new knowledge. In my study, cognitive and social constructivism will be the theoretical framework. Constructivism is a viewpoint of learning that maintains that, by reflecting on what they know, learners construct their own understanding of the world they live in. Constructivism helps learners to generate their own rules and mental judgments, which are used to make sense of their experience (Vygotsky, 1978). Learning is a process that enables learners to use what they know to accommodate the new experience.

Constructivism, a theory on how learning takes place, is used in South Africa. This theory focuses on how learners construct new knowledge. The role of the teacher is to facilitate the learning process in the classroom through helping learners to construct their knowledge. A constructivist perspective indicates a way of teaching in which learners' ideas are used to generate new understanding (Piaget, 1964, 2003; Hewson, Beeth and Thorley, 1998). In the next pages, I described the descriptors that a teacher uses when facilitating the learning process.

2.5.1. Descriptors of constructivist teaching

Brooks and Brooks (1993) use a set of descriptors of constructivist teaching behaviours that the constructivist teacher performs when facilitating teaching and learning. Some of the descriptors of constructivist teaching behaviours include using learners' prior knowledge, allowing learners' responses to drive lessons, encouraging and accepting

student autonomy and initiative, using physical experiences and concrete models to simplify the content, encouraging learners to engage in dialogue, both with the teacher and with one another, and asking thoughtful, open ended questions. In this study I used these descriptors to guide my observations.

The teacher uses learners' prior knowledge: According to Hewson *et al* (1998); Scott, Asoko, Driver & Emberton (1994) and Piaget (1964, 2003) a constructivist teacher consider learners' prior and existing ideas when planning and teaching a lesson. Scott *et al* (1994) and Piaget indicated that these considerations of learners' prior knowledge are important in the selection of teaching activities and strategies which are appropriate for promoting conceptual development and change. This is because science views are developed from learners' existing ideas. Scott *et al* (1994) indicated that the teacher should take into account the nature and status of student's existing ideas and understanding, and the nature of the intellectual 'demand' for the student in developing the science view from the existing understanding.

The teacher allows learners' responses to drive lessons: During the teaching process, learners' responses are taken into account to drive the lesson towards expected learning outcomes. Brooks and Brooks (1993) indicated that learners' knowledge, experience and interest helps during teaching and learning. Carr, Barker, Bell, Biddulph, Jones, Kirkwood, Paerson and Symington (1994) show that the teacher should take into account and interact with the ideas that learners bring to a lesson about their world, so that by the end of the lesson learners can assimilate and construct new ideas about the expected goals.

The teacher encourages and accepts student autonomy and initiative: According to Brooks and Brooks (1993), learners who are able to develop the questions and issues and go about answering and analyzing them take responsibility for their own learning. Therefore, a constructivist teacher should motivate learners to realise that their inputs are appreciated and learners provide a sense of ownership of the science they are learning. The teacher facilitates the lesson, designs well structured, sequential tasks and activities so that learners are able to see how their ideas develop slowly into scientific ideas (Hewson *et al.*, 1998; Scott *et al.*, 1994; Piaget, 1964, 2003).

The teacher uses physical experiences and concrete models to simplify the content: The constructivist perspective on learning indicates that learners interact with and interpret the world through their own understanding of the situation (Hewson *et al.*, 1998, Vygotsky, 1998). This means that, during learning, learners organize knowledge from their physical experiences and ideas, and relate it to world experiences (Vygotsky, 1978; Von Glaserfeld, 1989). The teacher should bring relevant concrete models to simplify information for the learners. The teacher should establish a classroom environment that provides opportunities for students to explore their own ideas using the physical experiences and concrete models.

The teacher encourages learners to engage in dialogue, both with the teacher and with one another: Brooks and Brooks (1993) indicated that social discourse is a powerful tool in learning, and gives learners the opportunity to present their own ideas. The teacher should decide on the suitable context that will suit learners during learning, and allow group work to occur, while monitoring the teaching and learning (Scott *et al.*, 1994). During this process the teacher will draw new insights from students' ideas and link them with their experience and teaching goals. The new insights should include out-of-school experience that forms part of the teaching and learning (Scott *et al.*, 1994). According to Piaget (1964, 2003), the activities that the teacher must prepare should allow learners to understand them and enable each individual to make his/her own ideas. The activities should be concerned with the pedagogical issue of motivation. These activities should help learners to make links between their thinking and the science views; and also allow them to explore their ideas (Piaget, 1964, 2003; Scott *et al.*, 1994).

The teacher asks learners thoughtful, open-ended questions: The questions that the teacher asks should give learners the opportunity to think (Brooks and Brooks, 1993). In a constructivist perspective, the teacher uses open-ended questions to identify and recognise the misconceptions in the child and see how these misconceptions can help the child in his learning. The teacher also uses questions to guide the learners and encourages them to collaborate with their peers (Vygotsky, 1978; Wertsch, 1984; Wertsch, 1985). The teacher promotes discussions and activities that enable the students to interact on their own using learners' thoughtful, open ended questions.

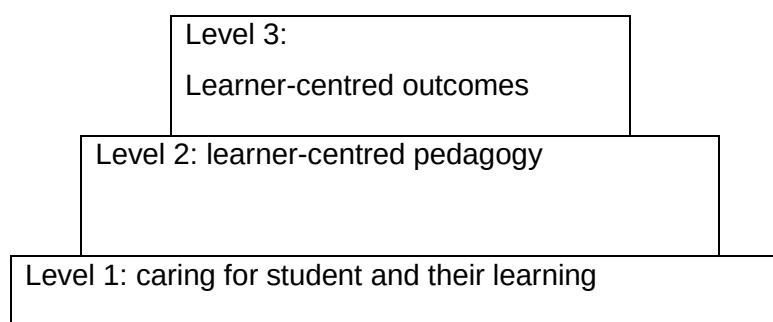
In conclusion, Bennett (2003, 34) summarises key findings on how learners construct knowledge when a teacher facilitates a learning process.

- children construct their own explanations for scientific phenomena and these explanations may differ from the accepted scientific explanations
- learning involves the reconstruction of existing ideas not just accumulation of new views
- the ideas and explanations that children construct tend to persist even after formal instructions because they make sense in terms of everyday observation and experience whereas the accepted scientific ideas are often counter-intuitive
- there is general knowledge that teaching strategies should begin by eliciting childrens' existing ideas and then presenting children with situations which they are thinking
- there is less agreement on how to introduce accepted scientific ideas. There is little firm evidence on effectiveness of particular teaching strategies developed within constructivist framework over others.

2.5.2 Levels of learner-centredness

This is one of the frameworks that other researchers have used to check the levels of learner-centredness in the classroom, but in this research report it was not followed. According to Keane and Malcolm (2002), constructivism is applicable in learner-centredness teaching and learning. Keane and Malcolm define three levels of learner-centredness, which includes caring for the student, learner centred pedagogy and learner- centred outcomes.

Table 1: Levels of learner-centredness



The three levels of learner-centredness describe the way in which learners are involved in the teaching and learning process. According to Keane and Malcolm (2002), the first level of learner-centredness means knowing what learners know, their interest, concerns, educational purposes, and their wish to learn. The second level shows the teaching and learning that caters for individual learning styles. This includes the teaching methods, assessment, contexts and examples that suit background and learning styles of learners, and that build on learners' existing knowledge and skills. The last level shows the teaching and learning process that allow learners to influence what is learned through their interpretation, learned from their society and culture, and what they have experienced and understand. This means that during the learning process, content is shaped by learners and their cultures (Keane and Malcolm, 2002). The teachers apply different facilitation strategies in these levels of learner-centredness.

2.6 LITERATURE REVIEW

There are several research reports that have been done on the National Curriculum Statement in South Africa that show how the teacher facilitates learner-centred teaching and learning. Some reports show the teachers' understanding of learner-centred teaching and learning, while others show the teachers' practices of learner-centred teaching and learning.

2.6.1. Learner- centred teaching and learning

In this section, research about teachers' understanding and practices of learner-centred teaching and learning were reported.

2.6.1.1. The teachers' understanding of learner-centred teaching and learning

Teachers have different understandings of learner-centred teaching and learning in the classroom. Learner-centred teaching and learning is a major paradigm shift in teaching that was discussed a few years back, where teaching has to be learner-centred, not teacher-centred. The focus of teaching and learning has shifted to the constructive role of the learner, which differs from a teacher-centred model in which knowledge is

transmitted from teacher to learner. Brandes and Ginnis (1986, cited in Ching, Murphy and Jenkins, 2002. 463) identify seven principles for a learner-centred learning approach. Brandes and Ginnis show that learners should have full responsibility for their own learning. The subject matter should be relevant and meaningful for the learner. During teaching and learning, involvement and participation are necessary for learning, and the relationship between learners should show helping styles and learner self-responsibility (Brandes and Ginnis, 1986). The teacher is a facilitator and resource person, while the learner sees himself differently as a result of the learning experience because their learner experience is important. According to Brandes and Ginnis, the learners' experience and needs are valued, and balanced emphasis is based on cognitive understanding and effectiveness in the learning process.

Ching, Murphy and Jenkins (2002) suggest some generic principles for learner-centred practice. The principles are categories as sets of 'Rs' –Responsibility, Relevance and Rewards. Ching *et al* explain these principles and outline the several components that should be involved in implementing a learner-centred perspective, which include: learner's ability, resources and opportunities for access to learning; and the choice in course content and process. They also indicate that there should be relationship between theory and practical. Immediate practical problems should be solved between one's own experience and knowledge and that of others, and the diversity in individual preferences in learning styles and needs should be shown (Ching, Murphy and Jenkins, 2002).

O'Neill and McMahon (2005) investigated the understanding of the meaning of student-centred learning by students and lecturers as facilitators in the classroom. The research report shows that pupils describe teacher-centred learning strategies as the focus on the teacher transmitting knowledge, from the expert to the novice. In contrast, they describe student-centred learning as focusing on the students' learning and 'what students do to achieve this, rather than what the teacher does'. According to O'Neill and McMahon student-centred learning involves the followings:

- 'the reliance on active rather than passive learning,
- an emphasis on deep learning and understanding,
- increased responsibility and accountability on the part of the student,
- an increased sense of autonomy in the learner

- an interdependence between teacher and learner,
- mutual respect within the learner teacher relationship,
- and a reflexive approach to the teaching and learning process on the part of both teacher and learner.

Wohlfarth, Sheras, Bennett, Simon, Pimentel, Laura & Gabel (2008), surveyed the perceptions of graduate students in learner-centered classrooms of their experiences in relation to the key dimensions of the learner-centered paradigm. They discovered that the approach contributed to their feeling respected as learners, developed their critical thinking skills, and encouraged their self-directedness. Wohlfarth *et al* indicated that the learner-centered paradigm departs from traditional teaching models by focusing on students more than teachers and learning more than teaching.

2.6.1.2. Teachers' practices of learner-centred teaching and learning

There is an attempt to implement learner-centred teaching and learning in the classroom by teachers.

Brodie, Lelliott and Davis (2002) examined the ways in which teachers, enrolled in an in-service programme in South Africa, have taken up learner-centred practices. They introduce the notions of form and substance in learner-centred teaching i.e. use of strategic questioning, groupwork and student mobility where a teacher draw out ideas of the student, and describe how these are developed in the learning programme. Their analysis of the teachers' practices reveals that teachers take up learner-centred practices in different ways i.e. in some secondary schools, teacher-centred practice in the classroom remained robust but with a small element of learner-centred practices e.g. students move freely to work in activity centres; use learners' prior knowledge to drive the lessons; use of initiation-response-feedback to enable learner participation. They also discovered that some teachers do not implement learner-centred approaches (Brodie *et al.*, 2002).

An investigation of possible resistance to curricular reform in four rural schools revealed that teachers continue to use old approaches to teaching and learning (Cooper, 2007). This is where a teacher continues to provide learners with knowledge and skills. The teacher does allow learners to participate during the lesson, but does not use learners'

prior knowledge to achieve lessons' outcomes and activity to promote groupwork. Cooper found that the schools are struggling to cope with the new curriculum that require the use of learners' prior knowledge and experience, groupwork, discussions, and active-learner participation; and teachers are applying the old method of teaching and learning (teacher-centred approach of teaching and learning).

Schreuder (1998) and Pillay (1998) investigated the science teacher educator's shift towards teaching and learning approaches which are learner-centred, where the teacher uses different facilitation strategies such as use of learners' prior knowledge and experiences, asking thoughtful, open ended questions, allowing learners responses to drive the lessons, encouraging learners to engage in a dialogue, and allowing classroom interaction to enhance learning. They discovered that some science teacher educators had made appropriate changes and were using strategies such as learners' prior knowledge and experiences to drive the lessons; and asking thoughtful, open ended questions to facilitate a learner-centred approach to teaching and learning. The results also show that other teachers are continuing in a traditional teacher-centred approach to teaching and learning.

In Hong Kong, Ching, Murphy and Jenkins investigated the part-time postgraduate student teacher's role in supporting a learner-centred learning environment (Ching, Murphy and Jenkins, 2002). The investigation was able to reveal both key differences between and key similarities among the groups of student teachers. The differences relate to conceptions of the roles and responsibilities of both learners and teachers, while the similarities relate to the relationships between the parties in the teaching and learning environment. Some of the student teachers were able to use groupwork and activities without taking learners' experience into consideration to allow learners participation while others were using learners' prior knowledge and experiences to drive the lessons; and asking thoughtful, open ended questions to enable learners to be involved in their learning without groupwork and activities. The study shows that it is a challenging task to influence learners' learning conceptions and help them take a more active role in their learning.

Rogan (2007) examined and analyzed how science teachers in one rural school responded to the demands of new curriculum. He considered the capacity of the school

and the extent to which outside support and pressure was provided. The levels of implementation were analyzed in terms of the 'zone of feasible innovation'. The results of this report shows that time management and planning by the teacher was a problem, learners' answer questions and continue copying notes, the understanding of OBE was that learners work in groups and discuss their knowledge about a particular topic, teacher must not teach but facilitate, and the understanding of OBE implementation was seen as a change of teaching style and not achievement of outcomes.

Kriek and Basson (2008) investigated the teacher perceptions on the implementation of the new FET Physical sciences curriculum. The data showed that even though the teachers generally held positive views about facilitating FET physical science curriculum, they had concerns about the content overload, the ability to teach it, the availability of resources and the level of support they were given as well as the quality of training which they received.

Liu, Qiao & Liu (2004) under the title, 'the paradigm shift of learner-centered teaching style', investigated the teaching style of instructors in a southwestern university using factors to assess participants' teaching styles such as learner-centered activities, personalizing instruction, relating to experience, assessing student needs, climate building, participation in the learning process, and flexibility for personal development. Results show that most instructors still use traditional, teacher-centered styles in university settings despite the call for a paradigm shift to learner-centered ones. Among the seven factors, personalizing instruction and flexibility for personal development are the least practiced by university instructors.

Barraket (2005) attempted to enhance student learning through the introduction of student-centred teaching methods in a masters-level social research methods subject. The introduction of a range of specific techniques, including case study teaching, problem based learning, groupwork, role-play and simulation, was reflected upon. The report concludes that the re-orientation of the curriculum toward student-centredness in this case had a positive effect on student performance, learning experience and subject evaluation. In particular, the use of student-centred technique enables learners to work together, and provided them with a common experiential framework from which to explore the technical aspects of the curriculum. However, the analysis also found that

students continued to place value on more formal teaching methods, and that the value of student-centred techniques in this case rested in the way in which they were integrated with more didactic teaching practices.

2.6.2. Inadequate training of teachers

Some studies show that the training that was done in preparation of teachers on outcomes-based education was not adequate.

A review of the literature over the past decade on teaching and learning approaches in South Africa classrooms indicated that some teachers are not well informed of which teaching and learning approaches they are to apply in a learner-centred classroom (Lelliott, Mwakapenda, Doidge, Du Plessis, Mhlolo, Msimanga, Mundalamo, Nakedi and Bowie, 2009). This results in teachers applying the old method of teaching and learning which is teacher-centred.

Stoffels (2005) identified why teachers continue to use the teacher-centred approach in the classroom by exploring teachers' decision-making frames in the context of curriculum change in South Africa. He wanted to find out if teachers are applying teacher-centred approaches (the South African post-apartheid curriculum) in the context of the new outcomes-based curriculum. He discovered that teachers are failing to comply with the new curriculum due to lack of proper training for the new curriculum. This causes teachers to resist using the new approaches that allow learners to be responsible and involved in their learning i.e. use of learners' prior knowledge and experiences, asking thoughtful, open ended questions, allowing learners responses to drive the lessons, encouraging learners to engage in a dialogue, and allowing classroom interaction to enhance learning, because they are more informed of the old method of teaching. There is clearly a need for adequate training of educators in the use of learner-centred approaches to teaching and learning.

Stoffels (2008) investigated teacher decision-making in the context of curriculum change in South Africa. He found that not all teachers respond to curriculum change in the same way. The decisions teachers made were shaped by the use of new outcomes-based learning support material, the directives from the local education department, and available resources. The report further shows that there was a deafening silence from

the education department and the training manual on how teachers should adapt their decision-making.

Scholtz, Watson and Amosun (2004) explore how teachers' pedagogic practices changed in response to a curriculum innovation and why they changed in the ways that they did. The teachers were exposed to a training programme designed to develop science process skills in school pupils. The report explores the educational setting of each teacher in order to identify physical and social factors affecting the ways in which teacher' pedagogy changed. The needs of each teacher were influenced by their educational setting, which in turn influenced the level of engagement in the training programme and the way they adapted pedagogic strategies to their particular circumstances.

2.7 CONCLUSION

This chapter covered the theoretical framework and literature that was relevant to my research topic on facilitation strategies. In making sense of the views and understanding of teachers on the facilitation process, I reviewed the literature defining facilitation, types of facilitation and purpose of facilitation. In the next chapter I present the design of the study.

CHAPTER 3: RESEARCH, DESIGN AND METHODOLOGY

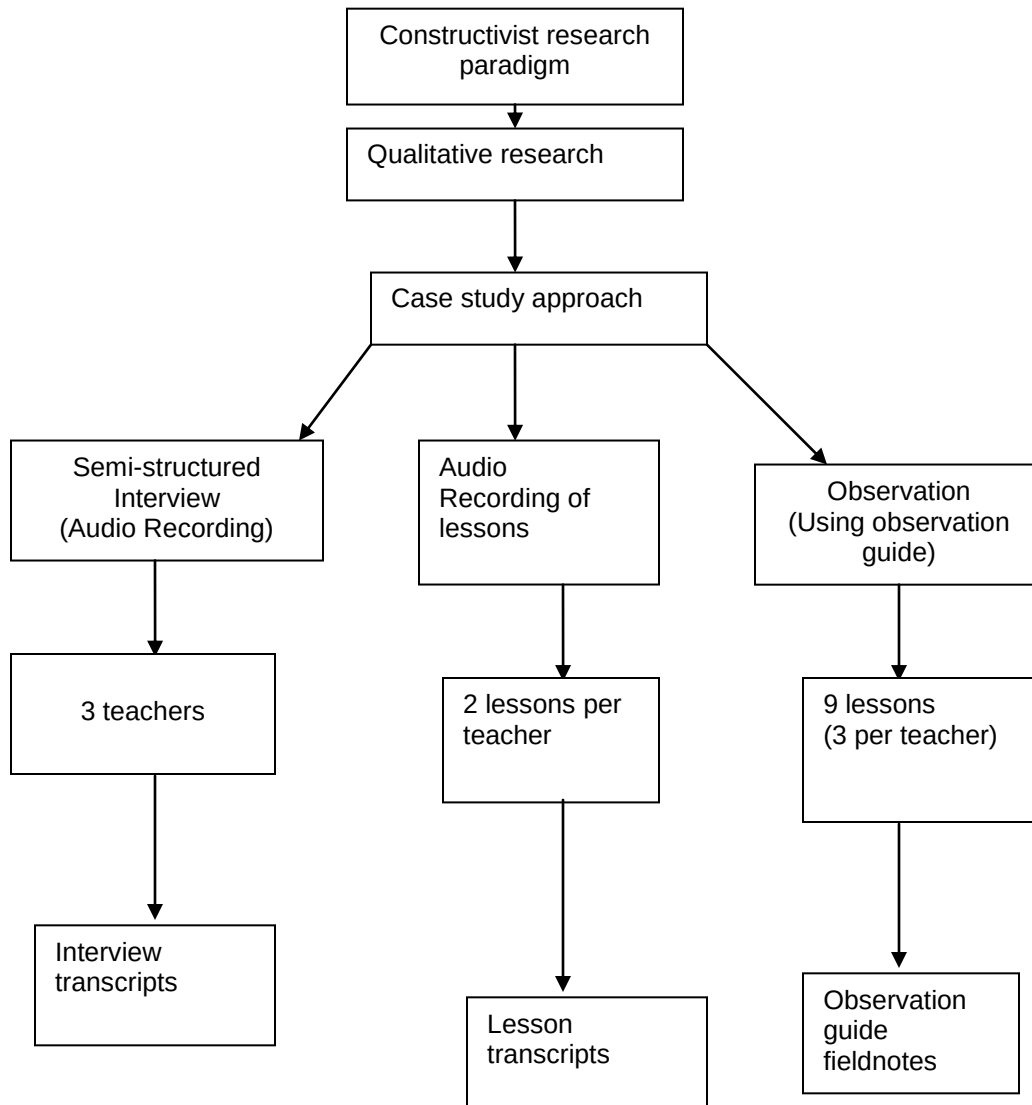
3.1 INTRODUCTION

A suitable research design had to be adopted to investigate the facilitation strategies that the three FET life science educators implement during teaching and learning. Hence here I have described the research methodology which was used in this study. The research procedures and the sample and how it was chosen were discussed as well as a mention of how data was collected and analyzed.

3.2 RESEARCH METHODOLOGY

During the research process one needs to think of the type of information and the method and procedure to collect the information. A research methodology describes procedures used in conducting the study and provides insight on how the collected data should be analysed and possible limitations in interpreting the results of the study. The figure on the next page outlines the research paradigm, methodology, methods and research instruments that were used to collect and analyse data in this study.

Table 2: Flowchart of the research methodology for the study



3.3 RESEARCH PARADIGM

According to Hatch (2002), a paradigm refers to a set of beliefs about the nature of knowledge that guides researcher's actions when conducting the study and helps a researcher to make sense of the data collected. Hatch shows that a research paradigm is defined by answers to questions about knowledge (epistemology); nature of reality (ontology); how knowledge about that reality is solicited (methodology); and the forms of knowledge produced. He describes the five research paradigms as positivist; post positivist; constructivist; critical or feminist; and poststructuralist paradigm. This study was developed within a constructivist research paradigm which operates with reference to ontology, epistemology, methodology and the product. The theory of constructivism asserts that knowledge is constructed by individuals (Hatch, 2002).

3.4 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). In this study, I collected data in the form of field notes during the classroom observations and recorded the way the teacher presents the lesson when attempting to implement facilitation strategies in learner-centred learning. Interviews were conducted, transcribed and analyzed to find out the teachers' understanding of their facilitation strategies during their lessons.

3.5 CASE STUDY METHODOLOGY

The study was a qualitative case study of three teachers at the same school using semi-structured interviews and classroom observations. According to Opie (2004, p. 74), a case study may be viewed as an 'in-depth study of interactions in a single instance in an enclosed system'. In my research, each teacher was observed in the classroom, their lessons were recorded and they were interviewed as part of the data collection. A case study provided a picture of certain features of social activity in a classroom and the

factors influencing the situation (Opie, 2004; Denscombe, 2007). The research covered real things happening in the classroom, use of prior knowledge, physical experiences and biological models by the teacher, classroom arrangement and engaging learners in dialogue through open-ended questions. The choice of case study allows me to focus on a number of interactions between the teacher as a facilitator; and the learner and the subject matter.

In order to investigate the facilitation strategies that the three FET Life Science educators were implementing during teaching and learning, I visited the different classes wherein an enquiry was carried out in order to understand and observe what is happening in the classroom (Bassey, 2003). I was not intending to change a situation, only striving to understand the situation for three secondary school teachers in one school only.

Yin in Soy (1997: 1) defines a case study as “an empirical inquiry that investigates a contemporary phenomenon within its real life context...” Stake (2006: 2) indicates that “qualitative studies were developed to study the experience of real cases operating in real situations”. This indicates that in a case study whatever is to be investigated in the environment wherein a case is found, its context is not changed or manipulated to suit the researcher but it is studied in its real situation. Hitchcock and Hughes (1995) hold the same view. This also indicates that the case to be studied can be a single person or single group which has a common purpose. This made sense and strengthened the conviction that this study had to be embedded in the case study methodology in that I wanted to find out the facilitation strategies that the teachers in a nearby secondary school are using during teaching and learning. Hitchcock and Hughes (1995: 316) also indicated that “...case study is in many ways the most appropriate format and orientation for school-based research”.

The study was a descriptive case study. Hitchcock and Hughes (1995: 321) indicate that “descriptive case studies have aimed at giving a narrative account of life as it is in a social situation”. The choice of the research methodology was also influenced as Opie (2004) indicates; by what can actually be done, what were practical, situational factors and interests. Within the context of the Masters programme, I am expected to complete the research in 6 months and as I was only doing the research on a part-time basis I had

limited time to gather the data. Hence it was practical and feasible to adopt the case study methodology.

However the familiar problem as indicated by Bassey (2003) is the generalization from the findings of the case study. My findings cannot be generalized to teachers in South Africa, because only three educators are involved in the data collection. Bassey (2003: 36) however indicates that “one of the advantages cited for case study research is its uniqueness, its capacity for understanding complexity in particular contexts”. This advantage is paramount to my study hence it weighs far more than the necessity of generalizing from the study. Inferences and recommendations will be made from the study which might have a bearing on the general understanding of how some teachers facilitate learning within the context of the NCS.

3.6 SAMPLING

A sample is a group of people from whom research information is collected (McMillan & Schumacher, 2006). Sampling, a process of selecting a group of people from a large population to provide research information, can be done in different ways. For this study a convenience sample was used. The sampling participants were chosen because of their availability to the researcher (McMillan & Schumacher, 2006). I chose convenience sampling because this is a small scale study and time for data collection was limited hence accessibility of participants was an essential factor. Data was collected in a two month period. The qualifications of teachers were different but they have all attended National Curriculum Statement training and workshops, and use the same resources. Therefore, drawing from one school enabled me to check how the National Curriculum Statement training and the resources available to them influenced their use of constructivist approaches in teaching and learning.

3.6.1 Pilot sample

I drew my pilot sample from one high school within Gauteng province in Johannesburg East. My pilot sample was a Life Science teacher from a different high school to the school used in my study. Although the teacher came from another school, she had a qualification that was similar to the main sample of my study and also attended the

National Curriculum Statement training. She had Secondary Teachers' Diploma obtained from a college of education, and an Advance Certificate in Education from a university institution. The selection of the pilot sample was for convenience. During piloting, three lessons were observed using an observation schedule and an interview was conducted. The pilot study helped me to validate the instruments and to estimate the duration of interviews which was important when booking appointments with the teachers.

3.6.2 Main sample

The sample consisted of three teachers and three FET classes from one high school within a township in Johannesburg. The three teachers have the required South African teaching qualification and have attended the National Curriculum Statement (NCS) course. The teachers that are involved in this study teach different grades in the same school. The table below outlines the teachers' profiles and the classes they were teaching during this study.

Table 3: Teachers' profiles during data collection

Name of teacher (pseudonym)	Class they teach (Grade)	Qualification	Experience (Years of teaching)	NCS Training
Jack (Mr)	12 and 11	STD, ACE	13	Attended
Collen (Mrs)	11 and 10	STD, ACE	11	Attended
Phillips (Mr)	11 and 10	STD, ACE & B Sc Honours in Science Education	9	Attended

Note: STD stands for Secondary Teachers' Diploma, and ACE stands for Advanced Certificate in Education.

3.7 THE SCHOOL CONTEXT

In this school, the learners stay put in their classes for the whole day while teachers rotate. The classroom ownership by learners was applicable to this school because the school has more learners and estimated minimum of 46 learners in each class. The grade 12 classes were situated next to the laboratory to ensure that they could easily use the laboratory without disturbing lessons. The school laboratory was well resourced and all grade 12 classes (mathematics and physical science classes) were conducted in the laboratory. All learners in this school have textbooks. The three teachers were also teaching other grades i.e. grade 12 and grade 10, and not only grade 11. I found it challenging and interesting, and negotiated for another visit to come and observe other lessons in other grades that the three teachers teach. As a result, I further observed two lessons each in grade 12 and 10 respectively.

3.8 RESEARCH METHODS

3.8.1 Lesson observations

According to Opie, (2004) and Denscombe (2007), observations as a research strategy in data gathering rely on what the researcher sees and how the researcher records the information. Classroom observation was selected as the principal method of collecting the data in my research. Classroom observation provides the researcher with first-hand information as opposed to reports given by participants (Opie, 2004; Denscombe, 2007), and enabled me to analyse the classroom interactions.

I observed 3 lessons from each teacher, i.e. a total of 9 lessons and audio recorded 2 lessons per teacher. This was followed by structured interviews. The teachers decided on number of lessons to be recorded and to be observed. The aim of the classroom research is to study, through direct observations and recording, the processes of learning and teaching which will take place inside the classroom (systematic observation). Systematic observation is a process whereby the observer will devise a set of rules for recording the classroom events. I constructed an observation guide for recording instances of facilitation by the teacher. The observation guide helped me record teachers' verbal interactions in lessons, management, and cognitive and social processes (Mbanjo, 2002; Opie, 2004 and Denscombe 2007).

The observation guide enables me to investigate teacher-pupil interactions. In teacher-pupil interaction activities such as introduction, lesson development, and feedback mechanisms, the teacher's roles during learning, content and class management were observed. Other things that the teacher was doing in the classroom such as accepting learners' feelings, praises, using ideas from learners, asking questions, and giving directions formed a major part of the data which was collected. I also checked if the lesson was sequential and based on mastery of content or social information. Teaching strategies that the teacher was applying during teaching and learning were observed to check if the strategy is learner-centred or teacher-centred.

Systematic observation was used in this research, to find out the facilitating strategies that the three FET life science educators implement during teaching and learning. Systematic observation was useful to this study because it allows me to code the same events in the same way and is easy to use (Mbano, 2002; Opie, 2004; Denscombe, 2007). I made a critical analysis of my observation guide in order to select what is to be observed and be made explicit through the pre-specification of how the data is going to be collected and classified. Systematic observation allowed me as the observer to directly record what learners were doing in the classroom (Opie, 2004; Denscombe, 2007). Lastly, systematic observation was efficient in this study because it provide a means for collecting substantial amounts of data in a relatively short time span (Opie, 2004; Denscombe, 2007).

Systematic observation has a number of limitations. The fact that data collection was based on what the teacher was doing, makes it impossible for the researcher to take account of underlying factors like 'intention of interaction' (Opie, 2004; Denscombe, 2007), and the observation guide tends to miss contextual information which has a bearing on the behaviours recorded. Systematic observation is not a holistic approach. Sometimes people, consciously or unconsciously, may change the way they behave when being observed; and this may have an effect on the interpretation of findings. To overcome these constraints, teachers were not told the focus of observations. The contextual information and observation of interactions that do not fall under the specified categories were taken into account and recorded in the field notes. To ensure the accuracy of recording and reduce observer bias, an effort was made to write down as

much information on each theme as possible in an attempt to collect adequate information.

3.8.2 Interviews

An interview is a data collection strategy that involves the interchange of views between the researcher and the respondent (Opie, 2004) and allows researchers to explore views of respondents on issues. Interviews enable participants to express their opinion on situations. According to Breakwell (1995) and Opie (2004), the interview is used due to its ability to enable researchers to collect in-depth data from respondents. In this study, interviews enabled me to get teachers' understanding of facilitation strategies that can be used when implementing learner-centred teaching in the classroom.

There are different types of interviews. Interviews can be structured, semi-structured and unstructured (Opie, 2004). The structured interview has a predetermined agenda, is controlled by the interviewer and has less flexibility; the unstructured interview has unpredictable direction, is very flexible and open-ended while semi-structured interview is less controlled, more flexible and not completely predetermined by the interviewer (Opie, 2004).

In this research, semi-structured interviews were conducted with each of the three teachers in the study individually and in a place free of disturbances for confidentiality purposes. During the interview, the teacher's own ideas, feelings, insights, attitude and expectations about facilitation was obtained. According to Opie (2004), 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 progresses. An interview schedule was organized to guide the process of the interview (refer appendix 2 interview schedule).

The interview schedule consisted of a list of questions that were asked during the interview to ensure that the interview attained its intended purpose. The interview covered some of the issues from classroom observations that may need to be probed further. According to Opie (2004), interviews have limitations. Opie shows that flexibility in the interview schedule can bring in researcher bias if the researcher tries to probe

respondents in a way that would push them to provide responses expected by the researcher. In my research, I attempted to avoid such bias.

3. 9 RESEARCH INSTRUMENT

3.9.1 Observation guide

Several stages in preparing for and carrying out systematic observation were considered such as preparing the observation guide and piloting. The observation guide was planned carefully and thoughtfully to ensure that it caters for what it is supposed to measure i.e. teachers' facilitation of learners' ideas, dialogue and learners' arrangement and involvement (appendix E). The table below shows the categories used in the observation guide and the justification for each category.

Table 4: Observation guide and its justification

CATEGORIES	JUSTIFICATION
1.1. Using learners' prior knowledge	Teacher considers learners' prior and existing knowledge that enables them construct their understanding (Scott <i>et al.</i> , 1994; Hewson <i>et al.</i> , 1998)
1.2 Asking thoughtful, open-ended questions	Teacher asks learners questions that give them the opportunity to think (Brooks and Brooks, 1993)
1.3 Allowing learners' responses to drive lessons	Learners' knowledge, experience and interest help them to understand the content (Brooks and Brooks, 1993).
1.4 Encouraging learners to engage in dialogue, both with the teacher and with one another	Gives learners the opportunity to present their own ideas (Brooks and Brooks, 1993)
1.5 Teacher uses physical experiences and concrete models to simplify the content:	to create classroom environment that provides opportunities for learners to explore their own ideas (Vygotsky, 1978; Von Glaserfeld, 1989)
1.6. Learner arrangement and other contextual factors	Reasonable number of Learners (35) arranged in groups

According to Opie (2004) and Denscombe (2007), piloting of the observation guide helps to eliminate confusion and ensures that it covers the appropriate behaviours. One teacher participated in the pilot study. I observed three lessons during piloting. Piloting helped me to check if the observation guide would allow me to gather as much information as required; in the particular time of the lesson. (The person who was involved in the piloting of the observation guide was a colleague of mine who was willing to take part in my research).

3.9.2 Interview schedule

An interview schedule was used to guide the interview. According to Opie (2004), an interview schedule is a list of questions that are asked during an interview to ensure that the interview achieves its intended purpose (appendix D). The table below shows the questions that were asked during the interview and their justification.

Table 5: Interview schedule and its justification

QUESTIONS	JUSTIFICATION
1. What is your understanding of facilitation in teaching?	To enable the teacher to explain the concept of facilitation in the classroom situation
2. Which facilitation strategies do you use in your classroom?	To find out the facilitation strategies that the teacher uses during teaching and learning
3. What is your role as facilitator in the classroom?	To find out if the teacher knows the function of a facilitator in the classroom
4. Do you think facilitation is 'easy' or 'difficult' to apply in the classroom practice?	To get the teacher's feelings about teachers being the facilitators in the NCS
4.1 (if easy or difficult) please explain why it's easy/ difficult to apply.	To support the idea
5. Which of the teaching and learning approaches do you prefer when teaching? i.e question and answer, group work etc	To find the approaches that allow teachers to facilitate the lesson
6. Do you use learners' prior knowledge to enhance teaching and learning?	To find out teachers use prior knowledge to enable learners to construct new knowledge
7. What type of questions do you prefer to ask learners during the lesson (closed or opened)?	To find out which questions the teacher uses to enable learners to think.
8. During the lesson, do you encourage learners to engage in dialogue, both with you (the teacher) and with one another?	To find out if teachers give learners the opportunity to present their own ideas

Several stages in preparing for and carrying out the structured interview were considered such as preparing the schedule, piloting, and selecting the respondents (Opie, 2004). When constructing the interview schedule, I considered the research questions that need to be answered during the interview; clarity and sensitivity of the questions; the order of questions and the possible duration of the interview as these have a bearing on the success of interviews. I included issues from classroom observations in the interview schedule that needed to be probed further as the interviews were done after observing all planned lessons for each teacher. Interviews were recorded using a digital audio-recorder.

Piloting of interview schedule

Piloting of the interview schedule helped me to check the length of time of the interview process. According to Opie (2004), the piloting of interview questions eliminates confusion, and ensures that questions are not ambiguous. The teacher who was observed was also interviewed in a pilot study.

3.9.3 Audio-recording of the interview

The three teachers in the main sample were interviewed at their schools after I had observed their lessons in Life science. In each case, a quiet place was used for the interview for confidentiality purpose as well as to prevent noise during the recording process. The interview duration was for 20 minutes. In addition to the questions on the interview schedule, follow-up questions were used to clarify certain matters from their answers. An assurance was made to the teacher that no record of names of the teachers and the school would be kept and that tapes and transcripts would be kept confidential (while being used in order to get rid of their fears).

The interview was recorded using a digital audio-recorder. The audio-recording was of advantage in my research. According to Opie (2004), recorded interviews preserve the natural language and the data collected becomes more objective. The audio recording can also record the interviewer's contribution and the data can be re-analysed later to ensure that the information collected is valid and reliable.

The audio-recorded data was transcribed so that I could analyze the information in the transcripts. Audio recordings also have some limitations. Too much data collected can take more time to transcribe and irrelevant information can divert attention away from the actual information which was supposed to have been collected, analysed and interpreted (Opie, 2004). According to Opie, the audio-recording cannot also show facial expressions as compared to video-recording. The audio-recorder was of advantage over the video-recorder because emotions and movements of the speaker won't influence my results.

3.10 DATA ANALYSIS USING THE INTERPRETIVE MODEL

Interpretation is about giving meaning to data and making sense of social situations by generating explanations for what is going on within them (Hatch, 2002). The interpretive model of analyzing data was of advantage because it is about making inferences, developing insights, attaching significance, refining understandings, drawing conclusions, and extrapolating lessons (Hatch, 2002). Interpretation situates a researcher as an active player in the research process. I undertook interpretation because it is a "productive process that sets forth the multiple meanings of an event, object, experience, or text" and researchers construct interpretations. The model that I have proposed here provides tools for linking interpretations to data; but finally, according to Hatch (2002), they are the researchers' best efforts to produce meaning that makes sense of the social phenomena they are studying (Hatch, 2002).

In this study, I started data analysis with predetermined categories in order to save time and to be more efficient as suggested by Hatch (2002). However, I also created new categories from the data to accommodate important information left out by the initial categories in line with suggestions from Hatch (2002). Therefore, I went through my data several times to ensure that I captured as much information from it as possible according to the categories and codes developed (Hitchcock & Hughes, 1995; Hatch, 2002).

3.11 VALIDITY AND RELIABILITY

When doing educational research, issues of validity and reliability need to be considered. For example, Opie (2004) defines validity as the degree to which a method, test or research tool actually measures what it is supposed to measure and reliability is defined as the extent to which the research instruments could produce similar results in a constant setting and validity as the degree to which the research instruments measure what they are intended to measure (Scaife, 2004).

According to Golafshani (2003), in qualitative research validity and reliability are understood in terms of trustworthiness, rigour and quality. Scaife (2004) explains trustworthiness of a case study research in terms of credibility. According to Scaife, credibility in a case study research is achieved through thoroughness in explaining the data-gathering procedures and how data have been analysed; reporting all instances in the research process including negative aspects; acknowledging biases; supporting claims with evidence; separating the researcher's own data from that obtained from other people and distinguishing interpretation from description. To ensure validity and reliability, several stages in preparing for and conducting the observation and structured interview was considered such as preparing the observation guide and interview schedule, piloting, and selecting the case study respondents.

Internal and respondent validity

The internal validity of the research data capturing tools needs to be checked (Scaife, 2004) and this was done by the supervisor. I did not attempt to generalize my results to a wider population of teachers; since the scale of my study is small. I do not aim to ensure external validity. Respondent validity was ensured by returning the interview transcripts to the selected teachers so that these teachers can check whether their responses accurately represent what they intended to say. According to Griffiths (1998), respondent validity can be ensured by taking the data and its analysis back to the subjects so that they can add or subtract their understanding. In an attempt to improve reliability of the results, the data collected from three classes that were taught by three different teachers were used.

Piloting instruments

The lesson observation guide and the interview schedule were piloted before using them in collecting data. After piloting, the instruments were modified as they seemed to cover a small portion of the research. The “contextual factors” were included to be part of the observation guide, and some of the interview questions were changed (i.e. question 6-8).

Triangulation

According to Golafshani (2003) and Scaife (2004), use of multiple procedures to collect data helps to address validity through triangulation. In this study, data was collected through observation of lessons, audio-recording and interviews with teachers. Triangulation helps me see the same issues from different perspectives and the methods.

3.12 ETHICS

Ethics is a set of principles that people use to decide what is wrong and what is right. According to Sike (2004), research ethics deals with the application of moral principles to avoid harming and affecting other people’s life in the process of doing research. This research was a qualitative research and tends to be more intrusive in personal lives than quantitative research. The ethics of doing the research was considered by honouring the three aspects of conducting the research in schools, as given by Setati (2005), which are: negotiating access, providing feedback and exploring the nature of teachers’ involvement in the study. Ethical guidelines regarding issues such as informed consents; confidentiality; anonymity; and privacy were adhered to (McMillan & Schumacher, 2006) (refer to appendix A to C).

Application for approval of the research to be conducted was done with the University of Witwatersrand ethics committee and Gauteng Department of Education. The University of Witwatersrand ethics guidelines requires that participants be informed about the nature of the research, consent forms be signed by participants before data collection commences and permission from organisations where the participants work should be obtained. Research only commenced after I obtained approval from the designated ethics committee of the University of Witwatersrand (appendix L).

Access was negotiated by sending request letters to the Gauteng Department of Education and to the principal of the school that was involved in the research (appendix M). A meeting was held with the three life science educators to inform them about the research and to invite them to participate. Consent forms accompanied by a subject information form were given to the participating educators. This was done to allow participants to decline from participating or to agree to participate. All participants were informed that all the information gathered from this research will be used for the purposes of this research only and will be kept safe until it is destroyed after a period of three to five years. Feedback will be provided to the teachers after the findings have been compiled in order to allow them to challenge my interpretations and claims. Names of schools, teachers and learners participating in this research were kept confidential. Only fictitious names were used.

To adhere to research ethics for the University of Witwatersrand and Gauteng Department of Education, I applied for clearance to conduct the research from the Human Research Ethics Committee of the University of Witwatersrand for the University of Witwatersrand and Gauteng Department of Education. The University of Witwatersrand committee cleared me to conduct this study in a letter, Protocol: 2009ECE45 (appendix L) and the Gauteng Department of Education also allows me to conduct this research (appendix M).

Information collected during the study was treated confidentially. Interviews were conducted individually and in secured places to avoid interruptions as well as to keep information given confidential. Information obtained was kept confidentially by the researcher and used for the purpose of the research report only. Pseudonyms have been used where reference has been made to the teachers or their schools and no record of names of teachers and schools was kept.

3.13 CONCLUSION

The chapter has explained what was done and why it was done in the research process to assist the reader in understanding the choice of the research design. In the next chapter I presented the results and analysis of the data.

CHAPTER 4: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 OVERVIEW OF THE CHAPTER

This chapter critically and conceptually analyses the data and information gathered in this research study. I also present how the interpretive model of analysing data for this study was developed and implemented. This chapter begins by explaining how data was analysed before presenting results and the discussion. The results are presented in themes and tables that reflect the research questions and each outcome of the study was discussed before moving to the next one.

4. 2 DATA COLLECTION

The purpose of this study was to investigate the facilitation strategies that three FET teachers use to implement learner-centred teaching and learning in their Life Science classes. My study attempts to find answers to the following research questions:

- How do FET Life Science teachers interpret and understand their role as facilitators in the classroom?
- What facilitation strategies do three FET Life Science teachers use to implement learner-centred approaches to teaching and learning?

Qualitative data was collected from lesson observations using an observation guide, and from interviews using an interview guide. The table on the next page shows the number of observations, the topics that were taught and interviews that were conducted during data collection:

Table 6: The number of observations and interviews conducted during data collection

Name of teacher	Grade	Number of lesson observed (observation schedule)	Number of lesson recorded and transcribed	Topic	Interview recorded and transcribed
Jack (Mr)	12	1	-	Genetics,	1
	12	-	1	Dihybrid crosses	
	11	1	-	Anatomy of Dicotyledonous plant, internal and external structure of the root and stem.	
	11	1	-	The structure of the heart	
	11	-	1	The human circulatory system.	
Collen (Mrs)	11	1	-	Anatomy of Dicotyledonous plant, internal and external structure of the root and stem.	1
	11	1	-	The structure of the heart	
	11	-	1	The human circulatory system.	
	10	1	-	Biotic factors	
	10	-	1	Abiotic factors	
Phillips (Mr)	11	1	-	Anatomy of Dicotyledonous plant, internal and external structure of the root and stem.	1
	11	1	-	The structure of the heart	
	11	-	1	The human circulatory system.	
	10	1	-	Biotic factors	
	10	-	1	Abiotic factors	

4. 3 DATA ANALYSIS

Analysis of data requires a systematic search for meaning from the data collected (Hatch, 2002). In this research report, data analysis involved working with data, organising it, breaking it into manageable units, synthesising it, finding patterns, identifying what is important and what can be learnt so that the researcher can inform others as suggested by Hatch. Hatch (2002: 148) indicates that “analysis means organizing and interrogating data in ways that allow researchers to see patterns, identify themes, discover relationships, develop explanations, make interpretations...”. All this was done in order to make sense of the data (Hitchcock and Hughes, 1995).

In this study data recorded in the observation guide and in the transcripts of some lessons as well as transcripts of interviews were placed in two main categories based on the two research questions. The information on interpretation and understanding of teachers’ role as facilitators in the classroom was broken into sub-categories as informed by the theoretical framework. These sub-categories are:

- understanding of facilitation in teaching
- teacher use of facilitation strategies in the classroom,
- the importance of teaching and learning approaches when teaching
- role of teacher as a facilitator in the classroom
- the facilitation process in the classroom practice;

The information on the facilitation strategies that three FET life science educators use to implement learner-centred teaching and learning was also broken into sub-categories as used by Brooks and Brooks (1993):

- teachers’ use and understanding of learner’s prior knowledge,
- type of questions the teacher prefers to ask learners during the lesson
- teachers allowing learners’ responses to drive lessons,
- teacher use of physical experiences and concrete biological models to drive the lesson, encouraging learners to engage in dialogue, both with the teacher and with one another, and

- classroom interaction

Therefore, the interpretive model of analyzing and interpreting data was used.

4.4 INTERPRETIVE MODEL

The analysis of the data for meaning was reached “through direct interpretations of the individual instances and through aggregation of instances” (Stake, 1995:74). Hence the interpretations were grounded (Maxwell, 1992) in the language from the documents and the interviews. The interpretations from the interviews were substantiated with data from the official documents (McMillan and Schumacher, 2006). This was to enhance the trustworthiness and credibility of the study (Opie, 2004 and Maxwell, 1992). The model that I have proposed here provides tools for linking interpretations to data; but finally, according to Hatch (2002), they are researchers’ best efforts to produce meaning that makes sense of the social phenomena they are studying.

4.5 RESULTS AND DISCUSSION

In this research, the understanding of the facilitation process and the facilitation strategies that the FET Life Science teachers implement during teaching and learning were investigated. The results reflect what the individual teacher was doing during the five lessons that were observed or recorded and what each teacher said in their interview.

As indicated in table 6, all teachers were observed teaching similar topics in grade 11, two were teaching the same topics in grade 10 and one teacher was teaching grade 12 topics. During the first data collection period, the three teachers in grade 11 taught the anatomy of the Dicotyledonous plant, and the internal and external structure of the root and stem. During the second data collection period, the three teachers taught the structure of the heart, and the human circulatory system. Students had some knowledge on plants and hearts as they have learned about the process of photosynthesis in grade 10, and practical life experience about the heart as it pumps blood. Mr Jack, Mr Phillips

and Mrs Collen taught the circulatory system and presented lessons on blood groups. Mr Jack and Mrs Collen further taught structural differences between arteries and veins, movement of blood in veins and exchange of gases through the blood vessels. These topics are also covered in grade 10 so the three teachers could build on that. In grade 12, Mr Jack was teaching genetics, dihybrid crosses and presented lessons on heredity. In grade 10, Mrs Collen and Mr Phillips taught the biotic and abiotic factors and learners have done living and non-living things in grade 9 and the teachers could build upon these experiences.

The results of the data collected from the interviews and observations of all three educators are discussed next.

4.5.1 The interpretation and understanding of FET Life Science teachers of their role as facilitators in the classroom

The information for this theme came from semi-structured interviews which were conducted with each of the three teachers and classroom observations. Even though I was using an interview schedule, the wording of the interview questions changed slightly during the interview because of conversational style of the interview. For easy presentation and discussion of this theme, sub-themes were created.

a. Understanding of facilitation in teaching

The teachers (Mr Phillips, Mr Jack and Mrs Collen) were asked their understanding of facilitation in education in the context of teaching and learning. Their interview transcripts show that the three teachers have similar understandings of facilitation in teaching and learning but their emphasis is different. Mr Phillips indicated that the word facilitation in teaching is another word to explain the teaching and learning process. Mr Jack explains facilitation as using methods which will enable learners to understand data in the lessons. Mrs Collen indicated that facilitation in teaching is a process whereby a teacher as a facilitator creates the environment that is conducive to teaching and learning. Spangler and Kemshal-Bell indicated that the teacher creates an environment wherein learners are going to do the work and the teacher acts as a

facilitator to monitor, guide, direct, give instructions and asks questions where necessary. For example:

Interviewer: what is your understanding on facilitation and teaching?

Mrs Collen: Eer! Basically facilitation is a process whereby the teacher as a facilitator is going to create an environment which is conducive for the learning. So in other words basically as opposed from lecturing and standing in front of kids and teaching, you just create an environment whereby learners themselves are going to be doing more. Then as a facilitator you only guide where they have problem but most of the activity are done by the learner, so that you are there as a person who is going to guide and create a conducive environment for the learning process.

Mr Phillips: facilitation is another word for teaching; this describes how one teaches either learner centred or teacher centred.

Mr Jack: To facilitate is simply means using methods which will enables learners to understand data in the lessons. To facilitate is to use words which makes people to understand whatever that you are teaching, or is to make learners to learn or to change their behavior, and enhance. You use different ways to make them understand that what you want to achieve.

From the interview conducted, one can also realize that the understanding of Mr Phillips and Mr. Jack were around the use of different methods to make learning simpler to the learners. This is supported by Cambourne (1990), who explained facilitation in teaching and learning as a process whereby the teachers manage the teaching and learning. Mrs Collen understands facilitation as guiding learners so that learners can work on their own. The understanding of Mrs Collen is supported by Kemshal-Bell (2001), who defines facilitation as a pedagogical term that applies to student- centred approaches to teaching as opposed to teacher-driven approaches, where the teacher moves from being expert to one of facilitation or vice versa. Mr Phillips and Mrs Collen further understand facilitation as engaging students productively in their own learning. This means learners need to be competent with the requisite skills such as skills in thinking, reading, writing, presentation, note-taking, writing examinations and time management.

b. Role of teacher as a facilitator in the classroom

The three teachers were asked what their role as a facilitator was in the classroom. The teachers, Mr Phillips and Mr Jack, indicated that their role as facilitator is to plan their

lessons regularly before presenting the lesson to the learners and their plan should include assessment and evaluation at the end of each lesson. The following categories emerged from the interview: rates of learning, different abilities, cooperative learning and control of groups.

Rates of learning: Mrs Collen indicated that her role as facilitator is to cater for all learners in order to accommodate the slow, the gifted ones and the intelligent ones. This means a teacher ensures that all different rates of learning and abilities are accommodated. Different rates of learning and abilities enable the teacher to explain or demonstrate something that learners fail to understand using learners' languages or by pairing learners so that the gifted learners can help the slow learners as they will be working in pairs. Different learners have different abilities, in a learning situation there are learners who are able to perform certain duties faster while some struggle to perform the very same duties on time. Mrs Collen indicated that pairing or grouping learners in accordance with abilities enables each learner to benefit from the learning situation, as all learners including 'the slow, the gifted ones and the intelligent ones' will be accommodated.

Cooperative learning: Learner-centred teaching and learning allows learners to help one another. Mrs Collen indicated that by pairing or grouping slow learners with brighter learners, strong learners are able to assist weaker ones. She indicated that, if as a teacher you realize that some learners don't understand some information, involve other learners to assist their peer. Mrs Collen indicated that as a teacher, 'you can ask other learners who understand to explain to the group or class so every learner can be able to understand easily. She indicated that if possible, allow learners who understand to explain in their vernacular language or use any other way that will make the other learners to understand.

Control of groups: During teaching and learning in the classroom, teachers have managed their classes to ensure that effective teaching and learning took place. Mr Jack indicated his role is to monitor learners as to whether they are participating in the discussion. This further suggests a teacher should take control of all activities taking place in the classroom. Below is an interview that was conducted in relation to teachers'

role as a facilitator: Cambourne (1990) suggested some of the roles of facilitator during the teaching and learning such as giving instructions, and giving directions.

Interviewer: what are your roles as a facilitator in a classroom situation?

Mrs Collen: The role is to cater for all learners to see, to accommodate the slow, the gifted ones, the intelligent ones,that's facilitation, so you realize that maybe you can explain something that they fail to understand from educator's point of view, but maybe if you can ask another learner to explain then the learner can be able to understand easily or maybe by using the vernacular language or the learner can use another way to make the other learner to understand.If you realize that they are all weak learners, you can try to maybe bring in a better learner from the other group, or you can make them work in groups or sometimes learners can come to make demonstration.

Mr Jack: Err, to make sure that in the case of discussion there is order. If the learners are not being controlled you might find that they are discussing something which you have not given them, so you are there to monitor them. Ah! Well actually you are a monitor because is not just discussion they also have to write, so you have to monitor if they are doing what they are suppose to do.

Practically, I noticed that Mr Phillips, Mrs Collen and Mr Jack presented their lessons logically as they follow the lesson plan; and assessed and evaluated the learners as suggested by Cambourne (1990) through classwork and homework. However, in their interview, these three teachers did not indicate giving instructions, and giving directions as roles of facilitators. These are two roles identified by Kemshal-Bell (2001) and Cambourne (1990). Mrs Collen indicated building groups and teams, while Mr Jack indicated monitoring and managing discussions. According to Cambourne, the teachers' role as facilitator includes planning their lessons, engaging learners in the learning process, asking learners appropriate questions, listening and giving feedback, providing directions, and motivating the learners.

c. Challenges in facilitating the classroom practice

The teachers were also asked if the facilitation process is challenging in the classroom situation. The teachers show that the facilitation process in the classroom has some challenges that the teacher should overcome so that the learning process is effective and efficient. The teachers' understanding is that a teacher can facilitate in a learner-centred teaching. Mr Phillips, Mrs Collen and Mr Jack indicated that the facilitation

process is helpful because it allows learners to do the work on their own. Brandes and Ginnis (1986, cited in Ching, Murphy and Jenkins, 2002) assert that in a learner-centred approach, learners should have full responsibility for their own learning. The subject matter should be relevant and meaningful for the learners.

Mr. Jack suggested that during teaching and learning, involvement and participation by learners is necessary for learning, and the relationship between learners should show helping styles and learner self-responsibility (Brandes and Ginnis, 1986). Mrs. Collen indicated that as a facilitator, she is a resource person, and learners see her differently as a result of the learning experience because their learner experience is important. According to Brandes and Ginnis, the learners' experience and needs are valued, and balanced emphasis is based on cognition and effectiveness in the learning process.

Despite the good part that they have mentioned about the facilitation process, Mr Jack and Mr Phillips show that in practice the process is demanding. They indicated that as a teacher you must always check the condition before engaging learners in an activity. Mrs Collen supported Mr Jack and Mr Phillips by saying the facilitation process is difficult in her class.

Interviewer: All right, so do you think facilitation is easy or difficult to apply practically?

Mr. Jack: Err! It varies now, you see the thing which is important is class management, facilitation, if is well managed you must make sure that people who are friends you move them away from each other, make sure that the good, the ones that are intelligent are paired with the other ones which are less intelligent, err you try to give them access, when you give them the duties you say to them you the one I want you to write down what your group is doing, boost the self esteem, manage them, is how you manage them, you must know them because if you just say sit in pair, go into group of five they can choose themselves into friends and they will end up talking about soccer, talk stories of neighborhood, and they won't do anything, so is a question of how good you are in the classroom.

Ching *et al* (2002) explained several components that should be involved in implementing a learner-centred perspective, which include: learner's ability, resources and opportunities for access to learning; and the choice in course content and process. When analysing the data on challenges in facilitating the classroom practices, the following codes emerged from the interview: involvement and participation by learners,

classroom control and preference for teacher-centred approaches, resources, learners' experience and effectiveness of the learning process:

Involvement and participation by learners: Mrs Collen and Mr Jack indicated that facilitation strategies are effective if classrooms are well managed. They say a teacher must make sure those pupils who are friends are moved away from each other. Mr Phillips indicated that class management should be done properly, because learners may engage themselves in their own activities not paired properly in groups.

Interviewer: So, do you have any part or point maybe to can say facilitation is difficult when it comes to the classroom?

Mrs Phillips: Yes, if it is not done properly, like when you don't group them properly. if you don't pair them properly, at the end of the lesson you will find that they have done nothing but if it is properly managed by the teacher is usually simple, you group them. Enemies, you group them together because they have got a common business, they have got a common.....

Classroom control and preference for teacher-centred approaches: Mrs Collen indicated that she couldn't try group work or teamwork because learners are naughty and she is not trained to apply learner-centred teaching and learning. She stressed that she is good in telling learners what they have to learn. Cooper (2007), who investigated possible resistance to curricular reform in four rural schools, discovered that some teachers are continuing to use old approaches to teaching and learning. This is where a teacher continues to provide learners with knowledge and skills. Cooper found that the schools are struggling to cope with the new curriculum that requires the use of learners' prior knowledge and experience, groupwork, discussions, and active-learner participation; and teachers are applying the old method of teaching and learning (teacher-centred approach of teaching and learning).

Resource: Lack of adequate resources can hinder the teacher's ability to facilitate learning. Mr Jack and Mrs Phillips indicated that they don't have enough classrooms. In addition, the classes that I observed were overcrowded with more than 35 learners. This affected the use of learner-centred practices. Mr Jack and Mrs Phillips indicated that they practice the facilitation process sometimes to ensure that learners understand some of the information from their peers. During the observation I discovered that they (Mr

Jack, Mrs Collen and Mrs Phillips) mainly apply teacher-centred style of teaching and learning. This is similar to Brodie, Lelliott and Davis' findings that some secondary teachers take up learner-centred practices in different ways, but teacher-centred approaches remained robust. They also discovered that some teachers do not implement learner-centred approaches (Brodie *et al.*, 2002).

Learners' experience needs to be valued: During teaching and learning, learners' prior knowledge and experience need to be taken into consideration. In an interview, Mr Jack indicated that as a teacher, 'you must know your learners because if you just say sit in pair, go into group of five they can choose themselves into friends and they will end up talking about soccer, talk stories of neighborhood, and they won't do anything'. This means that learners' experience and needs should be valued when developing groups so that each group can be effective.

Effectiveness of the learning process: The three teachers (Mr Phillips, Mr Jack and Mrs Collen) indicated the importance of class interaction in lessons but the applications during the lesson were different from their words. During the observation the teacher-learner interaction was dominant over learner-learner interaction. The teachers were the main force of discussion either in a class or group discussion. Mr Phillips, Mr Jack and Mrs Collen were mostly interacting with their learners in classrooms using question and answer strategy even though they were teaching a minimum of 46 learners in a classroom. These processes help the learners to learn as they participate through the lesson. Lord (2001) indicated that cooperative learning enhances thinking and learners' understanding of new content. However, in some cases students' questions that need clarifications were not entertained by the teachers.

4.5.2 The facilitation strategies that three FET Life Science teachers used to implement learner-centred teaching and learning

The information for this theme also came from semi-structured interviews and classroom observations. For easy presentation and discussion of this theme, the following sub-themes were created: Teacher's use of facilitation strategies in the classroom, understanding and use of learners' prior knowledge; allowing learners' responses to drive lessons; use of physical experiences and concrete models; encouraging learners

to engage in dialogue, both with the teacher and with one another; asking thoughtful, and open ended questions. The classroom interaction, learner arrangement and other contextual factors were also taken into consideration.

a. Teachers' understanding and use of learners' prior knowledge

During the interview, the three teachers were asked their understanding of learner's prior knowledge and whether they use them in the learning situation. The three teachers (Mr Jack, Mr Phillips and Mrs Collen) indicated that they used learners' prior knowledge, but the interview shows that they understand learners' prior knowledge differently. Mr Phillips thinks that learners' prior knowledge is about what learners have learnt in the previous lesson or topic, while Mr Jack and Mrs Collen understand learners' prior knowledge as the knowledge inherited from the society, home, or environment that could help learners to understand new content to be taught.

Table 7: Three teachers' understanding of learners' prior knowledge (responds in verbatim)

Name of teacher	Response
Mr Jack	Is like when you are dealing with the prior knowledge from the subject or when dealing with prior knowledge from their background, like in biology if you are talking about let's say pollination of the Flora that's the real life does the person know what flower is? That's the background you can take into consideration
Mr Phillips	Prior- knowledge is what they have done in the previous lesson, so when introducing a topic you must always find out what they already know...
Mrs Collen	Prior- knowledge is what they know i.e let's say we are talking of a concentrate solution, you add some of the sugar in cold water, will not dissolve fast, so prior knowledge is from what they know from society and homes, and you introduce the topic. So prior knowledge is the things that they know so it varies.

Mr Jack and Mrs Collen have similar understanding of prior knowledge while Mr Phillips has another view of learners' prior knowledge. During the interview, while Mr Jack and Mrs Collen seemed to realise that prior knowledge also originates from informal learning

outside the classroom, their teaching and interview did not reflect this understanding. In the classroom, they were teaching like Mr Phillips. They did not elicit students' prior knowledge from outside the classroom on these concepts. Mr Jack and Mrs Collen helped learners to recall what was taught in the previous lesson, as a way of determining learners' prior knowledge (Cimer, 2007).

During the observation, I noticed that the three teachers started their lessons almost the same way, even though there were certain lessons which were started differently. This shows that the teachers were offered training that guide them as to how to start a lesson. Mr. Jack, Mrs. Collen and Mr Phillips started all their lessons by asking learners a series of questions so as to find out what they already know. Mr Jack and Mrs Collen started their lessons by asking learners' questions based on the previous lessons but Mr Phillips used learners' prior knowledge based on the previous lesson that was covered in the first term to introduce the new topic of the lesson. In other words all lessons of Mr Jack, Mr Phillips and Mrs Collen lessons were a continuation of the previous lessons. Below is table to show some of the questions that were used by the teachers in grade 11 to find out learners' prior knowledge.

Table 8: Three teachers' understanding of learners' prior knowledge

Mr Jack	Mrs Collen	Mr Phillip
The teacher asked a series of questions to find out what learners have learned from the previous lesson. He asked learners a series of questions as part of the introduction to remind learners of what they have done previously. i.e. 1. <i>What is the difference between roots and stem?</i> 2. <i>What is the function of a cuticle?</i> 3. <i>What is the function of a stem?</i>	The teacher introduces the topic by asking questions: i.e. Topic: Abiotic factors 1. <i>What are biotic factors?</i> 2. <i>What are components of biotic components?</i> 3. <i>What are the requirements of photosynthesis?</i>	The lessons were a confirmation of the previous lesson covered in the first term. Previous information was used. Questions based on the previous lessons were asked i.e. Topic: internal structure of the heart. 1. <i>What are the functions of the hearts are.</i> 2. <i>How do we know that the heart is functioning?</i>

The other lessons that I observed were having same style of questions, requiring learners to give out what they have learnt in the previous lessons.

Based on information from table 8, the understanding of the three teachers is that learners' prior knowledge can be discovered by asking a series of questions of what they have done. The only difference is that Mr Phillips does not give learners the topic of the day; he asked learners a series of questions from a previous learnt lesson of the student's textbook, and to remind learners of what they have done in the previous chapter (lessons). When Mr Phillips was teaching the circulatory system, he started the lesson by asking the functions of the heart, different chamber and veins. Mr Jack and Mrs Collen always introduce the topic (to the learners) before asking questions and then ask questions of what was covered in the previous lesson.

The teaching strategies that all the teachers (Mr Jack and Mrs Collen) use exclude prior knowledge that comes from their society. The findings suggest that the teachers' understandings on teaching from the known to the unknown are restricted to the previous knowledge on what was taught in the classroom. The way Mr Jack, Mr Phillips and Mrs Collen taught during observation of their lessons differs with what Nykiel-Herbert discovered in her research. Nykiel-Herbert (2004) found that South African teachers understood prior knowledge as being what the learners learnt from their homes and communities leaving out what were learnt in school.

All three teachers agreed that learners' prior knowledge is important in the learning process because it allows learners to understand and familiarize themselves with the new content. This can be seen in the following response by Mrs Collen.

Interviewer: How important is learners' prior knowledge in your lessons?

Mrs Collen: It is important because without the prior knowledge is like this person does not even have an idea, normally like let me take for an example maybe a concept of an atom to somebody in grade 8, so that idea of an atom is not something which a person have already seen or is something abstract so that you have to take advantage into consideration. So, not like when we are talking about like let's say a digestion so we talk about a stomach and everyone knows a stomach.

b. Teachers' use of facilitation strategies in the classroom

The teachers were asked which facilitation strategies they use in the classroom when teaching. Mr Phillip, Mr Jack and Mrs Collen indicated that there are many facilitation strategies that one can use during teaching and learning. According to Cambourne (1990), facilitation strategies in teaching and learning refer to the processes that the teachers' use to manage the teaching and learning process using groupwork, class discussion, question and answer, and demonstration.

The three teachers suggested strategies such as groupwork, class discussion, question and answer, demonstration, and experimentation as suggested by Cambourne. For example:

Interviewer: Which facilitation strategies did you apply or use in your classroom situation?

Mr Jack: Eer! One can use the discussion..... You can also use the life science experimentation like what they are actually doing and then you are there to guide them and help them where there is a problem, but they are actually involved doing the activity in the classes or the even the classworks is part of the learning process, the method you can use to facilitate.

Mrs Collen: Err, the facilitation usually, sometimes you can use group works, sometimes they can work in pairs, sometimes you can demonstrate, sometimes you can explain the teacher himself you can explain the terms, where they don't understand, so it varies.

Mr Phillips: There are many strategies to facilitate learning. You can use demonstration, question and answer, discussion, group work.... there are many. You start from simple to complex, you try to give them what they understand, try to give them example of where they live, give them example of what they know, things that are within their environment. Then from there you can recap from the previous lessons or you can use those things to be able to help you to explain what you want to do, because is easy for them to use the example that they experience in a day to day life, so that they can easily understand the concepts, so you move from simple then from there you introduce the topic as you move on to the complex.

Mr Phillips, Mr Jack and Mrs Collen further indicated that groupwork is one of the facilitation strategies that are applicable to learner-centered learning. They believe that groupwork allows them to support the learners i.e. helping, giving instructions and guidance. They also mention other facilitation strategies that they use. In addition to

groupwork, Mr Jack and Mr Phillips indicated that discussion is the other facilitation strategies that they preferred to use in the learning situation. Mr Phillips further indicated demonstration, and question and answer as the other strategies that promote learner-centred learning and help to facilitate the learning process.

During the observation, the three teachers were mainly using question and answer as compared to the use of groupwork, discussion, dialogue and debate. Mrs Collen indicated that groupwork is not applicable in their classroom because their classes are over-crowded. The teacher-learner ratio of 1:36 is not followed and each class is having a minimum of 46 learners.

Interviewer: Ok, it's fine, you have raised the discussion, is that the groupwork?

Mrs Collen: Groupwork, Not necessary the same, you can have them discuss in the classroom and you can have them doing groupwork somehow, somewhere involve discussion. (Ok! Is this process very difficult, I mean facilitation processes is it very difficult or is it easy?). It depend on the number of learners, sometimes you might find that if you are dealing with a very large group and in some cases you find it difficult. So in a reasonable group it is going to be easy/or the best. (In a reasonable group, like how may?). At least 35 to 40 is going to work, but if you are having 50 learners and above it becomes very difficult.

The three teachers were aware of which facilitation strategies promote learner-centred learning as required by the National Curriculum Statement. The National Curriculum Statement suggests that during the teaching and learning process in the classroom the teacher should use different strategies that will promote learner-centred learning such as groupwork, teamwork, class discussion, question and answer, and experiments, so that learners can understand (Department of Education, 2005).

c. Teachers allowing learners' responses to drive lessons

The table in the next page summarizes what the three teachers were doing in the three lessons that I have observed.

Table 9: Use of learners' responses to drive the lesson

Mr Phillips	Mr Jack	Mrs Collen
<ul style="list-style-type: none"> -invited ideas from students and attempted to probe for more but rejected them if not familiar to him -rarely elaborated on the ideas from students even when doing so was critical for conceptual understanding. -gave out facts from reference book without explanations or simplifications 	<ul style="list-style-type: none"> -Jack sought ideas from one student per question then progressed -did not give students enough information to guide their knowledge construction -provided a lot of inaccurate facts that may have perpetuated misconceptions 	<ul style="list-style-type: none"> -asked students to recall what was learnt in lesson before -probed students for more information if responses were not clear or incomplete -corrected students' diagrams on chalkboard -she rephrased and elaborated students' ideas

The three teachers' used the question and answer method in their teaching process to a certain extent. Mr Phillips and Mrs Collen ask a series of questions to drive their lessons. These were mainly to remind the learners of what they have learnt in the previous lesson. Brooks and Brooks (1993) indicated that learner' knowledge, experience and interest help during teaching and learning. During the lesson teachers were the main source of information and very little information was from the learners. According to the data above, the three teachers did allow some of learners' responses to drive lessons; the questions that they continually asked were to remind learners of what they have learnt in the previous lesson. They always shelved ideas if they were not under that topic in the syllabus. They attentively listened to the learners' information and used very little of learners responses to drive the lesson.

The table above also reflects that Mr Phillips and Mrs Collen use some of the responses from individuals to drive the lesson particularly in the introduction of the lesson. They invited ideas from learners and attempted to probe for more but rejected them if not familiar to their invited ideas. Mr Phillips and Mrs Collen mostly shelved learners' ideas if they were not under that topic in the syllabus or if they did not have an explanation at that time. They rarely elaborated on the ideas from learners even when their elaboration will help learners to understand.

During the teaching process, some of the learners' responses were taken into account to drive the lesson towards expected learning outcomes by the three teachers. The

majority of responses were based on a previously learnt lesson, and have very little to do with the new lesson.

d. Asking thoughtful, open-ended questions

The three teachers were asked the type of questions they prefer to ask learners during the lesson (open-ended questions or close-ended questions) and motivate why they prefer a particular type of questioning. In an interview, the three teachers indicated that they use a variety of questions to stimulate learners thinking and understanding. They all indicated that they use both open-ended questions and close-ended questions because they are important. According to Spangler (2003), the teacher as a facilitator should have strong verbal and analytical skills that can help to know what questions to ask, when to ask them, and how questions should be structured to get good answers without defensiveness. When the three teachers were asked whether they do like open-ended questions or close-ended questions (see no.7 in interview schedule), they responded as follows:

Interviewer: So which questions do you like when teaching, do you like open-ended question or close-ended question?

Mr Jack: Usually is like at first they must use close-ended question because open-ended question is difficult, (So you usually use close-ended question?) Yes, open-ended question is difficult for the learners to express themselves in English. So you have to explain but if you are using the close-ended question, you as a teacher at the same time have to explain to the learners.

Mrs Collen: I think it depend on what you can ask them, the investigation questions, where you really want to find out their knowledge, to find out how much can do, they know about something, so that they say as much as they can, (Ok, but which one does you normally use in a classroom situation) Eer, the open ended questions are the most questions I use, like describe, discuss, and explain, although the other time you have to use the close ended questions.

Mr Phillips: I prefer the open ended questions the most, because it gives learners to engage in discussions with their peers.

Mr Jack indicated that he preferred close-ended questions because 'open-ended question is difficult for the learners to express themselves in English'. Mr Phillips and Mrs Collen indicated that they prefer open-ended questions over close-ended questions, even though they sometimes use close ended questions. According to Mr Phillips and

Mrs Collen, open-ended questions enable learners to think critically about what they learn. Spangler indicated that the teacher as a facilitator should know how to probe for more information when initial answers are not sufficient.

According to Brooks and Brooks (1993), the questions that the teacher asks should give learners the opportunity to think. In a constructivist perspective, the teacher uses open-ended questions to identify and recognise learners' prior knowledge and see how this prior knowledge can help the child. The observation revealed that Mr Phillips, Mr Jack and Mrs Collen use the question and answer method in their teaching and learning process. However, the types of questions that they were applying in the classroom were mostly close-ended questions as compared to open-ended questions.

Mr Jack was using close-ended questions that require only one answer. Some of the questions used were requiring either yes or no answer. All three teachers did not ask for justification from students even where students' ideas showed some misconceptions. Mr Jack and Mr Phillips always asked learners if they understood what they were doing. They were the source of information, explaining how the process takes place, and then gave learners tasks to work on following the instruction they set.

Mr. Phillip used questions to guide the learners and encourage them to collaborate with the peers. Mrs Collen was promoting discussions and activities that enable the students to interact on their own using learners' thoughtful, open-ended questions. She asked for justification from students and in cases where students' responses were wrong or inaccurate, she guided learners to correct responses without explaining why the responses given were not acceptable.

Mrs Collen allowed students to debate on some ideas they raised but she did not provide vital information to help students to construct relevant knowledge. Open-ended questions were asked e.g. *what will happen if one stop breathing, and why? Will the heart stop or not, and why. Will blood stop flowing or not, and why?*

The three teachers (Mr Phillips, Mr Jack and Mrs Collen) were mostly using close-ended questions as compared to open-ended questions. This indicated that, according to

Brooks and Brooks (1993), the teachers were in most cases not promoting the construction of knowledge.

e. Teacher use of physical experiences and concrete biological models

The constructivist perspectives on learning indicate that learners interact with and interpret the world through their own understanding of the situation (Hewson *et al.*, 1998, Vygotsky, 1978). This means that, during learning, learners organize knowledge from their physical experiences and ideas and relate it to world experiences (Vygotsky, 1978; Von Glaserfeld, 1989). During teaching and learning Mr Phillips, Mr Jack and Mrs Collen used physical experiences and biological models (e.g. chickens and human heart) to simplify information for the learners. Mrs Collen brought four hearts of the cow for dissection. She established a classroom environment that provided opportunities for students to explore their own ideas, setting guiding instructions and rules for learners to follow when dissecting the heart. Mr Phillips, Mr Jack and Mrs Collen used more examples from books to simplify information for the learners and few from the learners' environment e.g. referring learners to chicken hearts that they eat at their respective families.

Mr Jack used chicken hearts and some of the teaching aids such as charts as references to engage learners, for example, when he shows learners a chart representing the external & internal structures of roots, and gives learners an opportunity to draw in the classroom. He allows learners to draw and label the structures in their classwork books. Mr Phillips and Mrs Collen did not use charts during the observation, but only refer learners to the textbook. According to Brooks and Brooks the teacher should establish a classroom environment that provides opportunities for students to explore their own ideas. This means that, during learning, learners organize knowledge from their physical experiences, and relate them to world experiences (Vygotsky, 1978). Mr Jack and Mrs Collen used some of the teaching aids that enable them to facilitate the learning process and were able to give instructions and directions as to how to draw and to dissect the hearts of the cow.

f. Encouraging learners to engage in dialogue, both with the teacher and with one another

The interview and observation were conducted to find out if teachers encouraged learners to engage in dialogue, both with the teacher and with one another. According to Brooks and Brooks (1993), social discourse is a powerful tool in learning, and gives learners the opportunity to present their own ideas. The three teachers indicated that they do encourage learners to engage in a dialogue during the learning process. They further indicated that the dialogue amongst learners themselves sometimes is not fruitful because learners tend to discuss matters of their interest. Mr Jack and Mrs Collen said the dialogue that works in the learning situation is the one which is controlled by the teacher. They indicated that dialogue works best if the teacher walks around the groups or teams of learners, giving instructions, directions and also asking questions that will enable learners to engage in a dialogue further. This can be seen in the following response by Mr Jack and Mrs Collen.

Interviewer: During the lesson, do you encourage the learners to engage in a dialogue or discussion?

Mr Jack: yes like what I said they can work in a pairs, it means they can, their talking is a learner to learner interaction, people to people interaction and group work is a learner to learner interaction, the teacher will be always moving to give them guidance and say no here is what you are suppose to do.

Mrs Collen: Yes, learner to learner then the teacher to give them guidance, so that the teacher is there to correct, that's the duty of the teacher. So, you must always give them time so that they can also talk to themselves. But learner to learner is time consuming.

Mr Jack and Mrs Collen said if the teacher does not interact with learners, sometimes only bright learners dominate the discussion and weak learners fails to understand what the dialogue or the discussion is all about. Mr Phillips further support Mr Jack and Mrs Collen, he said for the fact that our class are overcrowded it becomes a challenge if teachers does not lead the dialogue. He indicated that the class becomes chaotic and uncontrollable. This can be seen in the following response by Mr Jack.

Interviewer: So is dialogue/discussion easy in your environment?

Mr. Jack: Are you saying in a class?

It depend on the size of the class, like if the number of the learners is less you can do it in the classroom, (Less like how many?) Like 30 to 35 it can be done, but if they are more than that it becomes a problem, the class becomes chaotic and uncontrollable, it will needs a lab where there is more space, in the class it will take time for you to group the learners

During my observation, I noticed that Mr Phillips uses classroom and group discussions to engage learners in their lessons. Mr Jack uses class discussion to engage learners, but he was the main force of discussion either in a class or group discussion. Mrs Collen did not engage learners in a dialogue, both with the teacher and with one another. She indicated that the use of dialogue is time consuming.

Mr Phillips, Mr Jack and Mrs Collen were teaching a minimum of 46 learners in a classroom. During group discussion' Mr Phillips arranged learners in large groups of six to eight. Clear instructions were laid out for learners to perform some activities. Scott *et al* (1994) indicated that teachers decide on the suitable context that will suit learners during learning, and allow group work to occur, while monitoring the teaching and learning. During the learning process the teachers were getting new insights from learner's ideas and linking them with their experience and teaching goals. According to Piaget (1964, 2003), the activities that the teacher prepares should allow learners to understand them and enable each individual to make his/her own ideas. Scott *et al* (1994) further claim that the teacher should help learners to make link between their thinking and the science views; and also allow them to explore their ideas

The three teachers indicated that learners should be encouraged to engage in dialogue, both with the teacher and with one another, but it seems difficult to apply both teacher-learner dialogue and learner-learner dialogue. The number of learners in the classrooms is discouraging teachers from applying some of facilitation strategies during the lesson. Mr Jack indicated that the facilitation strategy is applicable in an environment with less than 35 learners, but practically impossible in a class of over 35 learners.

4 .6 CONCLUSION

This chapter has explained how data obtained from interviews with teachers and lesson observation was analysed. The findings were presented and discussed in themes: the understanding of facilitation process, strategies of facilitation and role of teacher as facilitator in the classroom were discussed. This includes the teaching and learning approaches that teachers preferred when teaching. I have also presented and discussed results of observation in themes. This covers the use of learners' prior knowledge, allowing learners' responses to drive lessons, use of physical experiences and concrete models, encouraging learners to engage in dialogue, asking thoughtful, open-ended questions. These themes correspond to the two research questions that the study addressed.

Chapter five seeks to offer recommendations to the research study as possible solutions, as well as present recommendations for further research. In the next chapter I present a summary of my results, implications, reflection on the research process and conclusion.

CHAPTER 5: SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

5.1 INTRODUCTION

In this chapter I present the conclusion and recommendations wherein I attempt to answer the research questions. The implications of the findings of the study for the curriculum, and lessons learnt from the study and shortcomings of the study are discussed. I also present a summary of the study's critical reflection on the research process and suggestions for future research. The findings presented in Chapter 4 emanated from the semi-structured interviews and observations based on the three life science teachers. This chapter provides an overview of important points of this research through a summary of the research topic, the recommendations made and the suggestions that are made for further research.

5.2 OVERVIEW OF THE RESEARCH TOPIC

The promulgation of the National Curriculum Statement has brought about a change in fundamental employment practices in South African public schools. This implies that the role of teacher must be aligned with the provisions of the National Curriculum Statement which require that the teachers be facilitators in the learning process. This research has focused on facilitation strategies that have a direct impact on the role of the teachers in the implementing of learner-centred teaching and learning in public schools. The National Curriculum Statement has been used as a basis of analysis and critique. Of particular interest was the tension between theory and practice, which gave rise to the following research questions:

- How do Life Science teachers interpret and understand their role as facilitators in the classroom?
- What facilitation strategies do three Life Science teachers use to implement learner-centred approaches to teaching and learning?

Whilst the National Curriculum Statement has been promulgated, it does not yet provide the solutions for the realities. During the process of teaching and learning, teachers are supposed to guide, support, facilitate and give the direction, while learners must be active participants, discuss in groups and perform activities designed and planned carefully and clearly by the teacher (Schreuder, 1998; Department of Education, 2003; Department of Education, 2006).

5.3 FINDINGS

The following is a summary of the key findings that emerged from the observation schedule and interview data, and is discussed in Chapter 4.

5.3.1 Life Science teachers' interpretation and understanding of their role as facilitators in the classroom.

The three teachers understand facilitation the same way even though each teacher can explain and emphasize other aspects of it in different ways. They understand facilitation as a way to influence learning in the classroom. One of the teachers indicated that learners must be given a chance to practise, and shifts learning from the teacher to the learner's needs and skills, while the other two teachers describes facilitation as learner-centred or teacher-centred, but does not elaborate to show his understanding of facilitation. Facilitation relates more directly to everyday real-life situations.

The interview shows that the teachers have a good theoretical background of their roles as facilitators in teaching and learning. The challenge is on the implementation of their roles in the classroom situation due to some contextual factors.

The three teachers stressed much the issue of planning their lessons regularly before presenting the lesson to the learners, and that their plan should include assessment and evaluation at the end of each lesson. I have noticed that the three teachers presented their lessons logically as they follow the lesson plan; and assessed and evaluated the

learners as suggested by Cambourne (1990) through classwork and homework. The three teachers in this study did not indicate managing discussions, building groups and teams, giving instructions, monitoring and giving directions as their role as facilitators during the interview, but practising some of them in the classroom situation.

There was no consistency in using constructivist theory during teaching and learning in the classroom. The teacher-centred approach in teaching and learning was still robust to all teachers particularly Mrs. Collen. The three teachers highlighted the lack of proper training in the facilitation process so that they can properly implement constructivist approaches as approved by the NCS. Teachers were mostly using scaffolding learning, asking probing questions to trigger learners' minds. This is clearly demonstrated on table 9. The three teachers also indicated that the process of facilitation is difficult because the life science syllabus is too long to apply learner-centred teaching and learning.

5.3.2 The facilitation strategies used by three FET Life Science teachers when implementing learner-centred approaches to teaching and learning.

To answer this research question, in an interview I asked the three teachers which facilitation strategies they used in their classrooms and their role in facilitating the learning process. I also analysed how the three teachers worked with facilitation strategies.

There are number of facilitation strategies that teachers can use in the classroom. Some teachers believe that groupwork is the main facilitation strategy that is applicable to learner-centered learning. During the interview, one of teachers indicated that discussion, demonstration, and question and answer are other facilitation strategies that promote learner-centred learning.

The three teachers believe that groupwork is not applicable in their classroom because their classes are over-crowded. The three teachers know that the teacher-learner ratio of 1:36 which is required by National Curriculum Statement can allow teacher to promote learner-centred learning. National Curriculum Statement suggests that the teacher should also help, monitor, guide and give instruction to support facilitation strategy so that learners can achieve the expected outcomes.

The three teachers understood students' knowledge in terms of what students already knew on the topic. The three teachers believed that knowing what students already knew was important for teaching to progress from what was known to the unknown. Only one of the teachers indicated that the students' prior knowledge was a result of previous teachings but identified students' homes as another source of the prior knowledge that students bring to instruction. The three teachers' understandings of students' experiences were reflected in their teachings. All the three teachers began instruction by recapping what was taught in the previous lessons. According to information obtained from the interviews, these teachers recapped previous work in order to help students' progress from the known to the unknown. Teachers said teaching from the known to the unknown was necessary for conceptual understanding.

The three teachers understand the importance of learner's prior knowledge and they all asked questions at the beginning of the lesson but their questioning strategies shown in table 7 are not encouraging learners to speculate, hypothesise, predict and discover as suggested by Vygotsky (1962). The link between learners' ideas and scientific knowledge is often achieved through the use of examples from students' everyday contexts (Kasanda, Lubben, Gaoseb, Kandjeo-Marenga, Kapenda, & Campbell, 2005).

All three teachers attempted to find out their students' prior knowledge at the beginning of lessons. However, the teachers used closed questions that sought for specific answers from what was previously taught. According to Lobato, Clarke & Ellis (2005) and Cimer (2007), use of closed questions in eliciting students' ideas does not adequately expose students' conceptual understandings. Nevertheless the three teachers worked within their understandings of prior knowledge as discussed earlier.

Two of the teachers use learners' responses very little to drive their lessons, mainly to remind the learners of what they have learnt in the previous lesson. Brooks and Brooks (1993) indicated that learner' knowledge, experience and interest help during teaching and learning. During the lesson teachers were the main source of information and very little information was from the learners.

During teaching and learning the teachers use physical experiences and concrete biological models. Most of the time, the three teachers used more examples from books to simplify information for the learners and few from the learners' environment. The three teachers use teaching aids such as charts in their classroom to engage learners. According to Brooks and Brooks the teacher should establish a classroom environment that provides opportunities for students to explore their own ideas. This means that during learning learners organize knowledge from their physical experiences and ideas, and relate it to world experiences (Vygotsky, 1978).

During the learning process, some teachers encourage learners to engage in dialogue, both with the teacher and with one another. The three teachers encourage learners to engage in a dialogue during the learning process. According to Brooks and Brooks (1993), social discourse is a powerful tool in learning, and gives learners the opportunity to present their own ideas. The teachers believe that the dialogue amongst learners themselves sometimes is not fruitful because learners tend to discuss matters of their interest. Two of the educators said the dialogue that works in the learning situation is the one that is controlled by the teacher.

The three teachers believe that dialogue works best if the teacher walks around the groups or teams or learners, giving instructions, directions and also asking questions that will enable learners to engage in a dialogue further. One of the teachers believes that dialogue is time consuming because it affects the pacesetter.

During group discussion, learners were arranged in groups of six to eight in all three classes. Clear instructions were laid out for learners to perform some activities. Scott *et al* (1994) indicated that teachers decide on the suitable context that will suit learners during learning, and allow group work to occur, while monitoring the teaching and learning. During the learning process the teachers were getting new insights from learner's ideas and linking them with their experience and teaching goals. According to Piaget (1964, 2003), the activities that the teacher prepares should allow learners to understand them and enable each individual to make his/her own ideas. Scott *et al* (1994) further indicated that activities should help learners to make the link between their thinking and the science views; and also allow them to explore their ideas.

The use of different questions plays a major role in a learning situation. The three teachers indicated that they use a variety of questions to stimulate learners thinking and understanding. They all indicated that they use both open-ended and close-ended questions. However, they were mostly using close-ended questions as compared to open-ended questions. Some of the questions used were requiring either a yes or no answer. The teachers did not ask for justification from students even where students' ideas showed some misconceptions.

Two of the teachers always asked learners if they understood what they were doing. They were the source of information, explaining how the process takes place, and then gave learners tasks to work on following the instructions they set. One of them promoted discussions and activities using learners' thoughtful, open-ended questions. She asked for justification from students in cases where students' responses were wrong or inaccurate, and guided learners to correct responses without explaining why the responses given were not acceptable.

The three teachers believe that verbal interaction is the key to teaching for understanding because it enables the teachers to monitor students' understanding of scientific concepts (Tobin, Tippins and Gallard., 1994). All the three teachers made an effort to involve their students but they generally struggled to engage in dialogue that could enable students to express their opinions. The common strategy used by the three teachers to involve their students was the question and answer. All teachers mostly used closed questions that required students to reproduce what they were taught hence alternative ideas were not often explored, and one of the teachers use few of the open-ended questions.

During the observation the teacher-learner interaction was dominant over learner-learner- interaction. The teachers were the main force of discussion either in a class or group discussion. The three teachers were mostly interacting with their learners in classroom using question and answer strategy even though they were teaching minimum of 46 learners in a classroom. These processes help the learners to learn as they participate through out the lesson. However, in some cases students' questions that need clarifications were not entertained by the teachers.

These findings indicate that all three teachers were aware of their roles as facilitator. However their theoretical understanding of their role as facilitator often did not match their practice. Teacher-centred approach to teaching and learning was dominant over learner-centred.

5.4 RECOMMENDATIONS

The researcher is of the view that the following recommendations will contribute to the realization of the importance of learner-centred teaching and learning in public schools. With reference to this study's findings, I would like to suggest the following:

The Department of Education should develop a programme that will enable the current teachers in the system to be continuously trained and developed in accordance with the National Curriculum Statement. The teaching programmes in universities and educational colleges should be National Curriculum Statement based, and the training and development that the student teachers gained should enable them to cope with the current teaching process.

The training and development that the department should offer must focus on small groups of teachers at a time so that the process can be more effective and efficient. The university or college lecturers and tutors should be given the tasks to train and follow up the implementation process by the groups of teachers. Mentorship programmes should be designed in such a way that individuals are given practical experience.

The teaching and learning process should be well planned to cover all learners. This should include assembling all necessary equipment and resources to be used in a lesson in advance. The activities and teaching aids should link to the topic to be covered. The teachers should design necessary instruction to facilitate learning. Teacher should develop a wider repertoire of teaching approaches and styles, both to create interest through variety as well as cater to different learning tasks and a structured presentation provides a conceptual framework that enhances reception and enables students to fit in their knowledge and ideas

The teacher should promote active learning because it implies the involvement of the student in the learning process. Students need to participate, not merely receive; they need to understand, organize and encode information into their long-term memory. They must learn to relate it to their own experience and knowledge and be able to use it logically and creatively. Small-group work and project work are particularly conducive to such activities. The teachers should practice effective questioning skills. If properly applied, it can provoke thinking and expression, encourage discussion and debate, prompt further and more probing investigation of the subject as well as provide opportunities for students to ask questions to clarify their understanding

The department should ensure that there are sufficient and effective resources in all public schools. These include building extra classes additional to the existing ones to supplement what the schools have and employing sufficient staff. This will minimize over-crowding in classroom during teaching and learning and allow the teachers to engage learners in groupwork and experiments. The Department of Education should also hire enough teachers per school to match the principle of teacher-learner ratio of 1:36 as required by the National Curriculum Statement.

5.5 REFLECTION ON THE RESEARCH PROCESS

In this study, data was collected mainly through lesson observation and interviews with teachers. I also took field notes on teacher-related issues that I felt were vital in providing a clear picture of my sample and the environment under which they worked. I observed lessons in order to get first hand information on the facilitation strategies that three life science educators use to implement learner-centred teaching and learning in the classroom. I was aware that teachers may change their classroom practices while being observed hence decided to observe three lessons, and record two lessons per teacher hoping that with more visits, the teachers would behave normally. There were challenges during data collection i.e. after observing two lessons per teacher the school was disturbed by COSAS. COSAS claimed that learners are not taught regularly by teachers, one of the three teachers was suspended for a particular time, the principal was changed and I had to re-apply for access via the new management. This made me wonder if what I observed was a reflection of day-to-day classroom practices. After two

months the situation settled and the new management allow me to continue with the research. I then, observed the third lesson of each teacher.

During consultation, my supervisor advised me to observe and record the remaining lessons. The three teachers disagreed with the idea of observing and recording at the same time. They only allowed me to record the remaining lessons. The interviews I had with teachers were meant to follow-up issues that I observed and recorded in lessons, in addition to seeking the teachers' understandings of the facilitation strategies that life science educators use to implement learner-centred teaching and learning in the classroom. I further wanted to elicit what the three teachers viewed as hindrances to using constructivist approaches in life science lessons.

The interview led to the gap between theory and what I have observed during classroom practices. When I was observing lessons, the teachers did not know what I was actually focusing on but from the questions I used in the interview, they may have realised what I was looking for. When writing this report, I have struggled to present a balanced view of my observations in terms of positives and negatives observed. This follows my professional experience as a senior education specialist in secondary schools. During school class visits, good practices were acknowledged but more time was spent on helping teachers in improving the shortfalls. This study has indeed been a learning curve for me as a researcher.

5.6 SUGGESTIONS FOR FUTURE RESEARCH

This study focused on the facilitation strategies that three FET life science educators use to implement learner-centred teaching and learning in the classroom. Only the views of three teachers in one township school were sought. The findings of this report provide some insight into what teachers in secondary schools may be experiencing; a larger sample that would include teachers from different schools (urban and rural) would paint a bigger picture.

5.7 CONCLUSION

The study showed that there is an attempt to use some of the facilitation strategies to implement learner-centred teaching and learning in the classroom. Stoffels (2005) indicated that teachers need their confidence to be boosted for them to operate competently. The study has shown that there is need for proper training and development. How the results of the study best represent the majority of life science teachers is debatable but the findings can provoke the understanding of the facilitation strategies that life science educators use to implement learner-centred teaching and learning in the classroom. The study has shown that there is a need for the link between the understanding of facilitation strategies and teacher practice for the enquiry approach to be a success. Hence it calls into question the current methods that are used to inform life science teachers on how to use facilitation strategies to implement learner-centred teaching and learning.

Reference

- Barraket, J** (2005). Teaching research methods using a student-centred approach? Critical reflections on practice, *Journal of University Teaching & Learning Practice*, 2(2).
- Bassey, M.** (2003). *Case study research in educational settings*. Open University Press. USA.
- Bennett, J** (2003). Teaching and learning science. London: Continuum.
- Brandes, D.** and Ginnis, P. (1986) *A guide to student-centred learning*. Cheltenham: Stanley Thornes.
- Breakwell, G. M.** (1995). Interviewing. In G.M. Breakwell; S. Hammond and C. Fife-Schaw. *Research methods in psychology*. SAGE Publication: London, Thousand, New Delhi. 230-242.
- Brodie, K., Lelliott, A and Davis, H.** (2002). Forms and substances in learner-centred teaching: Teachers' take-up from an in-service programme in South Africa. *Teaching and Teacher education* 18, 541-559.
- Brooks, J. G & Brooks, M. G.** (1993). Search for understanding: *The case for constructivist classrooms*. Alexandria, Virginia: Association for Supervision and Curriculum Development.
- Cambourne, B.** (1989). *Theory into practice. The whole story*. Ashton Scholastic :Gosford.
- Cambourne, B.** (1990). Getting to the guts of whole language. In *Language as the core: Teaching in the 90's*. Proceedings of a conference sponsored by ARA NSW AND PETA. University of Wollongong: NSW.
- Carr, M.** Barker, M., Bell, B. Biddulph, F. Jones, A., Kirkwood, V., Paerson, J. & Symington, D. (1994). The constructivist paradigm and some implications for science content and pedagogy. In Fensham, P., Gunstone, R., & White, R. (eds). *The content of science: The constructivist approach to its teaching and learning* (147-158). London: Falmer Press.
- Chin, C.** (2004). Students' questions: Fostering a culture of inquisitiveness in science classrooms. *School Science Review*, 86(314), 107-112.
- Ching, K; Murphy, D and Jenkins, W.** (2002). The teacher's role in supporting a learner-centred learning environment: Voices from a group of part-time postgraduate students in Hong Kong. *International journal of lifelong education*. 21(5), 462-473.
- Cimer, A.** (2007). Effective teaching in science: A review of literature. *Journal of Turkish Science Education*, 4(1), 20-44.
- Cooper, R.** (2007). An investigation into constructivism within an outcomes-based curriculum. *Issues in Educational Research*, 17(1) 15-39. <http://www.iier.org.au/iier17/cooper.html>.
- Denscombe, M.** (2007). *The Good Research Guide for Small Scale Social Research Projects*. Maidenhead, England: Open University Press.

- Department of Education** (2003). *National Curriculum Statement grades 10-12 (general)*, Pretoria.
- Department of Education** (2005). *National Curriculum Statement Grades 10-12(General) Learning Programme Guidelines Life Sciences*. Pretoria.
- Department of Education** (2005). *National Curriculum Statement Grades 10-12 Subject Assessment Guidelines Life Sciences*. Pretoria.
- Department of Education.** (2006). *National Curriculum Statement grades 10-12 (general), Life Sciences*. Pretoria.
- Durham, M.E.** (1997). Secondary school teachers' responses to student questions. *Journal of Science Teacher Education*, 8(4), 257-267.
- Gaigher, E.** (2009). Exploring teacher responses to learner questions in science classrooms. In M. Shafer & C. McNamara (Eds.), *Proceedings of the Seventeenth Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education* (Vol 2, pp 135-139). Rhodes University: South Africa.
- Gibbs, G.** (1992). *Assessing More Students*. Oxford: Oxford Brookes University.
- Golafshani, N.** (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report*. 8(4) 597-607.
- Griffiths, M.** (1998). *Educational research for social justice; getting off the fence*. Open University Press: Buckingham. 279-300.
- Hatch, J. A.** (2002). *Doing qualitative research in educational settings*. New York: State University of New York.
- Hewson, P. W., Beeth, M. E and Thorely, N.R.** (1998). Teaching for conceptual change. In Fraser, B & Tobin, K.G (eds). *International Handbook of Science Education*, 199-218. Dortrecht: Kluwer.
- Hitchcock, G. & Hughes, D.** (1995) *Research and the teacher: A qualitative introduction to school-based research*. Routledge. London and New York.
- Kasanda, C., Lubben, F., Gauseb, N., Kandjeo-Marenga, U., Kapenda, H. & Campbell, B.** (2005). The role of everyday context in learner-centred teaching: The practice in Namibian secondary schools. *International Journal of Science Education*, 27(15), 1805-1823.
- Keane, M. & Malcolm, C.** (2002), OBE and learner-centred teaching: what do we understand by this? SAASTE Conference Proceedings. University of the North.
- Kemshal-Bell, G.** (2001). *The online teacher*; Final report prepared for the Project Steering Committee of the VET Teachers and Online Learning Project, ITAM ESD, TAFENSW. <http://cyberteaccher.onestop.net>.
- Kriek, J and Basson, I** (2008). Implementation of the new FET Physical Sciences curriculum: Teachers' Perspectives. *African Journal of Research in SMT Education*. (12), 63 – 76.
- Lelliott, A, Mwakapenda, W, Doidge, M, Du Plessis, J, Mhlolo, M, Msimanga, A, Mundalamo, F, Nakedi, M & Bowie, L** (2009). Issues of teaching and learning in South Africa: a disjunction between curriculum policy and implementation. University of Witwatersrand. Johannesburg. *African Journal for Research in MST Education*. 13(1), 47-63.

- Liu, R;** Qiao, X & Liu, Y. (2004). A paradigm shift of learner-centered teaching style: reality or illusion? *Arizona Working Papers in SLAT*.
- Lobato, J.,** Clarke, D. & Ellis, A.B. (2005). Initiating and eliciting in teaching: A reformulation of telling. *Journal of Research in Mathematics Education*, 36(2), 101-136.
- Lord, T.** (1998). Cooperative learning that really works in Biology teaching: Using constructivist based activities to challenge student teams. *The American Biology Teacher*, 60(8), 580-588.
- Lord, T.** (2001). 101 reasons for using cooperative learning in Biology teaching. *The American Biology Teacher*, 63(1), 30-38.
- Maxwell, J.A.** (1992). Understanding and validity in qualitative research. *Harvard educational review*, 62(3), 279 – 300.
- Mbano, N.** (2002) Verbal interactions in CASE lessons in Malawi. *African Journal of Research in Mathematics, Science and Technology Education*, 6, 83-94.
- McMillan, J. H.** and Schumacher, S. (2006). *Research in education evidence-based inquiry (6th ed)*. Pearson Education. Boston.
- Nykiel-Herbert, B.** (2004). Mis-constructing knowledge: The case of learner-centred pedagogy in South Africa. *Prospects*, 34(3), 249-265.
- O'Neill, G & McMahon, T.** (2005). Student–Centred Learning: What does it mean for students and lecturers? In: *Emerging Issues in the Practice of University Learning and Teaching*. O'Neill, G., Moore, S., McMullin, B. (Eds). Dublin: AISHE.
- Opie, C.** (2004). Research procedures. In Opie, C (Ed). *Doing Educational Research*. Sage. London. 5, 111- 128.
- Piaget, J.** (1964, 2003). Development and learning. *Journal of Research in Science Teaching*, 40, 8-18.
- Pillay, S.** (1998). Science teacher educators: A shift towards student-centredness. *Journal of Education*, 28(3) 38-46.
- Rogan, J. M** (2007). An uncertain harvest: a case study of the implementation of innovation. *Journal of curriculum studies*, 39(1), 97 -121.
- Saiti, A.** (2007). An assessment of the impact of university intervention for improving the teaching of science and mathematics in community day secondary schools in Malawi. A paper presented at the second African Regional UNESCO Forum on Higher Education, Research and Knowledge 22nd-24th March. Accra, Ghana.
- Setati, M.** (2005). Researching teaching and learning in school from “with” or “on” teachers to “with” and “on” teachers. *Perspectives in Education*. 23 (1), 91 – 102.
- Sikes, P.** (2004). Methodology, procedures and ethical concerns. In C. Opie (Ed.), *Doing educational research* (58-72). London. SAGE Publications.
- Soy, S. K.** (1997). *The case study as a research method*. Unpublished paper. University of Texas at Austin.

- Scaife, J.** (2004). Reliability, validity and credibility. In Opie (Ed). *Doing Educational Research*. 58-72. Sage. London.
- Scott, P,** Asoko, H., Driver, R. & Emberton, J. (1994). Working from Children's ideas: Planning and teaching a chemistry topic from a constructivist perspective. In Fensham, P., Gunstone, R & White, R. *The Content of Science: a constructivist approach to its teaching and learning*. (201-220). London: Falmer Press.
- Scholtz, Z;** Watson, R; & Amosun, O (2004). Investigating science teachers' response to curriculum innovation. *African Journal of Research in SMT Education*. 8(1), 41 – 52.
- Schreuder, D** (1998). Science teacher educators: A shift towards student-centredness. *Journal of Education*, 28(3), 38-46.
- Spangler, B** (2003). "Facilitation." *Beyond intractability*. Eds. Guy Burgess and Heidi Burgess. Conflict research consortium, University of Colorado, Boulder.
- Stake, R.E.** (2006). *Multiple case study analysis*. The Guilford Press. USA.
- Stoffels, N.T.** (2005). Why teachers do what they do? Exploring teacher decision-making frames in the context of curriculum change in South Africa.
- Stoffels, N.** (2008). Why do teachers do what they do. In *Weber, E: Educational change in SA. Reflections on local realities, practices and reforms*. Rotterdam. South Africa.
- Tobin, K.,** Tippins, D.J. & Gallard, A.J. (1994). Research on instructional strategies for teaching science. In D.L. Gabel (ed.), *Handbook of Research on Science Teaching and Learning* (pp 45-93). New York: MacMillan Publishing Company.
- Von Glasersfeld, E.** (1989). An exposition of constructivism: why some like it radical. In Davis, R.B., Maher, C.A. and Noddings (Eds). <http://www.oikos.org/constructivism.htm>
- Vygotsky, L. S.** (1978). *Mind in society. The development of higher psychological processes*. Cambridge, MA: Harvard University Press. 6, 79 - 91.
- Wertsch, J. V.** (1984). The zone of proximal development: some conceptual issues. In B. Rogoff & J. V. Wertsch (Eds). *Children's learning in the "Zone of Proximal Development"*. 7-18. San Francisco, Jossey Bass.
- Wertsch, J. V.** (1985). The social of higher mental functions. In Wertsch, J. V, Vygotsky and social formation of mind. Cambridge., Harvard University Press.
- Wohlfarth, D.,** Sheras, D., Bennett, S., Simon, J., Pimentel, B & Gabel, E. L (2008). Student Perceptions of Learner-Centered Teaching. *A Journal of Scholarly Teaching* (3) 67-74.

Appendices

Here I present the letters sent to the headmaster, teachers and the parents. I also present the observation schedule and interview guide as well as the categories used in the analysis of the data. Some of field notes from lesson observation, Interview transcript for teachers and lesson transcript of recorded lessons.

Appendix A: Information sheet for the school principal

Research study on the facilitation strategies that the three life science educators use to implement learner-centred teaching and learning

I (Mukatuni Gumani Enos) am conducting research for my MSc degree at the University of the Witwatersrand. I am carrying out a study that investigates the facilitation strategies that the three life science educators in grade 11 use to implement learner-centred teaching and learning.

I would therefore like to observe five lessons of each teacher paying attention to the strategies they use to facilitate learner-centred teaching and learning. I would also like to interview these teachers on their understanding of the facilitation strategies that they use to implement learner-centred teaching and learning. I would like to tape-record the proceedings of the interviews in order to save time if they allow me to do so.

My research will benefit your school in that the responses from the three life science teachers will contribute to an understanding of the facilitation strategies that your teachers use to implement learner-centred teaching and learning. This will hopefully also assist teachers, school principals and subject facilitators to address the issues or difficulties associated with the teaching of the current National Curriculum Statement.

If you allow your school to take part in my study, I would like to make it clear that your participation is entirely voluntary, no negative consequences will result from your participation, and all information will be treated with confidentiality. If you do accept to participate, please remember that the three life science teachers may decline to answer any questions, and you may withdraw from the study at any time. In order to protect confidentiality, all names I use in my research report and in any other publication arising from this research will be fictitious.

I will provide you with a summary of my research results on completion if you would like me to. Do not hesitate to contact me for any correspondence arising from this letter

Cell: 082 515 5412 Work: 011 882 1734

Email address: gumani@webmail.co.za

Yours faithfully

Mukatuni G. E

Signature: _____

Informed Consent Form for school principal

Research study on the facilitation strategies that the three life science educators in grade 11 use to implement learner-centred teaching and learning

I, _____ consent to the research conducted by Mr Mukatuni Gumani Enos on the facilitation strategies that the three life science educators in grade 11 use to implement learner-centred teaching and learning. I realize that no negative consequences will arise as a result of my school's participation in this study, and that the study is being conducted for purposes of improving the teaching of life sciences in South African schools. I give permission for the material to be used for research or teaching only. My school participates voluntarily and I understand that my school may withdraw from the study at any time.

Interviews:

I further consent to my three life science teachers being interviewed and tape recorded as part of the study. I also understand that the teacher has the right to review the notes made of the interview before these are used for analysis if s/he so choose. The teacher can delete or amend any material or retract or revise any of their remarks. Everything the teacher says will be kept confidential by the interviewer. S/he will only be identified by a pseudonym in the research report. In addition, any persons they refer to in the interview and the name of the school will be kept confidential.

Observations:

I consent to notes being made of classroom observations of the grade 11 life science lessons, and the use of these notes for research purposes only. All references to the teacher will be anonymous. The teacher will be identified by a pseudonym if specific reference is made to his / her views. The school will also be identified by a pseudonym if specific reference is made to it. The data collected will be destroyed after 3 years.

Name: _____

Signature: _____

Date: _____

Appendix B: Information sheet for teachers

Research study on the facilitation strategies that the three life science educators use to implement learner-centred teaching and learning

I (Mukatuni Gumani Enos) am conducting research for my MSc degree at the University of the Witwatersrand. I am carrying out a study that investigates the facilitation strategies that the three life science educators in grade 11 use to implement learner-centred teaching and learning.

I would therefore like to observe five of your lessons paying attention to the ways in which you facilitate learning through various teacher-pupil interactions I would also like to interview you in order to find out your understanding of the facilitation strategies that you use to implement learner-centred teaching and learning. I would like to tape-record the proceedings of the interviews in order to save time if you allow me to do so. All data from this research will be destroyed after three years.

My research will benefit your school in that the responses from the three life science teachers will contribute to an understanding of the facilitation strategies that some teachers use to implement learner-centred teaching and learning. This will hopefully also assist teachers, school principals and subject facilitators to address the issues or difficulties associated with the teaching of the current National Curriculum Statement.

If you take part in my study, I would like to make it clear that your participation is entirely voluntary, no negative consequences will result from your participation (including no negative job implications), and all information will be treated with confidentiality. If you do accept to participate, please remember that you may decline to answer any questions, and you may withdraw from the study at any time. In order to protect confidentiality, all names I use in my research report and any other publication arising from this research will be fictitious.

I will provide you with a summary of my research results on completion if you would like me to. Do not hesitate to contact me for any correspondence arising from this letter

Cell: 082 515 5412 Work: 011 882 1734

Email address: gumani@webmail.co.za

Yours faithfully

Mukatuni G. E

Signature: _____

Informed Consent Form for three life science educators

Research study on the facilitation strategies that the three life science educators use to implement learner-centred teaching and learning

I, _____ consent to participate in this study conducted by Mr. Mukatuni Gumani Enos on the facilitation strategies that the three life science educators in grade 11 use to implement learner-centred teaching and learning. I realize that no negative consequences will result from my participation in this study, and that the study is being conducted for purposes of improving the teaching of life sciences in our schools. I give permission for the material to be used for research or teaching only. I participate voluntarily and understand that I may withdraw from the study at any time.

Interviews:

I further consent to being interviewed as part of the study. I also understand that I have the right to review the notes made of the interview before these are used for analysis if I so choose. I have the right to delete or amend any material or retract or revise any of their remarks. Everything I says will be kept confidential by the interviewer. I will only be identified by a pseudonym in the research report. In addition, any persons I refer to in the interview and the name of the school will be kept confidential.

Observations:

I further consent to being observed while teaching grade 11 life science classes as part of the study. I also understand that I have the right to review the notes made of my teaching before these are used for analysis if I so choose. I can delete or amend any material or retract or revise any of my remarks. Everything I say will be kept confidential by the researcher. I will only be identified by a pseudonym in the research report. In addition, any persons I refer to in my teaching and the name of the school will be kept confidential. The data collected will be destroyed after 3 years.

Name: _____ **Signature:** _____ **Date:** _____

Consent to audio recording

I **do/do not** consent to having my interview recorded

Name: _____ **Signature:** _____ **Date:** _____

Appendix C: Information sheet for the parents

Research study on the facilitation strategies that the three life science educators use to implement learner-centred teaching and learning

I (Mukatuni Gumani Enos) am conducting research for my MSc degree at the University of the Witwatersrand. I am carrying out a study that investigates the facilitation strategies that the three life science educators in grade 11 use to implement learner-centred teaching and learning.

I would therefore like to observe five lessons conducted by each teacher, paying attention to the ways in which teachers facilitate learning through various teacher-pupil interactions. Your child will be in the class which I observe. I would therefore like to ask for your permission to observe your child during teaching and learning.

My research will benefit your school in that the responses from the three life science teachers will contribute to an understanding of the facilitation strategies that some teachers use to implement learner-centred teaching and learning. This will hopefully also assist teachers, school principals and subject facilitators to address the issues or difficulties associated with the teaching of the current National Curriculum Statement.

If you allow your child to take part in my study, I would like to make it clear that his/her participation will be entirely voluntary, no negative consequences will result from his/her participation, and all information will be treated with confidentiality. If you do allow your child to participate, please remember that your child may withdraw from the study at any time. In order to protect confidentiality, all names I use in my research report and any other publication arising from this research will be fictitious.

I will provide you with a summary of my research results on completion if you would like me to. Do not hesitate to contact me for any correspondence arising from this letter

Cell: 082 515 5412 Work: 011 882 1734

Email address: gumani@webmail.co.za

Yours faithfully

Mukatuni G. E

Signature: _____

Informed Consent Form for parents

I consent to notes being made of classroom observations of the grade 11 life science lessons in the present of my child and the use of these notes for research purposes only. All references to my child will be anonymous. My child will be identified by a pseudonym if specific reference is made to his / her views.

I **do/do not** consent to observation

Name: _____ **Signature:** _____ **Date:** _____

Informed Consent Form for learners

I consent to notes being made of classroom observations of the grade 11 life science lessons in which I participate, and the use of these notes for research purposes only. All references to me as a learner will be anonymous. I (learner) will be identified by a pseudonym if specific reference is made of my views.

I **do/do not** consent to observation

Name: _____ **Signature:** _____ **Date:** _____

Appendix D: Semi-structured interview

Teacher: _____ Class: _____

Learning

area: _____ date: _____

Thank you for agreeing to participate in this academic research. You are welcome and feel free to participate. The topic of my research is the facilitation strategies that the three life science educators use to implement learner-centred teaching and learning. This interview will be about your understanding and use of facilitation strategies as you attempt to implement learner-centred approaches to teaching and learning.

1. What is your understanding of facilitation in teaching?
2. Which facilitation strategies do you use in your classroom?
3. What is your role as facilitator in the classroom?
4. Do you think facilitation is 'easy' or 'difficult' to apply in the classroom practice?
- 4.1 (if easy or difficult) please explain why it's easy/ difficult to apply.
5. Which of the teaching and learning approaches do you prefer when teaching?

i.e. question and answer, group work etc
6. Do you use learners' prior knowledge to enhance teaching and learning?
7. What type of questions do you prefer to ask learner during the lesson?
8. During the lesson, do you encourage learners to engage in dialogue, both with you (the teacher) and with one another?

Appendix E: Observation guide

The facilitation strategies do three life science educators use to implement learner-centred teaching and learning

Teacher: _____ Class: _____

Learning

area: _____ date: _____

TOPIC:

INTRODUCTION:

BODY:

CONCLUSION:

1. Teacher-pupil interaction (NB: enough space was created during data collection)

1.1. Using learners' prior knowledge

1.2. Allowing learners' responses to drive lessons

1.3. Teacher uses physical experiences and concrete models

1.4. Encouraging learners to engage in dialogue, both with the teacher and with one another

1.5. Asking thoughtful, open ended questions

1.6. Classroom interaction

1.7. Learner arrangement and other contextual factor

Appendix F: Interview transcript for Mr Jack

Interviewer: Thank you very much, thank you very, very much for agreeing to participate in this academic research.

Mr Jack: Ok

Interviewer: You are welcome and feel free to participate, the topic of my research is the facilitation strategies that the life science educators implement in the learner centered teaching and learning. This interview will be about your understanding and the way you use different strategies in your teaching. So I have got few questions to ask you, the outcomes of this interview are not that detrimental to your career

Mr Jack: Alright

Interviewer: This is just an academic research, is meant to find out something as part of my studies, feel free whatever that I will write about you will be an anonymous.

Mr Jack: Ok

Interviewer: So, tell me what is your understanding of facilitation in teaching and learning?

Mr Jack: To facilitate is to use words which makes people to understand whatever that you are teaching, or is to make learners to learn or to change their behavior, and enhance you use different ways to make them understand that what you want to achieve

Interviewer: So what does it mean to facilitate?

Mr Jack: To facilitate is simply means using methods which will enables learners to understand data in the lessons.

Interviewer: Ok, thank you maybe you are right but I am not sure, we will find out, what facilitation is? So you have raised the issue of different method so are methods strategies to you?

Mr Jack: Ah, those is difficult to separate these things

Interviewer: Ok, if they are the same, which facilitation strategies do you use in a classroom?

Mr Jack: Err, the facilitation usually, sometimes you can use group works, sometimes they can work in pairs, sometimes you can demonstrate, sometimes you can explain the teacher himself you can explain the terms, where they don't understand, so it varies.

Interviewer: Ok, so tell me, what exactly do you do to make learning easier?

Mr Jack: For the learners?

Interviewer: Yes, for the learners

Mr Jack: You start from simple to complex, you try to give them what they understand, try to give them example of what they live, give them example of what they know, things that are within their environment, then from there you can recap from the previous lessons or you can use those things to be able to help you to explain what you want to do, because is easy for them to use the example that they experience in a day to day life, so that they can easily understand the concepts, so you move from simple then from there you introduce the topic as you move on to the complex.

Interviewer: Ok, so as a teacher what is your role as a facilitator in a classroom situation?

Mr Jack: The role is to cater for all learners to see, to accommodate the slow, the gifted ones, the intelligent ones, so your role is to try and use various methods which make all various group of learners to understand, that's facilitation, so you realize that maybe you can explain something that they fail to understand it from educator's point of view, but maybe if you can ask another learners to explain then the learner can be able to understand easily or maybe by using the vernacular language or the learner can use another way to make the other learner to understand. Is simple means to identify ways to make learners to understand?

Interviewer: Which ways are you referring to like?

Mr Jack: The ways like teaching method, like I said pair, you can say they work in pairs, if you realize that all they are down learners you can to try to maybe bring in the better learner, one learn from the other, or you can make group work or sometimes learners comes to demonstration, sometimes the teacher can demonstrate, the learner explain or the teacher explain or questioning and answering all the questions.

Interviewer: Ok, so is like you have touched some of the approaches you know?

Mr Jack: Yes

Interviewer: So, can you list some of this approaches you know?

Mr Jack: Which approaches?

Interviewer: Which teaching approaches do you know?

Mr Jack: I, usually recapping, am very important, trying to recap from the previous lessons, pair work, the following day you can give them explanation or you can introduce the topic by give the answers in the following day. You can use demonstration where the teacher demonstrate how they do this things like let's say section of kidney so you show them how to cut the kidney, you have to show them the precaution, you have to highlight the precaution to them, sometimes there is a need to demonstrate to them, there is also

need for group work when they do experiment so that they understand the definition had to make sure that you consolidate that information by practical and they see it, so use demonstration, practical, group work, pairs and experiment, explanation and answering and questions

Interviewer: SO I can see there are many that you know, many learning approaches you know, so which of the list that you know do you prefer?

Mr Jack: Which one

Interviewer: Which of the following approaches do you prefer?

Mr Jack: Mostly, you see that's why I say it varies it depending with topic. There are topics which prefer recap on the explanation like when you are doing capacity. Drainage. You have to explain and practical, so that they can see it. So it varies the topic are the one which determine the methodology or strategies so you can't usually have one.

Interviewer: So can you explain to me why do you prefer the recap?

Mr Jack: Recap is very important, it give the learners a challenge so that if you teach them today they go and read because they know that tomorrow you are going to ask question on what they have learned today, so to some it motivate also the learner give a correct answer you give a positive comment, you are also installing confident in the learner, in the entrance in the subject, so recapping is important why, it enables the learners to read always.

Interviewer: how do you recap?

Mr Jack: Recap?

Interviewer: What does that mean?

Mr Jack: recap is either when you are concluding a lesson you can conclude by give and ask them the questions, so the idea is to prepare because the learners will be commenting from another topic. So you must prepare them, asking them two or three question then you get the attention then you can move to another topic.

Interviewer: That's a form of a prior-knowledge, so do you use a prior-knowledge, a learner's prior knowledge to enhance teaching and learning.

Mr Jack: yes, prior- knowledge is different from recapping prior- knowledge is what they know from let's say we are talking of a concentrate solution you talk of it you add more whatever some of the sugar will not dissolve, so prior knowledge is from what they know and you introduce the topic. So, prior knowledge is the things that they know so it varies.

Interviewer: so, I wanted to know, do you use the prior-knowledge from other subject,

Mr Jack: so can link it to the topic that you want, so they can also do it at home. Like at home they use the spoon but in a science we use the spatula. Like when you add sugar in a hot water it dissolves fast than when you use cold water.

Interviewer: So which question do you like, do you like open ended question or close ended question?

Mr Jack: Usually is like at first they must use close ended question because open ended question is difficult.

Interviewer: So why close ended question at first?

Mr Jack: At first, because you want to try to motivate them, like when you are doing biodiversity so you are moving on now. Then you have to explain then you are moving from simple to a complex.

Interviewer: So you usually use close ended question?

Mr Jack: Yes, open ended question is difficult for the learners to express themselves in English. So you have to explain but if you are using the close ended question, you as a teacher at the same time have to explain to the learners.

Interviewer: so during the lesson Mr Jack do you encourage the learners to engage in a dialogue or discussion?

Mr Jack: yes, like what I said; they can work in a pairs, it means they can, their talking is a learner to learner interaction, people to people interaction and group work is a learner to learner interaction, the teacher will be always moving to give them guidance and say no here is what you are suppose to do. And at the same times the learners themselves you are giving them responsibility, so that they organize themselves like saying this one will set an apparatus, this one is going to write the answers so they organize themselves. Can also even ask the other learners

Interviewer: How do you encourage them to do discussion with you or dialogue with you as a teacher?

Mr Jack: So learners usually you must always give them time so that they can also talk to themselves.

Interviewer: Learner learner?

Mr Jack: Yes, learner to learner then the teacher to give them guidance, so that the teacher is there to correct, that's the duty of the teacher.

Interviewer: Alright Mr., so I think you have explain fully but I have got one last question, so do you think facilitation is easy or is tough practical?

Mr Jack: Err! It varies now, you see the thing which is important is class management, facilitation it is well managed you must make sure that people who are friends you move them away from each other, make sure that the good the one that are intelligent are paired them with the other one which are less intelligent, err you try to give them access, when you give them the duties you say to them you the one I want you to write down what your group is doing, boost the self esteem, manage them, is how you manage them, you must know them because if you just say sit in pair, go into group of five they can choose themselves into friends and they will end up talking about soccer, talk stories of neighborhood, and they won't do anything, so is a question of how good you are in the classroom.

Interviewer: So, do you have any part point maybe to can say facilitation is difficult when it comes to the classroom?

Mr Jack: Yes, if it is not done properly, like when you don't group them properly, if you don't pair them properly, because at the end of the lesson you will find that they have done nothing but it is properly managed by the teacher is usually simple your group them, enemies you group them together they have got a common business, they have got a common goal, then is good.

Interviewer: So is facilitation easy in your environment?

Mr Jack: Are you saying in a class?

Interviewer: Yes, in the class.

Mr Jack: It depend in what we call the size of the class, like if the number of the learners is less you can do it in the classroom.

Interviewer: Less like how many?

Mr Jack: Like 30 to 35 it can be done, but if they are more than that it becomes a problem, it will needs a lab where there is more space, in the class it will take time for you to group the learners.

Interviewer: So in terms of the text book, are your learners owning text book all of them?

Mr Jack: Yah! The problem is that some of them there no longer come with the text book in the classroom; we don't know whether they have sold them.

Interviewer: Do text book help you to facilitate?

Mr Jack: Yes, text book help the only problem is that our learners have is their attitude; they are not used to read on themselves.

Interviewer: Alright, that was my last question I wanted to know. Ok thank you Mr. is there anything that maybe you want me to know. Or is there anything's that I should improve on. How was the interview?

Mr Jack: No, I think it was ok, it was the challenging on. I think you have done properly because each and every question was developing from the previous one.

Appendix G: Interview transcript for Mrs Collen

Interviewer: Ok, thank you very much, thank you for agreeing even though the vibe/sound of the vuvuzela, everything for world cup is happening, is here, we are feeling it. Thank you for participating in this academic research, feel free, say whatever you know about what am going to ask you.

Mrs Collen: Ok, you are welcome

Interviewer: So the topic of my research is facilitation strategies that life sciences educators use to implement learner centered teaching and learning, that's my topic.

Mrs Collen: Ok!

Interviewer: The facilitation strategies that life sciences educators use to implement learner-centered teaching and learning, and the purpose of this interview I to find out your understanding of facilitation and the use of facilitation strategies when you teach, that's what I want to know

Mrs Collen: Err! Ok.

Interviewer: So like I said is an academic research. This interview won't have any impact on your work related matters, is just an academic research, so feel free.

Mrs Collen: Yah

Interviewer: So my first question is what is your, Mrs Collen what is your understanding on facilitation and teaching?

Mrs Collen: Eer! Basically facilitation is a process whereby the teacher as a facilitator is going to create an environment which is conducive for the learning, so in other words basically as opposed from lecturing and standing in front of kids and teaching, you just create an environment whereby learners themselves are going to be doing more than as a facilitator you only guide where they have problem but most of the activity are done by the learners. So, you are there as a person who is going to guide and create a conducive environment for the learning process.

Interviewer: SO, what does it mean exactly to facilitate?

Mrs Collen: Eer! To facilitate is to, how did I put it, is to help something to happen. When you facilitate you are not answering or you are not presenting but you are creating an environment so that whatever is about to happen is going to happen.

Interviewer: Ok, so that was my first question. So my second question is which facilitation strategies do you use in your classroom situation?

Mrs Collen: Eer! They can use the discussion, when there is a topic you created and learners have to discuss amongst themselves and then you are there to guide them. You can also use the life science experimentation like what they are actually doing and then you are there to guide them and help them where there is a problem, but they are actually involved doing the activity in the classes or the even the classwork is part of the learning process, the method you can use to facilitate.

Interviewer: But which one are, makes learning easier for you in a classroom? Which one makes learning easier?

Mrs Collen: Eer, the discussion when you give term to discuss the topic, so you present to them a problem in the class, so they actually help themselves and they get actively get involved in the learning process rather than standing in front of them in the classroom teaching all the time thinking maybe they understand but instead they don't understand.

Interviewer: So discussion to you makes learning easier?

Mrs Collen: Yes

Interviewer: Why?

Mrs Collen: No, when they discuss they understand better when their peer explain to concept incase of a barriers, so when they actually explain better than you using English.

Interviewer: Ok, so discussion makes learning easier in the class?

Mrs Collen: yes

Interviewer: So what is your role as a facilitator in the classroom?

Mrs Collen: Err, to make sure that in the case of, discussion there is order, because if they are not being controlled you might find that they are discussing something which is not have given them, so you are there to monitor.

Interviewer: Ok, beside discussion what other do you play as a facilitator?

Mrs Collen: Ah! Well actually you are a monitor because is not just discussion they also have to write, so you have to monitor if they are doing what they are suppose to do.

Interviewer: Alright, so there are numbers of teaching approach that can be applied in a learning situation. Can you give the teaching approaches that you know?

Mrs Collen: Eer! There is a lecture method that you can have to explain the concepts. There is a discussion method whereby you just present the work to them then they discuss, and we also have the demonstration method and are also having.....ah I forget.....what else

Interviewer: Ok, it's fine, you have raised the discussion, is that the groupwork?

Mrs Collen: Groupwork, Not necessary the same, you can have them discuss in the classroom and you can have them doing groupwork somehow, somewhere involve discussion.

Interviewer: Yah! So which one do you prefer of the teaching approach that you have stated?

Mrs Collen: is actually a combination, because they are some, you can't really say this is the only method which you are to apply it depend on the circumstances you might find that in some cases you need to do a discussion and in other cases you need to explain the concepts, so you have to use a combination of those methods.

Interviewer: Why combining them?

Mrs Collen: SO that you cater for all the learners, because some times you find that just lecturing some learners won't understand but they understand better if they get involved in a discussions.

Interviewer: Ok! Is this process very difficult, I mean facilitation processes is it very difficult or is it easy?

Mrs Collen: It depend on the number of learners, sometimes you might find that if you are dealing with a very large group and in some cases you find it difficult. So in a reasonable group it is going to be easy/or the best.

Interviewer: In a reasonable group? Like how may?

Mrs Collen: At least 35 to 40 is going to work, but if you are having 50 learners and above it becomes very difficult.

Interviewer: So, why do you think it's easy if they are few learners?

Mrs Collen: Because you can easily monitor or you can easily move around and monitor them.

Interviewer: Ok, So one other thing that we normally use is prior-knowledge

Mrs Collen: Of?

Interviewer: Of learners' prior-knowledge, of learners' previous knowledge, you have also touched the issue of dialogue which is part of the discussion

Mrs Collen: yes

Interviewer: SO tell me, do you use learner's prior knowledge in your teaching and learning?

Mrs Collen: Yes, that's very important because if you are to go to introduce a topic you find that this topic they are interrelated what you do, your approach is going to depend

on how much the learners know about that topic, what is their prior knowledge, so that you know where to start and how you are going to present that topic.

Interviewer: What exactly are you referring to? They are, the prior knowledge it might be in two ways, it might be from home or cultural background and from the previous lessons, so which one?

Mrs Collen: Is like when you are dealing with the prior knowledge from the subject or when dealing with prior knowledge from their background, like in biology if you are talking about let's say pollination of the Fiona that's the real life does the person know what flower is? That's the background you can take into consideration.

Interviewer: Can I safely say you use prior knowledge?

Mrs Collen: Yes, you do

Interviewer: How important is it in our lessons?

Mrs Collen: It is important because without the prior knowledge is like this person does not even have an idea, normally like let me take for an example maybe a concept of an atom to some body in grade 8, so that idea of an atom is not something which a person have already seen it or is something abstract so that you have to take advantage into consideration. So not like when we are talking about like let's say a digestion so we talk about a stomach

Interviewer: mmh, (listening)

Mrs Collen: So they have an idea of what a stomach is.

Interviewer: Ok, so do you usually ask learners questions?

Mrs Collen: Yes

Interviewer: Which questions, open ended question or closed ended questions? Why do you ask them?

Mrs Collen: And again I think it depend on what you can ask them , the investigation questions, where you really want to find out whether their knowledge, to find out how much do they know about something, they say as much as they can.

Interviewer: Ok, but which one do you normally use in a classroom situation.

Mrs Collen: Eer, the open ended questions are the most questions I use, like describe, discuss, and explain, although the other time you have to use the close ended questions.

Interviewer: Ok, somewhere in our interview you have raised the issue of discussion, to say you allow learners to discuss. Yes what is it that you allow them do you allow learners themselves to discusses?

Mrs Collen: The discussion actually can be controlled at the class or maybe you pose a question in the class and then they can actually discuss as a group and is good

Interviewer: So how helpful is discussion amongst learners themselves?

Mrs Collen: It is helpful because if sometimes they are involved in a discussion they help each other

Interviewer: Do you encourage learners to have discussion with you?

Mrs Collen: You mean during learning process?

Interviewer: SO how is that helpful?

Mrs Collen: It is helpful because it give them the chances or the whole class to get involved and they learn more and it shows that they will be learning something from me or from that discussion rather than sit down and keep quite

Interviewer: Ok, anything that you would like to tell me in general?

Mrs Collen: Yah, what I can say is facilitation is although it has some disadvantages but it actually gives the learners opportunities to get involved in the learning process. So you give them the work to do so is what we call a learner centered approach of teaching so you do less and learners do more.

Interviewer: Ok, thank you Mr Collen, so one or two things, how was the interview was it difficult or where a place that I have to push you.

Mrs Collen: No, it was fine

Interviewer: Ok, thank you very much, those was few question that I wanted to know, thank you

Mrs Collen: You are welcome

Appendix H: Lesson transcript of recorded lesson of Mr. Jack

(Lesson was based on a model of Human skeleton)

Mr Jack: Ok, where is your long bone, who can show me, where is your long bone?

Learner: here, here (learner pointing at leg)

Mr Jack: Ok a numerous is long bone. Bones such as humerus and femur are called the long bones. Open your book brother, you have been crying for a book and I gave it to you.

Learner: Ok sir

Mr Jack: Alright, now the heads are made up of type of bones called a spongy bone. How is a spongy?

Learner: Soft

Mr Jack: Soft, and then the heads are covered by a cartilage referred to as a articular cartilage. So when you check at that cartilage there is something a whitish thing, that is a cartilage how is it when you eat it?

Learner: Xwap.... Xwap...xwap (sound)

Mr Jack: So you label it or after eating make sure that you label that long bone. Alright the shaft of the bone is made up of certain bone tissue called the compact bone. Can you see the compact bone there?

Learner: Yes

Mr Jack: In the drawing there? Can you see it?

Learner: Yes

Mr Jack: That is it, and then the compact bone is covered by the endosteum. Endo means?

Learner: Inside

Mr Jack: Inside there, and the periosteum is outside. So we have got the endo and the peri, that is inside and outside. So this is the structure of a long bone, it is a long bone. So you must know how to label this, you can even draw and label it. So most long bone have the central hollow cavity called a marrow cavity, so inside there you can see that there is a hollow there, isn't?

Learner: Yes

Mr Jack: So there is a marrow cavity. So you know what a bone marrow is? "Marrow" do you know what is it? If it is cooked it become brownish

Learner: "Marrow"

Mr Jack: A marrow yes. Fine let's go to the next page, page 59, what do you think? Do you think a bone is a living or non living thing?

Learner: Living

Mr Jack: Is a living because it is written there?

Learner: We didn't see it

Mr Jack: Ok it means you are good then. Ok tell me why are you saying the bone is a living thing? What do you think?

Learner: Because it can grow

Mr Jack: Yes, it can grow and then what else? It can grow; it is true, and what else?

Learner: it can be broken.

Mr Jack: No I didn't say that. So what can happen if someone hit you on the bone? What can happen?

Learner: We can feel the pain

Mr Jack: structure of a bone tissue on page 59, this is the one there. Let's move to down there, bone tissue forms which in tend to leg of skeleton of Fish, Amphibious, birds, reptiles, and mammals. Endo skeleton have got the following functions number one. It gives shape to the body, so that is obvious. So just imagine if you haven't endo - skeleton you won't have a shape. Number two, it protects the important internal organs, like what?

Learner: Large intestine, lungs and.....

Mr Jack: Heart and all this important organs are protected by these bones. It serves for the attachment of muscles. So it means our muscles are attached to the bones. So it means without the attachment of muscles bones cannot move. Look at that skeleton there, since we put it like that it is like that it cannot move, but if we can put some muscles and other stuff it can move. Fine it serve for the attachment of muscles, we have done that. The endoskeleton and muscles works together in bringing the locomotion, what is locomotion?

Learner: Movement

Mr Jack: is movement, it can be able to move. Your eyes can be able to move because of muscles. Ok it stores mineral salts, so mineral salts are stored in that bones inside that vats/that hollow cavity. Tiny bones in the middle ear it is a ear not hear there is a mistake there they are called obstacles, and are responsible for the transmission of sound. So when we do ear you will be able to see, outer ear, middle ear, and inner ear.

That's why I also discourage you not to put earphone because it can damage your ear drum. So you must limit that?

Learner: Yes

Mr Jack: Ok, I want you to read this on page 60, about bone marrow transplant. Find out what is going in here. So they can be able to transplant the bone marrow and give it to Fezeka there. So let's move, let's go to the cartilage, what is a cartilage again? What do you think?

Learner: It covers spongy bones

Mr Jack: How is it like?

Learner: Transparent

Mr Jack: Ok, what is the function of a cartilage?

Learner: To protect

Mr Jack: To protect what?

Learner: To protect spongy bones

Mr Jack: Ok, is fine, we have got three types of cartilage there. Number one we have got the high limb cartilage and then we have got white fibro cartilage and then we have got the yellow elastic cartilage. Ok let's see the location, where do we find this? Where are they located? The high limb cartilage, we find it at the end of bones as curricular cartilage at the tip of the nose. That is the voice box this is the one, if you have got the nice voice like as me. Don't be jealous. Alright is ring shape like, they are C shaped like. Fine let's see the white fibro cartilage are disc between the vertebrae, it means between the vertebra there are ring you will find disc, disc. Ok in the ring of the ball and socket joints. Just imagine if it was a bone and bone, it was going to make noise. There have to be a cartilage so that it can move smoothly. Fine let's move on.

Learner: Ah, Mr is exciting

Mr Jack: Fine you have to be excited. Ok let's see the function of as C shape cartilage acts as shock absorber, do you know car shock absorber. When the car moves when it reach the bumps it keeps the car balanced.

Learner: Ok, sir

Mr Jack: When a car turns it keep the car balanced?

Learner: Yes

Mr Jack: Ok let's move on. It deepen the socket by adding to the ring, it deepen so that the socket will be able to click nicely.

Learner: I left it home

Mr Jack: Am waiting to see your results, in this class. Ok so that's it that is the structure of a high limb cartilage, we have got the coned ring, the Latina we have got the coned side so that the structure there. Let's move to page 62, tendons, tendons connect muscles to bones. So this is our bones there, we need to have a muscles there, so we are going to have a tendons there between a bone and a muscles.

Learner: A bostick

Mr Jack: Like that. Fine let's see we have got the tendons and ligaments. These are two different things. So this is the structure they are made up of white fibre tissue, white fibres. Tissue intends a large number of a non elastic fibre. What is non elastic and what is elastic?

Learner: Something that can stretch.

Mr Jack: What are you afraid of? I can be able to see each of you. Ok let's move to the ligaments, ligaments are made up of the yellow elastic tissue, it means this one can be able to starch. This yellow elastic tissue enables the ligaments to starch....starchy....and starch.

Learner: Yes

Mr Jack: Ok, fine joints we have got two main types of joints. We have got what we call fixed joints which cannot move, and then we have got the other one which is called synovial joints the freely movable joints. It can be able to move, look here, this bone is it movable or immovable?

Learner: Movable

Mr Jack: Example, a skull can not be able to move and all these others ball and socket, pivot, gliding belongs to the second group called movable joint. Let's move to the third joints, no let's have a look at the synovial joints. Fine let's move, different types of joints and their location, ball and socket joints, where do we find it?

Learner: In a shoulder

Mr Jack: Gliding joint, where do we find the gliding joint, here can you see that?

Learner: We can see sir.

Mr Jack: Ok, fine, is not school out just relax, and revise. The period is over.

Appendix I: Lesson transcript of recorded lesson of Mrs Collen

(Lesson was based on a model of Human skeleton)

Mrs Collen: Alright, good day.

Learner: Good day sir.

Mrs Collen: Ok, is fine, alright let's continue, what is the ribcage?

Learner: Is s cage for ribs

Mrs Collen: Ok, cage for ribs, what else?

Learner: A cage that protect the heart

Mrs Collen: A cage that protect the heart. Where do we find the rib cage?

Learner: Here....here! (Chorus)

Mrs Collen: Here....here....here! Alright is fine, ok just tell me, how many ribs do you have?

Learner: Twenty-five, Seventy five

Mrs Collen: How many?

Learner: Pairs

Mrs Collen: I said how many? Don't tell me about the pairs, I said how many?

Learner: Twenty four

Mrs Collen: Twenty five?

Learner: Twenty four

Mrs Collen: Twenty four! You have got twenty four ribs, when we talk about twenty four we are talking about twelve pairs. What is a pair?

Learner: Something that match

Mrs Collen: Exactly! That is a pair. So it means you have twenty four ribs, so this ribs are divided he?

Learner: Yes

Mrs Collen: Let's see, firstly we have got the true ribs, false ribs, and then the third one?

Learner: Floating ribs

Mrs Collen: Floating ribs, you still remember I showed you this rib in that structure?

Learner: Yes

Mrs Collen: SO when you count, it means from rib number one, on top, you start on top there, that is rib number one, number 2, 3,4,5,6,7, we call this true ribs, fine?

Learner: Yes

Mrs Collen: From there, you said why? Why do we call them true ribs? You still remember I told you?

Learner: Because they are directly attached to the sternum.

Mrs Collen: Yes, they are directly attached to the sternum

Learner: Both is directly are directly attached to the sternum

Mrs Collen: Ok, fine and then let's come to false ribs, it means from eight to twelve we call these false ribs. Why do we call them false ribs?

Learner: Because they are not directly attached to the sternum

Mrs Collen: They are attached but indirectly, right, is fine. Ok the last one is? A: Floating ribs; why a floating ribs?

Learner: Because they are just floating

Mrs Collen: Ok, they are just floating, let's go to the next page people, we are not going to go through reading and reading that because we have already done that. Ok, who can tell me, what is this?

Learner: Artificial of ribs with vertebra and sternum.

Mrs Collen: Ok, let's see, who can tell us? Which part? Who can tell me?

Learner: The top one

Mrs Collen: Where? Here?

Learner: No

Mrs Collen: Which one?

Learner: The first one

Mrs Collen: Exactly, the first one, ok look at that, can you see the sternum there? Look at the sternum there?

Learner: Yes

Mrs Collen: And then we do have the coastal cartilage, you still remember that is not ribs that go straight and just there, we do have the coastal cartilage, do you know a cartilage, what is a cartilage?

Learner: Is white and bone like

Mrs Collen: Can you eat a cartilage?

Learner: Yes

Mrs Collen: Ok, that is a cartilage, so you can be able to you know what?

Learner: Yes.

Mrs Collen: Ok, fine, let's move that's life science. Alright let's move..... Let's go to page 50. Ok very nice, they picture a girdle, we have got the vertebra there that we know and then we have got the clavicle, what another, what is another name of a clavicle?

Learner: Is a shoulder bone

Mrs Collen: It's a shoulder bone So what is a different between a shoulder bone and a collar bone.

Learner: A shoulder bone is like this sir.....laughing

Mrs Collen: Ok, what is this?

Learner: Ok, clavicle that is a clavicle there and then we have got a glenoid cavity, glenoid cavity. What is a cavity? Something like a curve

Mrs Collen: It's a curve, yes is a curve, when we are talking of a cavity it means, something. It means whatever is going to join here; it must be of the correct size?

Learner: Yes (laughing.... Laughing)

Mrs Collen: No, it must have some space there, like this so that it must be able to fit. Ok that is a glenoid cavity, and then we have got a scapula, what is another name of a scapula?

Learner: Shoulder blade

Mrs Collen: A shoulder blade, shoulder blade, let's go to the upper limb there, and we are going to number of bone there. Ok that's it. We do have a scapular there on top, that is a numerous, that is an elbow joints, and then we have got the radius, and then we have got eight cabals, now we are coming to numbers here, if I ask you how many carpals, you must say eight, they are eight, we have got the meta carpals bones, if I remember very well I have got this, who knows my table just go to my table, you will get a big envelope, is for X-ray. I just want to show you. Ok, we have got a meta carpals, how many meta carpals there?

Learner: Five

Mrs Collen: Five of them, and then we have got the thumb and the phalanges there. Alright let's go to this, let's do this, the numerous fits into the glenoid cavity forming a ball and socket joints, you still remember I told you that it must be like this. So that it will be able to move. I can see that you are much exited.

Learner: Laughing....laughing

Mrs Collen: Ok, the radius and ulna make up the fore arm and then look there, the ulna have a notch, like this a notch it means something should be able to get in and click there, this is going to joint there. Can you see the joint? Where is it?

Learner: Yes

Mrs Collen: Where is it? That is what we are talking about. Can you see that?

Learner: Yes

Mrs Collen: Fine, let's move, down there we have got eight cabals and then we have a gliding joint, gliding joint, you know something that is gliding? How is gliding? Something like this, let's say we have got something down and another thing on top they can glind. Ok let's go to page 63, I just want to show you the glinding. Can you see the glinding? How is moved?

Learner: Yes

Mrs Collen: And then the hinge joint, is like this, can you se the hinge joint? I wanted to show you this, there is a boy by the name of Simpiwe Stemmer, and he once got injured. I took this, so you can be able to see the cabals, the meta carpals and the phallanges and radius and the ulna. You know Stemmer?

Learner: Yes, we know him.

Mrs Collen: Ok, let's continue guys, we will just move it around so that you will be able to see it because is a real thing. Fine we have got the phalanges there, how many phalanges there?

Learner: Fourteen

Mrs Collen: Ok, 14 there, fine, move let's have a look at the pelvic girdle, pelvic gurdle.....

Learner: Which page sir?

Mrs Collen: Can you see the pelvic girdle, we have got the lumber vertebra, we have got illium, and you can be able to feel this

Learner: sir?

Mrs Collen: remember this is the only subject that you can be able to touch one another.

Learner: Yes sir (Laughing)

Mrs Collen: Ok, let's move then, let's see, let's have a look at a lower limb, ok it is written each leg or lower limb is make up of this, we have got the , fumer, the tibia, and then patella, tussals, meta tarsals, and phalanges, ok let's see there, on to there, that's is a Sacrum, the illium, the cocies, look at that the coccus in that err pelvic gurgle is not easy to see, and don't get confused people it is like that. And then the cubic hairs, the cubic err ok (Laugh)

Learner: Laughing....Laughing

Mrs Collen: And then we have got the hip joint, a hip joint, which is a hip joint. A hip joint is also called a ball and socket joint, that is ball and socket joint. So you must respect that joint because it makes you to move, and to stretch.

Learner: We have to do an obligation

Mrs Collen: Ok that's a femur, patella and then the tibia. You must know the structure, you must know the structure there, it is very clear there. Ok let's see the number of bones there. Let's see bulleting number three, there they say we have got how many tarsals?

Learner: Seven

Mrs Collen: Seven, what is the different between this one and that one, the limb this one there the upper limb and the lower limb, when it comes to carpals and tarsal?

Learner: The other one have eight and the other one have five

Mrs Collen: Fine, and then they are forming a gliding joint, which is a gliding joint there, we have got the five Meta tarsals and then there we have got fourteen phalanges. Ok if I may ask you, how many types of joint do you know, what is it that you are going to say? What can you say?

Learner: Ball and socket joint

Mrs Collen: And?

Learner: Hip joint

Mrs Collen: Yes?

Learner: Gliding joint

Mrs Collen: And then? What else?

Learner: Elbow joint

Mrs Collen: Fine, ok, I think for now we can stop here.

Appendix J: Lesson transcript of recorded lesson of Mr Phillips

Mr Phillips: Alright, good morning

Learner: Good morning sir

Mr Phillips: How are you?

Learner: Fine and you sir

Mr Phillips: No, I can see you are now smiling, you are happy because is raining

Learner: No

Mr Phillips: Or you are worrying because err....obviously

Learner: Laughing

Mr Phillips: Alright, err, so what I am going to explain to you today is three things. Is the issue of ... of what? Tropic level, food chain and food web, that exactly what I am going to explain.

Learner: Food chain and food web.

Mr Phillips: And what make up three things? The topic on its own is called energy flow in the ecosystem, is in page 42 of your text book. So what is important is firstly we have to remember what we have done, we have done something on biotic components, do you remember biotic components?

Learner: Yes

Mr Phillips: Biotic components. So we said there are three groups of living organism, so what are they? What are the three groups of living organism? Yes?

Learner: Producer, we have the first one which is called producer. Guys make sure that you understand this so that when I start saying what a tropic level to you is, you know exactly what you are talking about. Decomposer

Mr Phillips: Decomposer and what?

Learner: Consumer

Mr Phillips: And consumer. So can you tell me, can you briefly tell me, what a producer is?

Learner: Producer is green plants that make their own food.

Mr Phillips: Alright, so what make possible for green plants to make their own food?

Learner: Because they have got chlorophyll.

Mr Phillips: and what is that chlorophyll for? To absorb sunlight: Sunlight

Alright, except producer we know these are green plants, these are green plants. What about consumer? What are consumers? I understand some of you are going to say

people who buy at the shop are consumers, which are correct on the side of commerce and scientifically?

Learner: components biotic (rectifying the mistake)

Mr Phillips: Oh yes that's biotic, components of biotic thank you very much, not components of abiotic. Alright what is your understanding of consumer?

Learner: Consumers are plants that cannot make their own food.

Mr Phillips: Plants that cannot make their own food, but the question is how do they survive? How do they survive?

Learner: They depend on producer.

Mr Phillips: They depend on producer, thank you very much; I can see you still remember this very well. What are the three types of consumer? What are they? Fezile!

Learner: Primary consumer, secondary consumer and tertiary.

Mr Phillips: Correct, they are three, do you remember which one is a primary consumer?

Learner: Yes

Mr Phillips: Can you give me one example of a primary consumer, one example?

Learner: Goat

Mr Phillips: Goat! Why are you saying goats? Why?

Learner: Because they feed on plants

Mr Phillips: We also have secondary; under secondary consumer we said there are two groups of secondary consumer. Which one and which one?

Learner: Lion (laugh)

Mr Phillips: Lion?

A: **Learner:** Laughing

Mr Phillips: There are two group of secondary consumer.

Learner: Carnivores

Mr Phillips: What does that mean? Meaning?

Learner: Animal that feed on meat

Mr Phillips: And the other one is a.....

Learner: Omnivores

Mr Phillips: What are omnivores?

Learner: Animals that feed on meat and also on plants material.

Mr Phillips: SO guys, let's think of which one feed on what? We have plants here as a producer, we have a consumers. Some of the consumers, let's say a goat, let's also say a pig here, some of this what do they do? Consumer feed on what?

Learner: Green plants

Mr Phillips: A pig, also feed on green plants and it can also feed on something else. What about a lion?

Learner: It feed on meat

Mr Phillips: It feed on meat, so if you can now see, what does that mean? A lion eat a goat and what happen with a goat?

Learner: A goat eat plants

Mr Phillips: Green plants err, so what is all about today's topic tropic level, food chain and.....

Learner: food web

Mr Phillips: That topic is simply about, who eats who? So the idea is to find out to say energy from plant is then transferred to primary consumers and then from primary to secondary consumers if possible to tertiary consumer and along the way same energy will be transferred to decomposer which can be fungi or bacteria. How? How? When plants and animals dies obviously they will be decomposed, so what are trophic levels? What is all about tropic level, trophic levels involve plants, why? Because, they manufacture their own food. Number 2 they involves consumers or heterotrophs because they cannot make their own food, they feed on plants. It also involves decomposers why? Because they only feed on dead organic material of plant and animal

Learner: Animals

Mr Phillips: Alright, so which one is which one, in terms of tropic level, we have got three levels. We have got level one, tropic level on (first tropic level), we are saying these are the first organism that receive energy and which ones are those?

Learner: Green plants

Mr Phillips: Ok, a tropic level are producer, tropic level, the first group is the what? Producer that's the first tropic level it's because they are able to make their own food, they receive energy from the sun, direct from the sun. So which one is our second tropic level, which one?

A: **Learner:** Primary consumer

Mr Phillips: Primary consumers or what? Herbivores. Second tropic level is the herbivores and third tropic level is the what?

Learner: Omnivores

Mr Phillips: Omnivores which is the secondary or carnivores

Learner: Carnivores

Mr Phillips: So, we know what exactly is happening. Ok can you go to page 43? What is the topic all about? Energy flow, what does that mean? Flow of energy from one organism to the other, so if you can check the diagram there, in that diagram we notice that there is sun there; can you see that in page 43?

Learner: Yes

Mr Phillips: Sun is the source of energy, what types of energy?

Learner: Radiant energy

Mr Phillips: Who is this radiant energy?

Learner: Green plants

Mr Phillips: Green plants, which are producers, can you see that?

Learner: Yes

Mr Phillips: Producers, which level is that?

Learner: First tropic level

Mr Phillips: First tropic level and then what then happen we go to the second tropic level, plants are eaten by many animals but in that diagram we have got a 'buck' can you see is a buck or impala but the fact is that animal feed on grass. Which biological word describe animal that feed on grass?

Learner: Herbivores (Chorus)

Mr Phillips: Herbivores, you know I like your songs but at the assembly, I like your songs, you must learn to rise up your hand.....you must learn to rise up your hand.

Learner: Laughing

Mr Phillips: Now we can see that impala or a buck or a kudu, which is indicated there and there are many animal that can feed on that buck. Can you see that one?

Learner: Yes

Mr Phillips: A buck is the first tropic level, the second tropic level which is the secondary consumer...err no-no-no the third tropic level which is the secondary consumer can be carnivores, can be some parasite that can feed on that buck, we have got a lion there, a lion receive energy from that, can you see the arrow there?

Learner: Yes

Mr Phillips: The arrow head is pointing to the lion, why to the lion? Because is the one receiving energy. Alright, so meaning that the presentation that I was doing was to show you, which one feed on what? But, as we are showing the flow of energy. People can you go there, from the sun the arrow head pointed to the what? To the green plants, from the green plants pointed to the what? To the buck and then from there, there must be some ticks enjoying themselves there, a lion can also feed on what? On that animal. So all these animal possible one day they are going to die. Can you see the arrow here?

Learner: Yes

Mr Phillips: From plants moving down to decomposers, can you see that one?

Learner: Yes

Mr Phillips: From lion down to decomposers, from ticks down to what? Decomposers, how? How? A lion can die if not what can happen after eating an impala it will have to go and release some, something and some phases?

Learner: Yes

Mr Phillips: Obviously they will be some decomposed; it will loose some energy and what will then happen? All the remaining will be decomposed by what? By fungi and bacteria to form what? Inorganic energy. Which one is called inorganic energy?

It will form elements that can be absorbed by plants from the ground. That's the story. So what have you learn? In terms of tropic level, we have got three levels, first tropic level which is the producer and what happen with the producer? Producer receive energy from the sun, from the sun the producer to herbivores, from the herbivores possible to the carnivores from the carnivores possible to the fungi, you can use the word fungi as an example, fungi which is a decomposer. What does that mean when we say show of an energy flow; this is an example of energy flow. What are we suppose to understand?

We are supposed to understand that energy from the sun goes to the section organism first before it reaches us. We do feed from meal right?

Learner: Yes

Mr Phillips: Maze meal is from maize plant?

Maize plant receives energy from the sun, so what will then that mean? Who are we? Are we the first tropic level or second tropic level?

Learner: Second

Mr Phillips: Second tropic level. That's the story. So when talking about energy flow, we represent energy flow using arrow heads. Then let's go to food chain and food web in

page 45. Food chain and food web. What does that mean when saying food chain? Food chain is still the very same thing but what are we saying is a food chain, can you underline that? Food chain is the sequence of living organisms eating and living of other living organisms. That's what we call food chain. Grass will be eaten by a grasshopper, do we all know grasshopper (a locust), a locust one day will be eaten by a frog, a frog one day will be eaten by a snake, and a snake one day will be eaten by a vulture, a vulture one day it will be eaten by.....?

Learner: Fungi

Mr Phillips: That's what? Food chain, so we have that good example of food chain here can you see food chain there?

Learner: Yes

Mr Phillips: Food chain is more or less the same as a food web. Now the question is what is a food web? Interconnections of food chains forms a food web, can I give you an example of food chain then extend it to a food web. Let's say we have got a grass there as a first trophic level, so who is going to feed on the grass? A lion and what happens to the lion and a lion?

Everything can go to bacteria why because a bacteria feeds on dead organic material, this is a food chain, what about a food web, who else can feed on grass? Is a?

Learner: A cow

Mr Phillips: Who else can also eat grass?

Learner: A locust

Mr Phillips: Do we all know a locust? A grasshopper.

Learner: Yes

Mr Phillips: Ok, let's think about these two animals. A cow can be eaten by what? A lion. Do we all understand that one?

Learner: Yes

Mr Phillips: What about a locust? A locust can be eaten by a?

Learner: A frog

Mr Phillips: Ok, can be eaten by a frog, beside a frog what else can also feed on a locust? Snake can eat a locust. A snake can again also eat a frog, from there what else are we thinking? What else can eat a goat?

Learner: A tiger

Mr Phillips: A tiger, can you see a tiger there?

Learner: Yes

Mr Phillips: A tiger can also feed on a cow, that's correct? That's very correct. Who else can feed on a vulture? Don't you think a vulture can be eaten also by other animals "akiri"? All animals that eat meat can attack a vulture, do you understand?

Learner: Yes

Mr Phillips: This one can also be eaten by wild dogs, can you think of a wild dog? They eat this one. Wild dog, they can be eaten by a tiger, they can be eaten also by a lion, so it become now a food web.

Learner: Yes

Mr Phillips: So we know what a food chain is, a food chain is sequence of living organisms. Describe who eat who? And what about a food web? A food web is an interconnections of food chain, they are many food chains there.

Learner: Yes

Mr Phillips: We have grass, locust, frog and bacteria are one food chain. Grass, cow, tiger, bacteria. Cow, tiger, bacteria, they are many. When saying food web we are saying interconnection of food chain, what about food chain? Food chain is simply a sequence of living organisms eating and living of other organisms. So we know as to how a food chain is formed, as to how a food web is formed. So how then can we represent a food chain? How then can we represent a food chain? A food chain can be represented by a pyramid, it can be a number pyramid, it can be represented by biomass pyramid, it can also be represented by energy pyramid and so on. Can you check the diagram there?

Learner: Yes

Mr Phillips: Can you check the diagram?

Learner: Yes

Mr Phillips: Can you check the diagram of number pyramid? Can you see that diagram?

Learner: Yes

Mr Phillips: Number pyramid, producers at the bottom, why? Because they are many, they draw a very big box, herbivores they are many but not that many compared to the producers, carnivores very few but more than secondary consumers. Carnivores, we have got primary carnivores and secondary carnivores? Do you know which once are primary carnivores? Primary carnivores are the ones that sometimes eat plant materials, secondary carnivores, they strictly feed on meat. The tertiary, they are very little, how many hyenas are there? Very few. The biomass again. Biomass that's in terms of weight, can you see, is in page 47. And they represent them in kg's. So now I am going

to think of a simple way to represent a food chain except the pyramid that you seen there. The most common pyramid that we use to represent a food chain is this one which is very triangular, which is triangle like. How many levels are there? They are four “Akiri”? We have got the primary, secondary which is divided into two and also the decomposers. So we have got three things, why this pyramid is not equal? Why this pyramid tempers to the top? Why pyramid big at the bottom? What do you think is the reason? At the bottom it represent producer, why it bi there? Is because producer are in majority, they are many producer. As you draw this column will be producer, and this will be.....?

Learner: Herbivores

Mr Phillips: And this one here will be carnivores and this side will be a.....?

Learner: Decomposers

Mr Phillips: As you draw, what are you going to do at your portfolio? What are you going to do? The portfolio says think of an ecosystem? Think of the ecosystem and then you follow the instruction and what then are you supposed to do? List all organisms etc list all organisms not grouping them; they you just list, cow, goat, whatever, and whatever..... Group organism which form different tropic levels, can you see me now I have the three tropic levels?

Learner: Yes

Mr Phillips: From your ecosystem then you will say in the first tropic level I have got goat no not I have got grass, trees. Ok in the second tropic level this is herbivores you will check it is impala, goat, kudu, whatever.....whatever.... you group them and then from there you are done with that one. You go to number two, how you are going to make a model, your model can be this way but it has to be three dimensional, do you understand what is three dimensional?

Learner: Yes

Mr Phillips: Three dimensional? Make it a real box; Make it a real box with three sides. Thank you, is the end of the period

Appendix K: Summary of analysis of classroom observation

1. Teacher using learners' prior knowledge

Mr Phillips	Mrs Collen	Mr Jack
<p>1. The teacher asked series of questions to find out what learners have learned from the previous lesson.</p> <p>The teacher uses learner prior knowledge to introduce the new topic of the lesson.</p> <p>She also used learners' knowledge from grade 10 work.</p> <p>2. The teacher did not give learners the topic of the day: He asked learners series of questions as part of introduction.</p> <p>Information received was meant to remind learners of what they have done in the previous lesson, but not to influence the new topic.</p> <p>3. The teacher asks learners series of questions to find out what they have learned in the previous lesson.</p>	<p>1. The teacher asked learners series of questions related to topic covered previously e.g., Check the introduction</p> <p>How do we know the heart function?</p> <p>There is contraction of the heart.</p> <p>2. The teacher introduces the topic by asking questions i.e. what are biotic factors?</p> <p>What are components of biotic components?</p> <p>What are requirements of photosynthesis?</p> <p>The teacher uses the learners' responses to the questions to teach topic of the day.</p> <p>3. From the previous lesson, the teacher asked them the biotic factors.</p> <p>The teacher asked questions of soil types i.e. what is soil?</p> <p>What forms of soil?</p> <p>Use of learners' prior knowledge was poor.</p>	<p>1. Questions based on the previous lessons were asked? E.g. what are the functions of the hearts? How do we know that the heart is functional?</p> <p>2. The lessons were a confirmation of the previous lesson. Previous information was used i.e. meaning if – heterozygous, homozygous. No experience was used from their environment</p>

2. Allowing learners' responses to drive lessons

Mr Phillips	Mrs Collen	Mr Jack
<p>1. The teacher did not allow learners to drive lessons. The questions that were asked were asked in the previous lesson. The teacher was attentively listening to the information.</p> <p>Later during the lesson: teachers and Learners response were driving the lesson.</p> <p>2. Some of responses from individual learners were used to drive the lesson. Learners from introduction Were not used to drive the lesson. Chorus- answers</p> <p>The teaching process was teacher-centred –teacher control even though learners were given opportunity to read from the book , while the teacher explains everything</p> <p>3. Through series of questions, learners responses where driving the lesson.</p>	<p>1. The teacher use learners' responses to channel them to the goals of the lesson.</p> <p>2. Learners were not driving the lesson: the questions which were asked were to find out if learners still know what they have done for the previous day.</p> <p>3. the teacher used answers or responses to drive the lesson i.e. she asked questions on biotic factors so that she can move to the next lesson ,while she respond in many cases ;and sometimes in individually.</p>	<p>1. Learners responses where used to drive the lesson e.g. answer: the heart pumps the blood. o. How does that happen? Answer. There are 4 chambers responsible for pumping blood.</p> <p>2. Some respond to some questions (chorus) and the teacher use them to reflect on the genotype and phenotypes. The teacher uses the learners respond to continue explaining the situation. Other learners were left out; as they were not responding</p>

3. Teacher uses physical experiences and concrete models

Mr Phillips	Mrs Collen	Mr Jack
<p>-used examples from books and either ignored or dropped examples from students that were not found in the books she was using even if they were appropriate.</p> <p>-used a model of human heart</p>	<p>-attempted to use examples from students' everyday lives but sometimes the link to science was inaccurate</p> <p>-use a model of human heart</p> <p>-used real sample of a cow</p>	<p>1. There were charts attached in the class for commerce; and none for life science. No concrete models were used. Only examples was used e.g. chicken hearts</p> <p>-only shows learners a model of human heart</p> <p>- attempted to use examples that students were familiar with in explaining concepts being taught</p>

4. Encouraging learners to engage in dialogue, both with the teacher and with one another

Mr Phillips	Mrs Collen	Mr Jack
<p>1. No dialogue exchange was done early in the lesson.</p> <p>Teacher centred = source of information.</p> <p>Teacher teaching from the front, there was teacher-learner engagement, but no dialogue was encourage between learners.</p> <p>During the lesson, allow learners to engage in a dialogue, to find out the function of roots hairs.</p> <p>2. No dialogue between learners to learner.</p> <p>The dialogue was between teachers to learner.</p> <p>No activity used to encourage learners to engage in a dialogue.</p> <p>3. No group work was conducted; individual activity or a discussion was limited to allow learners to engage in dialogue. There was interaction between teacher and learner.</p>	<p>1. The dialogue was between teacher and learners e.g. - teachers asks questions and the learners answers the questions.</p> <p>e.g. What are the three phases of the heart beat.</p> <p>Atria systole.</p> <p>Ventricular systole.</p> <p>General diastole.</p> <p>2. No dialogue was encouraged. Teaching was teacher centred.</p> <p>Dialogue is a human being a nocturnal or diurnal, why?</p> <p>Do you think a camel can survive in a township environment?</p> <p>3. Teaching was teacher centred she was explaining the soil types, and how one check soil acidity and alkalinity in preparation of can experiment that was going to be conducted the following day.</p>	<p>1. No dialogue was encouraged. Learners were given opportunity to engage in an activity given the phenotypes and genotypes.</p> <p>The teacher moves around desk to desk helping individuals (a teacher was helping the learner individually).</p> <p>2. Dialogue was developing between learners themselves and between learners and teachers. The dialogue was bared on how do one knows that the heart is working.</p>

5. Asking thoughtful, open ended questions

Mr Phillips	Mrs Collen	Mr Jack
<p>-did not ask for justification from students even where students' ideas showed some misconceptions</p> <p>-if ideas were not clear, she would ask other students to help rephrase the sentence</p>	<p>-allowed students to debate on some ideas they raised but he did not provide vital information to help students construct relevant knowledge</p> <p>- asked students to comment on ideas from others before his input but it was more like finding out who accurately remembered what was taught</p>	<p>-did not ask for justification from students and in cases where students' responses were wrong or inaccurate, she just provided "correct" responses without explaining why the responses given were not accepted</p> <p>- The teacher always asks learners if they understand what he is doing. The teacher was the source of information, explaining how the process takes place, then gave learners tasks to work following the instruction he set.</p> <p>-open-ended questions were asked e.g. what will happen if "one" the breathing. Will the heart stop or not. Will blood stop flowing or not and why? Close ended, how many chapters are there in human heart. Answer: 4</p>

6. Classroom interaction

Mr Phillips	Mrs Collen	Mr Jack
<p>1. The teacher draws the structures of roots (external & internal in the chalkboard for the learners to interact in the classroom.</p> <p>Interaction was mainly between the teacher and the learners but minimal between learners themselves and the chalkboard.</p> <p>Learners were given opportunity to interact with drawing in the chalkboard.</p> <p>Learners were given the activity to discuss the function of the stem and also the external structure.</p> <p>2. To other learners interaction was inefficient as a result, some Learners sleep during the lesson</p> <p>no group work was conducted to allow learners to interact.</p> <p>There was a teacher –learner interaction-teacher asked questions and learners respond. Teacher ask learners questions and allow learner to answer before he can move to the next inform. Learners were given opportunity to read louder for everyone in the classroom while the teacher</p>	<p>1 .No learner to learner interaction.</p> <p>Learner checks what the teacher is saying in a textbook i.e. teacher and textbook interactions.</p> <p>2. There was no interaction between learners to learner.</p> <p>The teacher was more involved in explaining the soil acidity and alkalinity.</p> <p>Strong teacher –learner interaction took place. Teacher sometimes asked questions while learner response in a form of chorus.</p> <p>3. The teacher was the source of information, with little input from learners.</p> <p>Teacher-learner interaction- no learner to learner interaction took place.</p> <p>Teaching and leaning was teacher centred and textbook based.</p> <p>No chart and or videos teaching aid were used.</p> <p>No activity was conducted by the teacher to allow learners to</p>	<p>1. There was learners' interaction and very little teacher and learner interaction. Learners were given opportunity to explain and respond the questions the way think is correct; while the teacher listen to the lesson.</p> <p>2. No group work conducted.</p> <p>Some “few” learners where able to asks one another as to how crossing is done.</p> <p>Learners who were knowledgeable did not ask questions because they were able to workout the problem.</p> <p>Strong teacher-learner interaction. Non teacher to learner interaction. Individual attraction by teacher- created a situation whereby some learners discussed their own stories of interests.</p>

<p>explains from the front. No charts / (teaching aids) used to influence learning. chorus-answers were used.</p> <p>1. The interaction was mainly between teacher and learners. teachers were giving learners information and learners were taking notes.</p> <p>Teaching was teacher-centred, even though lessons were given opportunities to response to asked questions.</p>	<p>interact in the classroom.</p>	
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7. Learner arrangement and other contextual factors

Mr Phillips	Mrs Collen	Mr Jack
<p>1. Learners arranged traditionally, facing the chalkboard.</p> <p>Learners not arranged in groups.</p> <p>Double desk used ,</p> <p>Chalkboard on the front.</p> <p>The lesson was disturbed as the office meet some of the learners observation took place. Average of 46 learners</p> <p>2. Chalkboard = in front.</p> <p>Learner paired in double desks.</p> <p>Learners where disciplined.</p> <p>3. Desks arranged in traditional way.</p> <p>Teaching was textbook based-</p> <p>The teacher was explaining the textbook.</p> <p>Observer: seated at the back – to allow learners to be free. It was raining, there was an activity prepared for learners to go out to the school garden and see some of the features of item.</p>	<p>1.Old way: all learners face the chalkboard</p> <p>They were arranged in pairs.</p> <p>45 learners</p> <p>2. Table arrangement – all tables faced the chalkboard.</p> <p>Sitting arrangement – traditional way and seated and facing chalkboard.</p> <p>Teacher teaching from the front facing learners.</p> <p>Discipline: learner discipline was poor some exams were taking place at the back while teacher continue teaching.</p> <p>Average of 46 learners.</p> <p>3. Additional 46 learners.</p> <p>Arrangement of tables- all learners look at the chalkboard.</p> <p>I was seated at the back.</p> <p>In township schools with no school garden.</p> <p>Discipline learner was poor</p>	<p>1. traditional (all learners face chalkboard). 46 learners arranged in pairs. Teacher rotate</p> <p>Teaching was textbook based-</p> <p>The teacher was explaining the textbook.</p> <p>Observer: seated at the back – to allow learners to be free. It was raining, there was an activity prepared for learners to go out to the school garden and see some of the features of item. Average of 46 learners</p>

Appendix L: Wits Ethics letter



Wits School of Education

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STUDENT NUMBER: 0309298A

Protocol: 2009ECE45

29 October 2009

Mr. Gumani Enos Mukatuni
347 Donne Crescent
LOMBARDY EAST
2090

Dear Mr. Mukatuni

Application for Ethics Clearance: Master of Science

I have a pleasure in advising you that the Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has agreed to approve your application for ethics clearance submitted for your proposal entitled:

The facilitation strategies used by three life science teachers to implement learner-centred teaching and learning

Recommendation:

Ethics clearance is granted

Yours sincerely

Matsie Mabeta
Wits School of Education

Cc Supervisor: Ms. M Doidge (via email)

Appendix M: GDE approval letter



**UMnyango WezeMfundo
Departement van Onderwys**

**Lefapha la Thuto
Department of Education**

Enquiries: Nomvula Ubisi (011)3550488

<i>Date:</i>	<i>28 September 2009</i>
<i>Name of Researcher:</i>	<i>Mukatuni Gumani Enos</i>
<i>Address of Researcher:</i>	<i>347 Donne Crescent</i>
	Lombardy East
	<i>2090</i>
<i>Telephone Number:</i>	<i>0118821734</i>
<i>Fax Number:</i>	<i>0118821734</i>
<i>Research Topic:</i>	The facilitation strategies used by three life science teachers to implement learner-centred teaching and learning
<i>Number and type of schools:</i>	<i>1 Secondary School</i>
<i>District/s/HO</i>	Johannesburg East

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

Permission has been granted to proceed with the above study subject to the conditions listed below being met, and may be withdrawn should any of these conditions be flouted:

- 1. The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.***
- 2. The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.***
- 3. A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.***
- 4. A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.***
- 5. The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.***
- 6. Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.***
- 7. Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year.***
- 8. Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.***

Office of the Chief Director: Information and Knowledge Management

Room 501, 111 Commissioner Street, Johannesburg, 2000 P.O.Box 7710, Johannesburg, 2000

Tel: (011) 355-0809 Fax: (011) 355-0734

9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher must supply the Director: Knowledge Management & Research with one Hard Cover bound and one Ring bound copy of the final, approved research report. The researcher would also provide the said manager with an electronic copy of the research abstract/summary and/or annotation.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

Pp Nomvula Ubisi
Martha Mashego
ACTING DIRECTOR: KNOWLEDGE MANAGEMENT & RESEARCH

The contents of this letter has been read and understood by the researcher.	
Signature of Researcher:	
Date:	