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An investigation of the affordances and limitations of on-campus microteaching as an alternative to the traditional in-schools teaching practice in preparing the PGCE students for teaching Life Sciences after qualification: a case study

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An investigation of the affordances and limitations of on-campus microteaching as an alternative to the traditional in-schools teaching practice in preparing the PGCE students for teaching Life Sciences after qualification: A case study



A research report submitted to the Faculty of Humanities,
University of the Witwatersrand, Johannesburg, in partial fulfilment of
the requirements for the degree of
Masters in Education

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Abstract

The use of microteaching is a topic of controversy continuous discussion in teacher training programs. While some studies suggest that microteaching can be used effectively to develop student teacher skills other studies suggest that it has limitations. The purpose of this study was to investigate the affordances and limitations of the on-campus microteaching programme that was used as an alternative to in-schools teaching experience to train Post Graduate Certificate in Education (PGCE) students to teach life sciences in high school. To understand the affordances and limitations, this study investigated the competences that manifested in students' planning, microteaching, and video stimulated recall interviews. The study was done at a South African university. There were 5 participants in total. Collected data included lesson plans, videorecording of microteaching and interviews done with the participating PGCE students. The research study employed a qualitative research design and a case study research strategy. The analysis of collected data was guided by the Minimum Requirements for Teacher Educator Qualifications framework as well as the Topic Specific Pedagogical Content Knowledge framework. The results showed that the on-campus micro-teaching programme afforded PGCE opportunities to apply and develop further their knowledge of planning lessons and teaching of a life sciences topic. The on-campus micro-teaching also enabled students to get immediate feedback from supervising teachers and peers. Though the microteaching affordances were observed there were limitations that manifested during micro-teaching: the inability of the PGCE students to use certain teaching strategies due to the artificiality of microteaching classroom, limited teaching time, absence of opportunities to practice class management skills as peers were well-behaved most of the time and also lack of opportunities to deal with incorrect answers and misconceptions as peer students were providing correct answers most of the time. PGCE students' concerns included not having experienced actual learners and actual classrooms, no opportunities for practicing other teacher professional duties such as marking registers, class management, giving tasks, marking, and giving feedback. The findings suggest that the artificial nature of microteaching including short duration of the lesson is a limitation in developing certain teaching and professional skills.

Key words

Post Graduate Certificate in Education, Topic Specific Pedagogical Content Knowledge, on-campus microteaching experience.

I declare that this research report is my own unaided work, and no part has been copied from another source (unless indicated as a quote or referenced accordingly). All phrases, sentences and paragraphs taken directly from other works have been cited and the reference recorded in full in the reference list. I also declare that this report has not been submitted before any university.

M. Nkuna

Mary Nkuna

June 2021

Dedication

To my Lord and Saviour, Jesus Christ. To the Glory of God. To all young black girls, Thando Dube,

Girl your dreams are valid.

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CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 Introduction

This study seeks to investigate the affordances and limitations of an on-campus microteaching program as an alternative to in-school teaching practice in a PGCE (Post Graduate Certificate in Education programme) teacher training program. Teaching practice is an essential component of teacher training programs. This is because it allows student-teachers to practice professional aspects of teaching such as lesson planning, classroom management, and most crucially classroom teaching in authentic environments (Mannathoko, 2013). PGCE students are those that have applied for a teacher-training program after having obtained an undergraduate qualification in a discipline such as science that would enable them to teach Life sciences in high school (Verbeek, 2014). The initial qualification the students possess is expected to have equipped them with sufficient subject content knowledge to teach Life sciences to FET learners. The PGCE program is an alternative teacher training program that trains individuals who have a qualification on life sciences related field who wish to be qualified to teach Life Sciences in high school (Verbeek, 2014). For the fulfilment of the PGCE qualification, the PGCE students are required to go for teaching practice in schools where they are deeply involved in real teaching situations to apply theory in practice (Kiggundu & Nayimuli, 2009).

Due to the outbreak of the coronavirus (Covid-19) disease, many countries including South Africa implemented the lockdown strategy to manage the pandemic and to decrease the spread of the disease (Hatefi, Smith, Abou-El-Hossein, & Alizargar, 2020). As a result, contact learning and teaching were suspended and the PGCE students had to do microteaching as an alternative to traditional in-school teaching practice. Allen and Eve (1968) describe micro teaching as a system of controlled practice which allows student teachers to practice teaching under controlled conditions to develop their level of competency and teaching skill. Its standard components include a teacher, a micro class (usually four to five learners), a five to twenty-minute micro-lesson, and predefined targets for the microteaching lesson (Allen & Eve, 1968). Micro-teaching is vital in teacher preparation as it creates awareness for teacher behaviour before they embark into real classroom situations (Nair & Ghanaguru , 2017). Although

evidence supports this, the effectiveness of on-campus micro-teaching in preparing PGCE students in a situation where this is an alternative to traditional in-school practical teaching experience has never been investigated. This is the main motivation for this study in which I wish to investigate the affordances and limitations of on-campus micro-teaching at a South African university as an alternative to traditional in schools teaching practice in preparing PGCE students to teach high school life sciences at the end of their one-year professional training.

What is Life Sciences?

Life Sciences is a branch of sciences that allows the learners from grade 10-12 to understand the biological, physiological, environmental, and technological and the social processes that impact the environment (Department of Education, 2003). In the South African curriculum, Life Sciences is organized according to four knowledge strands for the FET phase namely, (i) Life at the Molecular, Cellular and Tissue level, (ii) Life Processes in plants and animal and (iii) Environmental studies (iv)Diversity, Change and Continuity. It is this content that PGCE life sciences students are expected to teach after qualification.

Teaching Competency

This research aims to investigate the affordances and limitations of on-campus micro-teaching by examining the competencies of the PGCE students that are developed through the micro-teaching program. Competency is described as the teacher's ability to choose appropriate teaching strategies, teacher understanding of the nature of the topic, knowledge of learner prior knowledge and misconceptions and the appropriate representations and analogies (Akdemir 2019; Mavhunga & Rollnick 2013). These competences should not be evident only during teaching but also in the teacher's planning prior to the lesson (Rashad Ali Bin-Hady & Abdulsafi, 2018). Shulman (1986) referred to this teacher's competency as Pedagogical Content Knowledge (PCK) and defined it as a way of representing and articulating content knowledge to make it more meaningful for learners. Since Shulman's articulation of teachers' teaching competency as PCK, the construct has proven to be useful in describing teacher professional knowledge for teaching and educational researchers have been developing a range of PCK models (See Chapter 2 for more details). One of these models is Topic Specific Pedagogical Content Knowledge (TSPCK) by Mavhunga and Rollnick (2013).

Mavhunga and Rollnick (2013) have shown that the framework of TSPCK can be used to develop teaching competencies in pre-service teachers and also for evaluation of teaching

competency. TSPCK as described by Mavhunga and Rollnick (2013) describes the teacher professional knowledge of a topic in a specific disciplinary domain. It is defined as a way of transforming content knowledge of a topic to make it more meaningful for learners. The transformation of content knowledge occurs through five components that are content specific in nature (Mavhunga, 2020). Namely the prior knowledge, curricular saliency, what makes a topic easy or difficult to teach, representations including analogies and conceptual teaching strategies. The model and its elements are discussed in depth in Chapter 2 of this report. In this study, TSPCK was used as a lens to guide an investigation of the affordances and limitations of microteaching by looking at the competencies of the PGCE students that manifested in their planning and teaching of life sciences micro-lessons.

1.2 Statement of the problem

Teachers who are skilled and competent have a positive impact on the development of quality students (Carlson, Lee & Schroll 2004). This means that if poorly prepared, teachers can impede the endeavours to settle the South African difficulties of learning Life Sciences.

Teaching practice is an integral component of the teacher training programme because student teachers get an opportunity to apply their pedagogical knowledge before getting into the real world of teaching (Kiggundu & Nayimuli, 2009). The shortage of an existing understanding of how the use of micro-teaching as an alternative impact the way in which the PGCE students plan and teach life sciences can be problematic. Quick & Sieborger (2005) argue that the teaching practice should be extensive and intensive enough for student teachers to demonstrate their skills during teaching practice. Considering that the PGCE students do not have any other experience of teaching and now that a supervised micro-teaching program was made part of their traditional in-school teaching experience. It is important that its affordances and its limitations are investigated and documented.

Aim of the study

The study aimed to investigate the competencies of the PGCE students that manifest during their microteaching program when teaching the subject of Life sciences. Davids (2016) pointed out that microteaching can assist student teachers develop the competencies and skills they need to sustain and enhance the quality of their educational practice. If significant student learning is to be achieved, powerful learning opportunities for teachers must be made available to them during and when they begin their careers (Feaiman-Nemser, 2001). This demonstrates that the early experiences of teacher trainees are critical in determining whether they develop

into competent teachers with extensive professional knowledge. PGCE students in this study are enrolled in a one-year program where microteaching was used as an alternative to the traditional teaching practice. This study therefore, sought to contribute to this gap by investigation and documenting the affordances and limitations of a microteaching programme that was used as an alternative to in-school teaching experience

1.3 Rationale

Currently it is widely accepted that quality teachers can play a role in improving the way in which the learners acquire scientific knowledge and in turn impact their learner outcomes (Loyalka, Popova, Li & Shi, 2019). Thus, teaching practice plays an important role in the teacher preparation programs where teachers gain skills that they may use in their future classrooms. Events such as disease outbreaks can interrupt traditional training methods for teachers, in this case microteaching was used to train PGCE students as an alternative to traditional teaching practice in schools. It has been indicated that student teachers find the microteaching experience very beneficial when incorporated to their pre-service programs (Benton-Kupper, 2001) however there is little said about using microteaching as a bigger part contributing to teacher training teaching practical. This is also evident in the findings of this study that microteaching afforded the PGCE students with opportunities to develop their skills un planning and teaching Life Sciences.

Why focus on the PGCE student teacher's PCK?

The assumption that was made in this study is that PGCE students already have the appropriate content knowledge to teach life sciences acquired from their previous qualification. Good content knowledge is regarded as a reliable indicator of high-quality science instruction (Hillier, 2013). Previous studies have examined how the quality of teacher content knowledge and teacher PCK impact learner outcome. Hanifar et al (2019) argue that teacher knowledge as in CK and PCK are essential to ensure that science knowledge is efficiently mediated to learners. Ergönenç, Neumann and Fischer (2014) found that teachers' PCK is linked to learner positive outcomes, teachers with quality PCK cultivate learner interest and participation through posing more cognitive questions that allow the learners to engage in the lesson. Previous studies have identified learning to teach science is a complex process whereby student teachers' development of PCK is shaped by their prior knowledge and their previous experiences (Russell and Martin, 2014).

The PGCE students' PCK is developed through the PGCE program where the students are trained on how to transform their CK and can apply their PCK in their teaching. Vail Lowery (2002) argues that the construction of PCK for sciences requires a collaborative environment where student teachers can actively construct their PCK. The traditional teaching practice and microteaching provide PGCE students with opportunities to develop their PCK along with their peer student teachers or supervising teachers. However, there is limited evidence in literature on how PGCE students' PCK is developed through microteaching as the bigger part of teaching practice. This study aims to examine how microteaching impacts the way in which PGCE students plan and teach Life sciences in their micro lesson and its benefits and limitations as the alternative to train PGCE students.

The findings of this study show that though microteaching is useful in developing the PGCE students PCK there were limitations that manifested which included; the artificiality of the microteaching classroom, limited teaching time, lack of opportunities to practice class management skills as peers were well-behaved most of the time, and also lack of opportunities to deal with incorrect answers and misconceptions as peer students provided correct answers most of the time, PGCE students were unable to use certain teaching strategies. Considering that this is a small study, these findings cannot be generalised to practice or policy However, findings from the study are expected to contribute towards the identified gap.

Why focus on life sciences

Life Sciences is a challenging subject for high school students in general. The difficulty of teaching and learning Life sciences has been persisting throughout especially in South Africa whereby most learners are English second language speakers (Ferreira, 2011). For improved learner outcomes, adequate development of the student teacher PCK is critical. This study aims to examine the PGCE students' planning and teaching of Life sciences to understand the benefits and limitations of microteaching as an alternative to the traditional teaching practice.

1.4 Research Questions

This study aimed to explore the affordances and limitations of on-campus microteaching as an alternative to the traditional in-schools teaching practice in preparing PGCE students for teaching life sciences after qualification. The study was driven by the following research questions.

Main Research Question

What are the affordances and limitations of on-campus microteaching as an alternative to the traditional in-schools teaching practice in preparing PGCE students for teaching life sciences after qualification?

Sub-Question

1. What are the teaching competencies that manifested in PGCE students' on-campus micro-teaching lesson plans?
2. What are the teaching competencies that manifested in PGCE students' on-campus micro-teaching?
3. What were the PGCE students' experiences of on-campus microteaching as their final teaching experience before qualification?

1.5 Report Outline

The first chapter of this report presents the study's topic, the problem statement, and the rationale for the research questions. Chapter 2 presents the literature review, which covers the debates around the limitations and benefits of microteaching for teacher education, the students experience of microteaching and the conceptual framework. The research design and methods of data collection employed in this study are discussed in Chapter 3. Chapter 4 presents the analysis of the data which included lesson plans, video recorded micro-lessons and interview transcripts to determine the participating PGCE students' competencies. Chapter 5 presents the summary findings from the study and also makes suggestions for how to prepare the micro-teaching program for a PGCE candidate, limitations of the study and reflections.

CHAPTER 2

"We aim to prepare high quality teachers. If we cannot define a high-quality teacher, we cannot adequately evaluate the true effectiveness of our teacher preparation programs" (Carlson, Lee & Scroll, 2004, p.350)

LITERATURE REVIEW

2.1 Introduction

The quotation above by Carlson, Lee and Scroll (2004) highlights the significance of teacher training programs in preparing educators of high quality. There have been various issues and problems in teacher education which include teacher unpreparedness after qualification, limited length of the training programs and inadequate teaching practice amongst the others (Chu, Craig, Yeworiew & Xu, 2020; Quick & Sieborger, 2005; Boudersa, 2016). This indicates that the efficacy of the teacher training program must be continually examined in the search for quality teacher training that can in turn influence quality learners. In teacher training, teaching practice is an indispensable element in which student teachers get opportunities to bring theory into practice and is also important for their professional development (Smith & Lev Ari, 2005). Teaching practice can be done in microteaching however there is also ongoing global concern over the use of micro-teaching in teacher training programs for successful professional development of teachers (Ralph, 2014 &Davids, 2016). This chapter discusses issues of microteaching in teacher training program, with specific attention to the affordances and limitations of microteaching it also locates the PGCE students' competencies within science education, by using the Minimum Requirements for Teacher Education Qualifications (MRTEQ) framework. The Pedagogical Content Knowledge (PCK) construct was used as the framework. The chapter also reviews the teaching and learning of Life sciences in the South African context.

2.2 Types of teaching practices

There are two types of teaching practice which are traditional in-schools teaching and micro-teaching practice (Richards & Ferrell, 2011). I describe these two types below.

2.2.1 Traditional in-school teaching practice

Traditional teaching practice as differentiated by Richards and Ferrell (2011) refers to student teachers doing their teaching practice in schools whereby they work together with a mentor teacher and for an extended length of time. During that time, they are required to prepare and teach part of lessons or whole lessons. In this arrangement of teaching practice, the student teacher works closely with their mentor teacher collaborating and sharing lesson plans

(Murtiana, 2012). The mentor teacher also observes the lessons that are taught by the student teacher and provides feedback on the lesson.

2.2.2 Microteaching practice

A survey of literature on microteaching shows that the concept of micro-teaching has a variety of definitions. Since the focus of this study is microteaching, I present these definitions in some detail below.

Bell (2007) defined microteaching as a method that helps student teachers practice teaching by having them teach a lesson to their peers to improve their lesson planning and their lesson delivery skills. Allen and Eve (1968) defined microteaching as a teaching scenario that is reduced to 4-20 minutes of teaching time and usually involves 3-10 students in order to minimize some of the complexities of the act of teaching and allow the teacher to concentrate on a few aspects of teaching. Richards and Ferrell (2011), say microteaching refers to planning and teaching of a short lesson by a student teacher to a group of peer student teachers and is usually followed by feedback on the student's teaching by their supervisor and their peers. It is a tool that was developed at Stanford University which aimed at identifying student teachers' specific teaching behaviours and it involved the steps of planning the lesson, teaching the lesson, re-planning, re-teaching, and re-observing (Higgins & Nicholl, 2003; Ralph, 2014). It is a teacher training technique that allows student teachers to develop appropriate lessons that they can use in their in-school teaching practice and allows them to reduce their shortcomings in order to become better teachers (Adhikari, 2020). Ledger and fischetti (2020) described microteaching as a strategy that is used to practice, rehearse, and reflect on action within a role play context for a real time feedback. Clift, Batten, Burke and Malley (1976) defined microteaching as a teacher training strategy which reduces the teaching situation to a simpler and more professional experience achieved by controlling the teaching practice to a particular skill and reducing teaching time and class size. Elias (2018) comments that microteaching consists of planning, teaching, critique, re-planning, re-teaching, and re-critique. Microteaching as gleaned from all the definitions above is about teaching under controlled conditions in terms of lesson planning, class size, type of learners (peers), duration of the lesson and the number of skills the student teacher practices and is done for a purpose different to in school teaching practice.

While microteaching became popular in the 1960s, its popularity declined because researchers examined its impact and concluded that its foundations were outdated. This was because, as argued by Ralph (2014) microteaching's features are positivistic in nature. This stems from the

fact that the theoretical basis for microteaching was initially related to the psychological theory of behaviourism (Reddy, 2019) and Bartley (1969) as cited in Adhikari (2020) agrees with this notion in the sense that microteaching provides direct feedback, reinforcement and behaviour shaping related to the Skinnerian principle. However, microteaching regained prominence amid these critiques and the skills to be practiced were extended to a variety of teacher skills such as comprehension, creative thinking, decision-making, and professional competence (Ralph, 2014). It is a teacher training technique that allows student teachers to develop appropriate lessons that they can use in their in-school teaching practice and allows them to reduce their shortcomings to become better teachers (Adhikari, 2020). Its differentiation from the traditional in-school teaching practice, therefore, lies in the opportunity it provides for student teachers to get immediate individual feedback and it works as a tool for measuring specific teaching practices (Allen & Eve). Allen and Eve (1968) comments that microteaching serves the purposes of providing preliminary experience and teaching practice. It serves as a research instrument for exploring teaching practice under controlled conditions

2.2.3 Microteaching Vs Traditional in school teaching Practice

When compared with traditional in-school teaching practice Allen, and Fortune (1968) claim that microteaching was an effective and superior teacher training technique. This claim was based on their study which found out that the student teachers trained by microteaching earned a significantly higher ratings on teacher effectiveness at the end of their training compared to the student teachers who were trained through the traditional in-school teaching practice method. Allen & Eve's (1968) findings were replicated by Kallenbach and Meredith (1969) where the findings indicated that microteaching is a superior teacher training strategy since it achieved similar results when compared to the traditional in school teaching practice. However, Kallenbach and Meredith noted that microteaching was not found superior in its effect on teacher classroom performance but only in the administrative issues incurred by the faculty arranging schools, and mentor teachers for student teachers. Therefore, missing in these studies are the findings on whether microteaching can be used as an alternative to the traditional in schools teaching practice in teacher training institutions.

Chowdhary (2019) differentiates between Traditional in school teaching and microteaching, in terms of class size, duration of the lesson and the number of skills the student teachers' practices**.** Reddy (2019) also provides a comparison between microteaching and traditional teaching which is presented in; **Figure 2 below.** I discuss the distinction in detail after Figure 2.

	Microteaching	Traditional teaching
1	Objectives are specified in behavioral terms	Objectives are general and not specified in behavioral terms
2	Class consists of small group of 5 – 10 students	Class consists 40 – 60 students
3	The teacher takes up one skill at a time	The teacher practices several skills at a time
4	Duration time for teaching is 5 – 10 minutes	Duration time for teaching is 40 – 50 minutes
5	There is immediate feedback	Immediate feedback is not available
6	Teaching is carried on under controlled situation	There is no control over situation
7	Teaching is relatively simple	Teaching become complex
8	The role of supervisor is specific and well defined to improve teaching	The role of the supervisor is vague
9	Patterns of class room interaction can be studied objectively	Patterns of class room interactions cannot be studied objectively
10	Provision for re-teaching	No
11	Trainee teachers gain confidence in teaching	Tense and scared

Figure 2: showing **Microteaching Vs Traditional** teaching *as adapted* from Reddy (2019)

The different features between microteaching and traditional in-school teaching as differentiated by Reddy (2019) are discussed in some detail below.

Teaching practice Objective

Reddy (2019) comments that the objective of microteaching is to train specific teacher behaviours and skills whereas in the traditional in-school teaching practice the teacher skill that is trained is not specific. Koross (2016) argues that an objective of microteaching is to allow student teachers to master teaching skills under controlled teaching contexts. On the other hand, the traditional in-school teaching practice students develops student teacher teaching skills in a way that student teachers can acquire and manipulate a range of teaching skills in a teaching context that is not controlled (Sa'ad, Sabo, Abdullahi, 2015).

Class Size

Class size has long been recognized as a potential problem for academic outcomes and the teaching and learning processes that take place in the classroom. Williams, Cook, Quinn and Jensen (1985) state that class size affects the quality of the learning environment, because

teachers in smaller class sizes are capable of adapting the lessons to the individual needs of the learner. Similarly, this indicates that class size has an impact on the teaching practices of the teacher which in turn influences their planning (James & Pedder, 2006).

However, research on the issue of the number of learners in a class has put more emphasis and focus on how class size impacts learner outcome. Research studies on how class size affects teacher planning and how this relates to their teaching practices, particularly in the context of micro-teaching, were lacking. James and Pedder (2006) state that although existing research shows that class size impacts teaching practices in complex ways it is crucial to take a closer look on how it impacts their professional knowledge particularly their interactive thinking and decision making. Findings from a study conducted by Phurutse (2005) show that numerous governments funded schools in South Africa comprise of large classes of up to 45-50 learners per classroom. The question of how microteaching trains student teachers to teach a large class when their training just incorporates a decreased class size remains unanswered. Kallenbach and Meredith (1969) argue that, despite the fact that microteaching reduces classroom teaching situations, it does not distort them because the teacher's actions during a microteaching lesson is not unique to the microteaching context, but rather consistent with the teacher's normal behaviour. Microteaching does not alter student teacher behaviour; however, it does enable student teachers to develop their teaching behaviours, according to Al Darwish and Sadeqi (2016).

Duration of the lesson

In microteaching lesson the duration of the lesson is reduced to 5 to 7min whereas the duration of a traditional classroom is 40-45mins. A study conducted by Quick & Sieborger (2005) shows that teaching practice should be intensive and extensive to allow student teachers to show and develop their teaching skills. There is limited evidence in literature on how the scaled down duration of micro lessons impact the development of student teacher teaching skills.

Number of skills

During a Microteaching lesson a teacher practices one skill at a time, whereas in a traditional teaching practice the teacher takes up several skills at a time. The context of microteaching focuses on a specific skill at a time. The skills include lesson planning and teaching strategies when teaching a specific lesson topic (Ralph,2014). Mahmud and Rawshon (2013) argue that microteaching allows student teachers to take up several functions such as being a teacher, source of feedback, pupil, video operator thus it allows student teachers to practice several skills.

Feedback

Reddy (2019) argues that microteaching allows student teachers to receive immediate feedback whereas in traditional teaching practice students do not always receive immediate feedback. However, it is also important to note that student teachers may receive immediate feedback from their supervising teachers in a traditional teaching practice. Spear, Lock and McCulloch (1997) argue that student teachers appreciate feedback from their supervisors as it enables them to develop in their teaching practice. Student teachers also indicated the feedback they received provided guidance and encouragement.

2.2.4 Affordances and Limitations in Microteaching

While the microteaching technique has shown to have a pivotal role in the teacher training programs, previous research studies have also shown the limitations and the affordances of micro-teaching. According to Ralph (2014), while microteaching has a prevalence of positive viewpoints, it is indefensible to see microteaching as an academic silver bullet. A study conducted by Ralph (2014) found that student teachers felt that though they actively taught human beings the teaching sessions were not authentic. The findings represented by Ralph were replicated by Gödek (2016) in a focus group study that wanted to evaluate the increase in the effectiveness of microteaching and to determine its influence on the student teachers from their own perceptions through their reflections on their own experiences. Ten out of 55 student teachers who attended microteaching practices were interviewed. Half of the student teachers stated that microteaching was an artificial environment which made the student teachers experience tension. Gödek (2016) comments that the tension experienced by the student teachers resulted from the critiques from the peer students, exaggerated pupil roles and the stress due to being recorded. In turn, Gödek (2016) recommends that teacher educators who might want to implement the microteaching technique ought to provide a strong supportive environment with the focus of guaranteeing positive experiences of the student teacher knowledge base development.

Despite these limitations of microteaching, a study conducted by Ogeyik (2009) showed that student teachers appreciated the use of microteaching as a technique for professional development. Microteaching was valued by 82.4% of student teachers who felt that it was advantageous for evaluating their teaching performance. Similarly, a study conducted by Mergler and Tangen (2010) to examine student teacher efficacy in relation to the use of microteaching as an assessment tool for post graduate education students in Australia showed that student teacher efficacy increased significantly over time with the use of microteaching.

Fernandez (2010) also found that student teacher lesson planning was greatly impacted, where the lesson plan prior to the micro lesson had more teacher centered teaching practices compared to the lesson plan after feedback from peer students and the mentor teacher. The student teachers also found it useful to observe their peers teaching as they had the option to gain the pedagogical practices used by their peers to integrate them into their own teaching (Ralph, 2014). **Table 1** below, is a summary of the limitations and affordances of microteaching**.**

Table 1: The affordances and limitations of microteaching

Affordances	Limitations
Simplifies teaching and reduces complexities of teaching, such as class size and lesson time.	Artificial teaching Situation. Limited number of learners fails to stir interest in teaching
Develops a variety of teaching strategies for real teaching contexts.	
Creates awareness of verbal and non-verbal communication.	Impedes with the classroom climate.
Develops a variety of teaching strategies for real teaching contexts.	
Develops student teacher's confidence	Limits Practice Opportunities
Effective feedback tool for student teacher behaviour modification	Covers only a few specific teaching Skills
	Skill orientated; content not encapsulated
Useful for acquiring various types of pedagogical practices.	Difficult to assess classroom management Skills
Develops teaching efficiency and increases teacher competency.	
More concerned with self-improvement and self-evaluation.	

2.3 The PGCE teacher training programs

In South Africa there are two possible teacher training programs namely: the four-year Bachelor of education degree and a three-year degree capped by a one year Post Graduate Certificate in Education programme (Verbeek, 2014). The focus of this investigation was on the one-year PGCE program whereby the students are recruits who already have degrees in relevant subjects (Christie, Conlon, and Gemmell & Long 2004). The program offers graduates (in different disciplines) an opportunity to develop teaching skills and competences in specialist areas such as lesson planning and inclusive approaches for teaching life sciences (Edwards, 2015). Smith and Lev-Ari (2005) argue that this initial teacher program is beneficial to the education system as it ensures access to diverse groups of teachers with different academic backgrounds who also have epistemological and methodological variety in the teaching

profession. The question whether teachers can be pedagogically prepared in one year has been an ongoing debate.

Another arising issue is that of the amount of time the PGCE students get to do the teaching practice in schools, in the case of this investigation. The PGCE students were involved in a two-week micro-teaching practice as part of the traditional in schools teaching practice. Quick and Sieborger (2005) argue that teaching practice should be sufficiently extensive and intensive for student teachers to demonstrate proficiencies in their teaching practice. This means that the teaching practice is also of vital importance in the teacher training program of the PGCE's. Smith and Lev-Ari (2005) comment that the teaching practice is essential in learning to teach as teachers are expected to be knowledgeable and up to date in subject matters however it is of importance that the PGCE students develop a personal practical theory when they engage in active learning.

A study conducted by Quick and Sieborger (2005) suggests that PGCE students appreciate being given more time to do their teaching practice. Harlin, Edwards and Briers (2002) stated that teaching experience plays an essential role in the formation of the PGCE students' attitudes and perceptions about their future responsibilities as teachers. The teaching practice provides an opportunity for the teacher supervisors to model desired teaching behaviours expected of the PGCE students (Edwards & Briers, 2001). Nkhata, Chituta, Banda, Choobe and Jumbe (2016) comment that the PGCE students observe the qualified teachers at work to learn about teaching skills, strategies, and classroom achievement. This is done to give the PGCE students skills needed before they graduate. Teaching practice puts the students into the real world of teaching and allows them to put philosophy and theory into practice (Matoti & Lekhu, 2016). During teaching practice, the PGCE students get the opportunity to be present into the culture of teaching, they get the opportunities to apply the teaching and learning theories they have learned which include teaching methods, teaching strategies, teaching principles, teaching techniques and practical training that schools engage in (Vumilia & Semali, 2017; cited in Marais& Meier,2004). Review of literature of previous studies show the advantages and limitations of microteaching as a teacher training technique with a main emphasis on its effectiveness, lacking in literature is whether microteaching can be used to train student teachers as an alternative to the traditional teacher training method.

2.4 Understanding teacher competency

This section draws from concepts emerging from the literature above and from the Minimum Requirements for Teacher Education Qualifications (MRTEQ) framework which is a South

African policy document used by Higher education institutions (HEI) for teacher education to advise their accreditation and quality assurance processes for teachers.

2.4.1 What is Competency?

To comprehend what constitutes an effective teacher preparing program it is essential to look closely at what entails quality teaching and the teaching practices. The significance of teachers' competencies for quality teacher education has been highlighted in research related to the advancement of teacher training programs and studies on teacher education. At this point, it is necessary to describe what is meant by the word competency to gain insight into 'teacher competencies. The term competency was firstly described by White (1959) as an individual's ability to interact effectively with their environment. It is characterized in terms of knowledge, abilities, skills and attitude and cannot be isolated from the professional contexts to which it occurs (Hager & Gonczi, 1996). Katane as cited in Selvi (2016) defines competency as "the set of knowledge, skills, and experience necessary for future, which manifests in activities". Jin and Scheider (2019) argues that, rather than referring to behaviours that people should be able to demonstrate, competency refers to a collection of personal attributes that enable employees work better in a specific role. According to these definitions it can be deduced that a competent teacher is one that has the ability and a set of diverse skills to effectively teach in a classroom.

2.4.2 Defining Teacher Competency

Literature suggests that competency refers to the teacher's ability to choose effective teaching strategies to teach a science topic (Akdemir 2019, Mavhunga & Rollnick,2013). In this study, the term "teacher competency" refers to a complex set of knowledge and skills that a teacher must possess in order to teach effectively in a variety of teaching situations (Bakkenes, Vermunt, & Wubbels,2010). Shulman (1987) describes this diverse set of teacher knowledge as the pedagogical content knowledge (PCK) whereby teachers have knowledge of the subject matter including the knowledge of how to teach that subject matter to be sensible to the learners. Fauth et al (2019) defines teacher competence as a set of personal qualities (motivation and knowledge) that teachers must possess to meet the high demands of their profession. According to Nessipbayeva (2012), teacher competency encompasses more than just knowledge and skills; it also requires the teacher's ability to meet complex demands in a certain context by focusing on and mobilizing psychosocial tools. The two authors contend that the teaching profession has high demands that require a competent teacher, but it is unclear what those demands are. Volman (2005) comments that huge demands are on teacher's ability

to successfully plan for different students and to teach the 21st century learners using a wide range of teaching methods which include the use of technology. Using the construct of TSPCK by Mavhunga and Rollnick (2013), teacher competency can be defined as the ability to transform content of a topic into a form understandable to the learners. This transformation is achieved through the consideration of what Mavhunga and Rollnick considered as components namely learner prior knowledge, Curricula saliency, what is difficult to teach, Representations and analogies, conceptual teaching strategies. These concepts will be described into detail in section **2.6** below.

2.4.3 Teacher competences After Qualification

This study uses the basic teacher competences of a beginner teacher after qualification as reflected in **MRTEQ (2015) (***see references***)** to understand the teacher competences that PGCE students should possess after qualification to teach Life Sciences in high school. This section will discuss the concepts that arise from the MRTEQ to understand and describe the teacher competences the PGCE students should possess after qualification. The following are the minimum competencies that newly qualified teachers must possess:

Sound subject knowledge: Newly trained teachers must have thorough subject knowledge at qualification. Khwaja (2006) argues that teachers' confidence in teaching science is influenced by their knowledge of the **content knowledge** which in turn influences how they teach.

Knowledge of how to Teach, Select appropriate teaching strategies, Sequence and Pace the lesson:

How to teach-Newly trained teachers must know how to teach their subject. This teacher knowledge refers to **Pedagogical Content Knowledge (PCK)** of a teacher which is defined as the teacher knowledge of representing and formulating the content knowledge in order to make it understandable to the learners as well as understanding what makes the learning of a specific topic easy or difficult (Even,1993). Mavhunga and Rollnick (2013) argued that PCK is topic specific and developed the Topic Specific Pedagogical Content Knowledge (**TSPCK**) which I used in this study as my conceptual framework for the study.

How to select appropriate teaching strategies- Another feature of newly qualified teacher is that they are able to select appropriate teaching strategies when teaching a specific science topic. Note that **teaching Strategy** is one of the TSPCK components.

Pacing and sequencing Content Knowledge: Newly qualified teachers should understand how to choose, sequence, and pace material based on both subject and learner needs. Davidson, Sherer and Goldsmith (2009) argue that pacing and lesson time allocation is important because it allows for a distribution of classroom time to favour for a range of activities especially the group or pair activities within a lesson period. Note that pacing and sequencing are aspects of the TSPCK component **curricular saliency**.

Learner needs Knowledge: Newly trained teachers must consider who their students are and how they learn, as well as their individual needs, in order to customize their teaching methods to suit learner needs. This explanation aligns with the knowledge domain **Knowledge of students** in the TSPCK framework

Effective Communication: In order to mediate learning, newly trained teachers must know how to communicate effectively in general as well as in relation to their subject(s). A study conducted by Çıldır (2019) found that student teachers who had effective communication skills were also able to choose the right teaching methods to teach and send correct messages to be well understood by their learners.

High Developed literacy, numeracy and Information Technology Skills: Teachers who are newly qualified must have strong reading, numeracy, and information technology (IT) skills. Kessler (2019) argues that technology use is a highly expected skill for newly qualified teachers who will be teaching in the 21st century classrooms however teacher preparation programmes put more effort in developing teacher teaching skills with limited emphasis on developing student teacher technology skills. Stevens (2006) comments that the difficulty in teacher preparation programmes in South Africa are because there are no general technology subjects where teachers get to develop their technological skills.

Curriculum Knowledge: Newly trained teachers must be familiar with the school curriculum and be able to comprehend its specialized content, as well as prepare (plan) and design relevant learning programs using available resources. This explanation aligns with what the TSPCK component **curricular saliency** is about.

Knowledge of the context and diversity: In order to teach in a way that involves all learners, newly trained teachers must consider diversity in the South African context. They must also be able to recognize and discuss learning and social issues in collaboration with trained service providers. This aspect captures what the domains **knowledge of context** and **knowledge of students** are about.

Class-room Management: In order to maintain a supportive learning environment, newly qualified teachers must be able to effectively manage classrooms in a variety of contexts. Laslett and Smith (2002) identify class-room management as the teacher's ability to organise and present lessons in such a way that all learners are actively engaged with reduced sources of friction which may disrupt the lesson.

Assessment: Newly trained teachers must be able to assess students in a variety of ways and use the results of their assessments to enhance their teaching and learning and also inform their planning.

Professionalism: Newly trained teachers must have a strong work ethic, demonstrate appropriate principles, and conduct themselves in a way that is appropriate for the teaching profession, strengthens it, and improves it.

Reflection: In order to consistently improve and adjust to changing situations, newly trained teachers must be able to objectively reflect on their own practice in technically educated ways and in collaboration with their professional group of colleagues. The analysis of student teacher reflection in this study will be observed only in student teachers' responses and not in the reflection diaries since they were not part of data collection due to the covid health measures put.

2.5 Students' experiences of microteaching.

Davids (2014) conducted research into students' experiences of Microteaching. This research study was conducted at a South African university of education, where first-year student teachers were receiving microteaching training. The Microteaching program was implemented in response to an academic audit that revealed that the faculty's highest first-year student dropout rate emerges after students have gone to the schools for their teaching practice. Microteaching was used as a mechanism to resolve this issue. In this study Davids found four main experiences of microteaching by the student teachers namely, learning from lecturers, learning about content knowledge and performance, learning through emotional experiences and learning about organization and planning.

Learning from Lecturers

Students indicated that lecturers were helpful during micro-lessons by offering feedback and lesson planning assistance, including advice about how to implement and conclude a lesson. Panhoon and Wongwanich (2014) argue that the learning of teaching skills can be improved when teachers get the right feedback given at the right frequency. The purpose of

giving feedback to student teachers is to reduce errors, close gaps, and improve knowledge and competence acquisition (Adarkwah,2021). Though feedback from the micro-lessons shows to be useful for student teachers, Davids also notes that some student teachers appreciated the feedback sessions while some were skeptical about the feedback received. Although it is important that students benefit from the feedback provided, it is also critical that common goals be established prior to the microteaching program (Davids,2014).

Learning about content knowledge and performance

According to Davids (2014) student teachers expressed cognitive and affective experiences towards the microteaching program. Student teachers were appreciative of the feedback they received on their content knowledge and their pedagogical practices. The feedback included the 'how' and 'what' to teach, the content on science knowledge and the art of teaching. The students' experiences were mostly focused on the 'how' which emphasizes the performative aspect of the microteaching activity. According to Davids performative practices focus on the 'how' about teaching however the 'what' which refers to content knowledge should not be underemphasized.

Learning through emotional experiences

Student teachers elicited emotional experiences which brought about learning for the student teachers. In this study, Davids reported that some students expressed discontentment, unfairness, alienation towards the microteaching program which showed negative emotions towards the microteaching program. However, in a study conducted by Benton-Kupper (2001) students showed positive emotional experiences such as appreciation, others had phobia with the microteaching videos taken of them while teaching while others were excited about videotaping.

Learning about organization and planning

Davids (2014) reports that student teachers critiqued the time allocation and management of the micro-lessons. In other words, the student teachers felt that the time allocation for the lessons was short in comparison to the actual lesson. The microteaching program was shown to be useful for planning, however the concern was that the student teachers felt that the micro-teaching program lacked sufficient planning itself.

2.7 Conceptual framework

As can be seen in earlier sections which described the competencies that a student teacher should have at qualification, most of the teaching competencies align with the TSPCK components. Therefore, the TSPCK theoretical framework was chosen as lens because the competencies in the TSPCK component link with those that are found in the MRTEQ. The literature on PCK as a construct of teacher professional knowledge and literature on students' experiences of microteaching as described in section 2.6 and 2.8 below informed the conceptual framework of this study as the two aspects are deemed to provide a holistic way of looking into the affordances and limitations of microteaching in preparing PGCE students to teach Life sciences in high school.

2.7.1 Pedagogical Content Knowledge

The notion of Pedagogical Content Knowledge (PCK) has been of interest for many years and has brought about many models of PCK. Shulman (1986) makes an important distinction between Content Knowledge (CK) and Pedagogical Knowledge (PK). Content knowledge (CK) refers to domain-specific subject- matter knowledge whereas pedagogical knowledge (PK) is described as the knowledge a teacher possess that goes beyond subject matter knowledge which includes knowledge of strategies for effective teaching (Rosenkränze, Stahl,Kramer, Hörsch, Schule & Rieß, 2016). PCK refers to the coming together of content and pedagogy in order to enhance how particular topics are organized, represented and adapted to the diverse learning abilities of the learners (Kathirveloon, Piteh & Matematik, 2014). PCK is the unspoken knowledge that is gained through teaching practice (Kind, 2009). It is considered as an indicator of teachers' and prospective teachers' competence to teach science in South Africa and other countries (Maryati, Prasetyo, Wilujeng & Sumintono, 2019).The role of a competent teacher also includes considering what the learners already know about a topic, what the learners are likely to find easy or difficult to learn about the topic and what concepts need to be challenged (Nilsson & Karlsson, 2019). PCK plays an integral role in teaching as it allows science teachers to identify and act on the factors that regulate their models of teaching (Martinez and Mellado, 2016). These factors include learner prior knowledge, curricula saliency, what is difficult to teach, representations (and analogies) and conceptual teaching strategies which inform teachers teaching methods (Mavhunga & Rollnick 2013). This implies that teacher training programs should emphasize PCK and how to teach specific scientific concepts for learners to better understand (Van Driel & Berry, 2012). PCK is central for

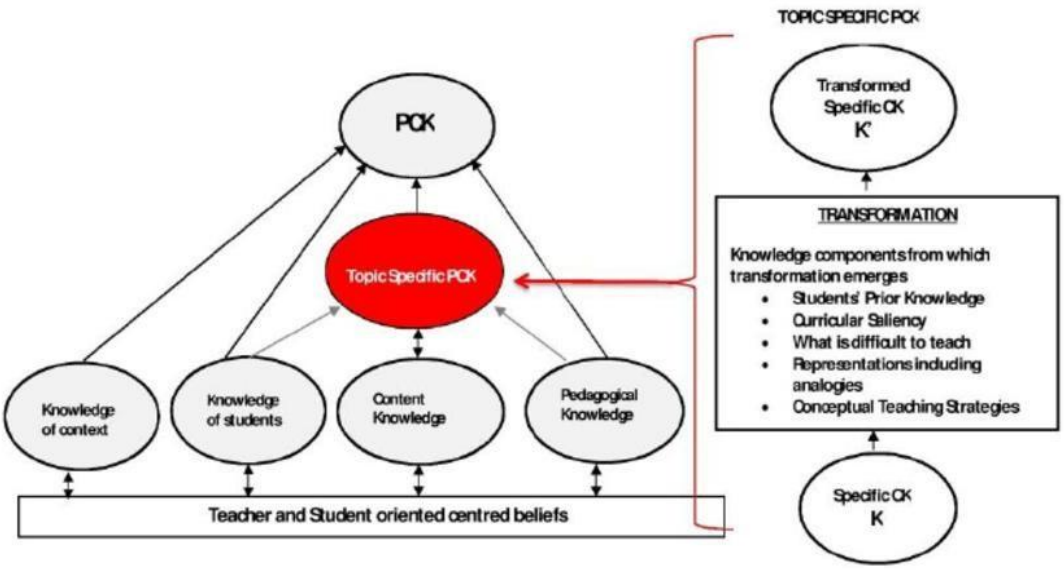
teaching and thus it is essential for teacher education programs to develop student teachers' PCK for effective teaching (Lepareur, Cross & Munier, 2017).

2.7.2 Topic Specific Pedagogical Content Knowledge

There is a large body of literature that identifies the ways in which teachers can competently teach. Mavhunga & Rollnick (2013) have shown that the framework of Topic Specific Pedagogical Content (TSPCK) can be used to train and evaluate the competency of teachers. In this study TSPCK was used as a lens to guide an investigation of the affordances and limitations of microteaching. Mavhunga & Rollick (2016) argue that PCK is topic specific (TSPCK), and it is possible to train quality teachers by developing their PCK topic by topic. In this study the model of TSPCK proposed by Mavhunga & Rollnick (2013) was utilized. This section dissects TSPCK as a construct to explain its characteristics, which are critical in this study's data analysis.

Mavhunga and Rollnick (2012) define TSPCK as the teacher's capacity to transform content knowledge of a specific topic. Mavhunga and Rollnick (2012) argue that the TSPCK construct also represents the knowledge of reasoning behind (pedagogical reasoning) planning for teaching a topic and the actual teaching of that topic (enactment of teaching). This study used the TSPCK construct as a lens of analysis to understand the competences the PGCE students show for both planning and teaching specific topics. This was done by looking at the TSPCK five components. TSPCK is differentiated by its five components namely learner prior knowledge including misconceptions, curricula saliency, what is easy or difficult to teach, representations including analogies and conceptual teaching strategies. The TSPCK model is shown in figure 3 below.

Figure 3: Rollnick & Mavhunga (2014) topic specific PCK model (TSPCK)



Rollnick and Mavhunga (2014) describe the components of the model as follows:

Learner Prior knowledge

Describes the conceptions and preconceptions that learners bring with them to a learning environment (Rollnick & Mavhunga, 2014). Diaz (2017) defines learner prior knowledge as a "broad range of pre-existing knowledge, beliefs, skills, attitudes" that learners bring into the classroom. This pre-existing knowledge could affect how the learners receive the knowledge that the teachers teach, for this reason teachers need to be aware of the conceptions and pre-conceptions learners bring into the classroom.

Curricular Saliency

Rollnick and Mavhunga (2014) define curricula saliency as the ability of a teacher to identify the big ideas of a topic and sub-ordinates concepts, how to sequence them and grasp their importance. Teacher understanding of which topics relate to each other and how to sequence them and the knowledge of why it is important to teach the topic is essential because it holds a science topic together (Rollnick & Mavhunga, 2014).

What is difficult to understand

Implies what makes the learning of specific topics easy or difficult. It includes the ability of the teacher to identify the concepts that are difficult to teach and understand. This component is beyond the abstractness of the topic, it is the teacher's ability to point out the actual difficulty of a topic (Pitjeng-Mosabala & Mavhunga, 2018).

Representations including analogies

Representations (including analogies) refer to the teacher knowledge about the illustrations, examples, explanations and demonstrations a teacher uses for a specific lesson topic. Mavhunga (2018) identifies three levels of explanations in science which are microscopic, symbolic and sub-microscopic. It is essential for a teacher to use all three levels of explanations side by side when explaining a scientific phenomenon (Mavhunga, 2018).

Conceptual teaching strategies

Conceptual teaching strategies refer to the knowledge the teacher has about teaching strategies most likely to be effective when teaching a specific topic. It also includes the teachers' reason for choosing specific teaching strategies. While conceptual teaching strategies is a component of the TSPCK framework this study focused on general teaching strategies because the PGCE students taught different topics which influenced their choice of general strategies. A study conducted by Marques, Loureiro and Marques (2015) suggests a wide range of teaching strategies teachers can use for effective science teaching that promote high positive impact learning. These strategies are summarized in the table below.

Table 2: A list of effective science teaching strategies including the features.

Teaching strategy description	Feature
Enhanced context strategies Learning is contextualized in real happening of the learner lives or in the student interests. The taps and finds out learner previous knowledge (what learners bring into the classroom, what the learners know about the topic at hand). **Collaborative or Group work** Science is a collaborative subject, learners should be given opportunities to engage with each other, work in groups, engage in collective reasoning. (Furtak, Siedel, Iverson, Briggs, 2012)	- *Previous knowledge (TSPCK component but referred to as prior knowledge)* - *Student interest (TSPCK aspect-knowledge of learners)* - *Knowledge of the context (TSPCK aspect)* - *Contextualizing Learning (Aspect of Knowledge of the context* - *Pair work or group work* - *Student engagement,* - *Collective reasoning*
Non-linguistic representations *(Aspect of the TSPCK component namely representations including analogies)* According to Marzano, Robert, Barbara, Gaddy and Dean (2000) non-linguistic representations refer to the use of words, phrases, terms to highlight key points and the use symbols and arrows to show relationships.	- *Words, phrases, terms* - *Drawings* - *Writing* - *Construction of graphic organisers* - *Multimodal representations* - *Pictures*
Questioning strategies Questioning strategies are highly cognitive (Johnson, Zhang & Kahle, 2012). These also includes "teacher wait time, including more high cognitive questions, pausing visual media at key points, posing comprehension questions to start of the lesson "(Schroeder, Scott & Tolson, 2007)	- *Probing Questions* - *High cognitive questions* - *Teacher wait time* - *Pausing visual media* - *Posing comprehension questions*

Laboratory inquiry strategies *Allows the learners to answer scientific research questions*	- *Lab Work* - *Lab reports*
Assessment strategies including feedback Schroeder, Scott & Tolson (2007) refer to these strategies as testing or evaluation. Providing feedback is one of the essential features of this teaching strategy. Aondolumun (2017)comments that the feedback process incorporates the provision of results, questioning, visual aids which are immediate sources of feedback.	- *Testing* - *Evaluating* - *Results* - *Questioning* - *Visual aids*
Manipulation strategies and instructional technology strategies These include the use of technology when teaching scientific concepts, including the use of practical engagement with science phenomenon	- *Technology* - *Practical engagement*
Debate or Discussions Science learning requires a teacher to include argumentation in learning.	- *Argumentation* - *Debates*

Mavhunga and Rollnick (2013) argue that teachers transform the content knowledge by reasoning about the topic they are going to teach using the five components described above which can develop in teachers a unique knowledge for teaching the topic. This shows that the TSPCK model can be used to develop teacher competency and the pedagogical practices of a teacher to teach a specific topic. To look at teacher competency this study looks at the TSPCK components that manifest in the micro-lesson plan and those that manifest during the teaching of the micro-lesson. This becomes the underlying focus of the study, looking at components of TSPCK that occur in the planning and the teaching of the micro lesson.

2.8 Student teachers' experiences

Benkendorff, Ruhanen and Scott (2009) comment that the term student experiences is characterized as a term that includes not only academic aspects of teaching, learning, and curriculum, but also student behaviour and extracurricular activities, academic guidance, encouragement, and mentoring, and work experiences. John Dewey *as cited in* Manaf (2016) defines experience as an individual's feeling through action, emotion, cognition and communication. To understand the student teachers' experiences researchers also look at student emotions elicited during and after the teaching experience. Shin and Wang (2015) identify a range of basic emotions elicited during an experience in individuals as found in literature by different theorists, these are listed in **Table 3** below from Shin and Wang (2015).

Table 3: A list of basic emotions as adapted by Shin and Wang (2015)

Theorist	Basic Emotion
Plutchik	Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise
Arnold	Anger, aversion, courage, dejection, desire, despair, fear, hate, hope, love, sadness
Ekman, Friesen & Ellsworth	Anger, disgust, fear, joy, sadness, surprise
Frijda	Desire, happiness, interest, surprise, wonder, sorrow
Gray	Rage, terror, anxiety, joy
Izard	Anger, contempt, disgust, distress, fear, guilt, interest, joy, shame, surprise
James	Fear, grief, love, rage
McDougall	Anger, disgust, elation, fear, subjection, tender-emotion, wonder
Mowrer	Pain, Pleasure
Oatley and Johnson-Laird	Anger, disgust, anxiety, happiness, sadness
Panksepp	Expectancy, fear, rage, panic
Tomkins	Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise
Watson	Fear, love, rage
Weiner and Graham	Happiness, sadness

The basic emotions listed above will be used as a lens to understand the PGCE student teacher experiences on the microteaching program.

Conclusion

In this chapter, I described the two types of teaching experience emphasizing the traditional in-school teaching practice and the on-campus microteaching. To understand the affordances and the limitations of on-campus microteaching as an alternative this chapter also compares the two teaching practice programs. This study attempts to understand the effectiveness of using microteaching as an alternative to the traditional in-school teaching practice in preparing the PGCE students for teaching life sciences after qualification by looking at the competencies of the PGCE and their experiences of the on-campus microteaching program. This study used the MRTEQ document to understand the minimum competencies that a newly qualified teacher should possess. As it can be seen in this chapter, the teaching competencies that a student-teacher should have after qualification align with the components of TSPCK. For this reason,

the construct of the TSPCK was described as it was used as a lens of analysis in this study. The literature on PCK as a construct of teacher professional knowledge and literature on the student experiences informs the conceptual framework of this study as the two aspects provide a holistic way of looking into the affordances and limitations of on-campus microteaching as an alternative to the traditional in-school teaching practice to prepare PGCE students to teach Life sciences after qualification.

Chapter 3

Methodology

3.1 Introduction

This study investigated the limitations and affordances of using on-campus microteaching as an alternative to the traditional in-school teaching practice in training the PGCE students to teach Life sciences. The study was located within the interpretivist paradigm, where the social interactions describe human actions, where people living together interpret the meanings between each other and these meanings occur in the social plane (Bassey, 1999). A qualitative method was used to carry out this research using a case study. Below the study is described further.

3.2 Research Design

The study made use of a qualitative research design method. Ritchie, Lewis, Nicholls, and Ormston (2013) define qualitative research as an interpretive approach concerned with exploring the phenomena at hand and considering the perspectives and accounts of research participants. Rahman (2017) outlines the advantages of the qualitative research method which include a thick and detailed description of the research participants' emotions and their experiences. Gray (2013) argues that descriptive studies provide a great advantage of information that can inform policy. Qualitative data is very useful to interpret the meaning of the participants' actions (Daniel, Molwus, Nkup & Wuyokwe, 2020). Anderson (2010) comments that qualitative studies have a shortcoming of being biased and unreliable, however, when it is carried out properly it is unbiased, reliable, and credible.

The qualitative research method allows the researcher to gather data mostly through naturally occurring ways like observations and interviews and most of the data collected are through words rather than numbers to allow the researcher to explore deeply using a variety of methods to achieve deep understanding (Zondi, 2018). Gillham (2000) notes that qualitative data enables the researcher to clarify data and possible explanations for human behaviour or lived experiences. To position this study in the qualitative design context, I used the case study methodology. This is described next.

3.3 Research strategy – Case study

According to Gomba (2017) case studies are ideal for examining an issue or an idea that affects a group of people. In this study, a case study was utilized to build a profound understanding of the affordances and the limitations of microteaching used as an alternative to training PGCE students to teach Life Sciences in high school at qualification.

A case study approach was used, using Harling (2012) definition of a case study as a holistic inquiry that investigates a contemporary phenomenon that occurs in its natural environment. This study was conducted in the natural setting of a PGCE teacher training HEI. Case studies are a suitable research strategy for such comprehensive studies of complex social phenomena in this case the affordances and limitations of using microteaching as an alternative to training PGCE students.

Case studies, according to Yin (2014), are an all-encompassing method that covers the logic of design, data gathering methodologies, and specialized approaches to analyse data. The case study inquiry relies on multiple sources of data collection and analysis of data which are guided by a specific theoretical framework (Yin, 2014). Data collected through case studies is advantageous because it allows the researcher to examine and describe data in the context of its use (Canli, 2020). Dos Reis (2012) suggests that a case study researcher should maintain an open mind to keep seeking data and review the analysis until the data makes sense.

Creswell and Poth (2012) describe a case study as a qualitative approach that has in-depth data collection which involves multiple sources of information. This ensures that the phenomena are not investigated through one lens but a variety of lenses that allows the researcher to understand the multiple facets of the phenomena (Baxter & Jack, 2008). Starman (2013) states that case studies are valuable in practice-oriented fields such as education because it allows the researcher to explore and understand complex issues. Zainal (2007) noted the limitation of case studies that they focus on a small number of participants which makes it difficult to generalize, hence the findings from this case study cannot be generalized to a population of PGCE students. However, findings can be transferable to another context and are essential in contributing to knowledge and informing policy development (Simons, 2009). These findings give insight into understanding the affordances and limitations of on-campus microteaching as an alternative to in-school traditional teaching practice. The participants in this study are, therefore, a smaller group of PGCE students in total 5 students.

3.4 The case

The case in this study was 33 PGCE students who were registered for a one-year life sciences methodology course at a South African HEI. For fulfilment of the PGCE program, PGCE students are required to go for a six-week teaching practice at a high school to teach life sciences as one of the subjects they major in. The MRTEQ document suggests a minimum of 5 weeks and a maximum of 8 weeks of teaching practice per year.

As a result of lockdown regulations due to the corona virus pandemic, the 33 PGCE cohort did a four-week online Teaching experience module followed by 2 weeks intensive microteaching, this took Data collection commenced during this period.

3.5 The Participants

Three classes were observed. Two students were observed in class A, two students in class B and one student in class C. Five PGCE students out of the 33 gave consent to be observed and interviewed for this study. Their details are shown in **Table 4** below.

Table 4: A summary of the participant details

Student	Gender	Race
Nomsa	Female	Black
Anna	Female	White
Ronell	Male	White
Nelly	Female	Black
Lihle	Female	White

3.6 The study site

The study was done at a HEI; Three class/lecture rooms were the study sites for this study. Class A had a total of thirteen PGCE students, class B had a total of 10 PGCE students and Class C with a total of 10 students. The rooms are equipped with the basic tools that a teacher needs for teaching such as: Wi-Fi, data projector and screen, chalk and chalk board and a white board. Laboratories were also accessible and the university's student technicians were on hand to assist with setting-up of lab experiments if any PGCE student would need to do experiments. All protocols for spread of the corona virus such as the wearing of masks at all times were also in place and were being followed. Each group was allocated a supervising tutor to supervise and evaluate the microteaching practice.

3.7 Research Instruments

Multiple sources of data were collected in this study namely, lesson plans and video recordings of microteaching-less1ons and interviews. Each of these data collection methods is described below.

3.7.1 Lesson Plans

Participants' lesson plans were the first source of data. Documents are an effective data source as they can be reviewed multiple times and remain stable from the researchers' influence (Bowen, 2009). Each student was required to prepare three lesson plans. Two lesson plans were to be taught during the scheduled two microteaching lessons for each student. The third one was going to be used only when the supervising tutor felt that a student needed to teach a third lesson for further assessment. I collected the two lesson plans, however due to time constrains only one lesson plan was analysed, the lesson plan of the micro-lesson observed from each of the five participants. In total five lesson plans were analysed.

3.7.2 Videos

In this study, micro-teaching lessons were video recorded and were used as data. For each participant, I video-recorded one micro lesson. The microlessons ranged in the length from 20-30 minutes. The lessons observed were video recorded and later transcribed. Video recording increases credibility because if direct observations are only done, the researcher may not remember everything that has occurred in the lesson. Although video-recording as a data collection tool has limitations, one of which is that the participants may alter their behaviour because they are aware that they are being recorded, for this study this limitation was mitigated through triangulation of data sources. Triangulation refers to the collection of data using more than one method to gain a good understanding of different perspectives of an investigated phenomenon (Ammewerth, Iller, Mansmann, 2003). It allows the researcher to increase their level of knowledge to strengthen their standpoint from various aspects (Ammewerth, Iller, Mansmann, 2003). Barter & Jack (2008) comment that triangulation of data sources for researchers is the main strategy that can be used for a case study research to observe a phenomenon to be studied from different angles.

3.7.3 Semi-structured interviews

This study employed non-contact semi-structured interviews as suggested by Adhabi and Anozie (2017). These include telephone, messenger, and email interview techniques. Adhabi and Anozie (2017) argue that with technological innovation the use of non-contact semi-structured interview strategy is effective to accomplish the same purpose of face-to-face

interviews. The advantage of using this mode of interviews is that it allows both the participant and researcher to be flexible and allows the researcher to explore the raised issues by the participant. The interviews were done over Microsoft Teams and were recorded.

This study used semi-structured interviews which were based on open-ended questions. The formulation of open-ended questions was guided by observations that I had made of participants' micro-teaching. Open-ended questions provide opportunities for the researchers and the participant to discuss the phenomenon in detail however the researcher should ensure that they are neutral to refrain from influencing the participant's responses (Fox, 2009). The interviews were done at the end of the microteaching experience as described above. The recorded audio of the interviews was later transcribed.

The interview schedule had seven scheduled interview questions which were prepared in advance. These seven questions were the same for all five participants (*see figure 4 below*). There were however additional follow-up questions for each student which were stimulated by what happened during the micro-teaching as viewed from the recorded videos and these questions varied in number from one participant to the other (*see examples of these questions also in figure 4 below*). As differentiated by Fontana and Frey (2000) semi-structured interview schedules include structured questions where participants receive the same set of question including open-ended questions which may vary from one participant to another. The validation process suggested by Prescott (2011) was utilized to validate the interview questions of this study. Validity for my research questions was obtained through face validation by my supervisor to rate the validity of the research questions. The research questions were found to be suitable for the purpose of this study.

Below are the examples of the interview questions (*see the rest of the interview questions in Appendix* **F-J***).*

Figure 4: Showing an interview schedule

Scheduled Interview Questions

1. What was in mind when planning the lesson? What did you consider?
2. Describe how the lesson you taught went?
3. What teaching strategies did you use to teach the lesson topic?
4. Why did you choose those teaching strategies? In a traditional classroom context, would you have used the same strategy?
5. How would you describe the 'level' of preparedness you had to teach the lesson topic?
6. What skills did you use for the micro-teaching lesson?
7. To what extent would you say the lesson went well?

Video stimulated interview questions

1. In the lesson I observed, at the beginning you mentioned that you were going to start the lesson with a Surprise test, why did you think it was important in your lesson?
2. In a traditional classroom context, would you have started the lesson the same way?
3. You allowed the learners to work in pairs, why was it important?
4. I also observed that you were engaging with the learners as they were doing the activity, what did you notice as you engaged with them?
5. In the lesson you allowed the learners to work in pairs, how did this impact the lesson?

3.8 Data Collection process

3.8.1 Collection of Lesson Plans

Five PGCE students participated in the data collection of this study. The students voluntarily agreed to share their lesson plans for various chosen topics. The topics and grades chosen to be taught by the PGCE students are explained and shown in chapter 4 (**table 1**). The lesson plans were collected immediately after the teaching of the micro-lesson.

3.8.2 Video-recordings of micro-teaching lessons

This study used an unobtrusive observation video recording capturing the PGCE students teaching a micro-lesson. The nature of the classrooms was different for all the five participants. As stipulated in **section 3.5** the participant classes were classified as class A, B and C. **Class A** was a lecture room which had a chalk board, projector, a white board, podium, and speakers. Class B was a practical lab classroom which consisted of lab working stations, a white board, speakers, projector, and a screen. **Class C** was a tutorial room which had a screen, white board, speakers, projector, and a screen. This was important for me to note because the setup classroom also impacts classroom interaction (Rands & Gensemer-Topf, 2017). The micro-teaching was video recorded using a camera. To video record the micro-lesson the researcher arrived early to setup the camera and sat at the back of the room to avoid intimidation for the of participant and the peer students.

3.8.3 The interview process

To interview the participants, I set up a non-contact session with the five participants on Microsoft teams. The participants were interviewed individually immediately after reviewing the video-recorded micro-lessons three times. This was essential to in helping me formulate the video-stimulated interview questions and to get the PGCE students' responses while they

still remembered their reasoning behind their teaching and the occurrences in the micro-lesson. The interview sessions ranged from 15-20 minutes and were recorded on Microsoft teams.

3.9 Data analysis

Data collection from the participants was analysed using qualitative in-depth data analysis, which involves methods that describe and interpret participants' views and includes content and thematic analysis (Smith & Firth, 2011). Data analysis of the collected data followed three steps for the lesson plans and four steps for the video-recorded micro-lessons and the interview questions. An in-depth description of data analysis for each data source is described in Chapter 4. Below is a summary of the analysis steps for each data source.

3.9.1 Analysis of Lesson Plans

The analysis of the lesson plans followed three steps which are explained in detail in chapter 4. **Step 1** involved me getting familiar with the lesson plans. To get acquainted with the lesson plans I read the lesson plans three times each taking not of important aspects in the lesson plans. **Step 2** was coding the lesson plans and **Step 3** included categorising the codes.

3.9.2 Analysis of video-recorded micro-lessons

The analysis of the micro-teaching videos included four steps. **Step 1** involved me getting acquainted with the video recordings, by replaying and watching the videos three times. **Step 2** involved transcription of the audio parts of the video-recordings. To transcribe the video recording, I transcribed word for word of the audible portions. **Step 3** I coded the transcripts and **step 4** I extracted and categorised the codes.

3.9.3. Analysis of interview transcripts

Step 1 involved getting acquainted with the data collected by playing back and listening to the interviews. **Step 2** involved transcription of the interviews. **Step 3** was open coding using open coding. Open coding involves the researcher making up codes when working through data when meaning is coded under a relevant code (Dos Reis, 2012). **Step 4** included categorising the codes and theme formulation. The detailed descriptions of the analysis process was presented in Chapter 4 of this stud1y.

3.10 Validity

Validity of a qualitative research refers to the extent to which the data is plausible, credible, and trustworthy and thus can be defended when challenged (Bashir, Afzal & Azeem, 2008). To ensure validity in this study several strategies suggested by Ekanayake (2011) were taken

into consideration to counter the limitations of case studies. This study also used multiple sources of data collection which include documents (lesson plans), video recorded micro-lessons and semi-structured interviews. Yin (2003) suggests that using theory in the research design improves the external validity of the study. This study used a conceptual framework as a lens to understand the competencies that are captured during planning and teaching, including the PGCE students experiences of microteaching. The purpose of this case study was to expand the theory and not to undertake statistical generalization (Ekanayake, 2015). To ensure reliability in this study the researcher did not involve personal biasness which will influence the reliability of the study (Combs, Adams, Michael, Penn, Basso,& Gouvier, 2006) rather steps were taken to address this issue for instance the interview guides were prepared based on the conceptual framework (Ekanayake, 2015) and face validated by my supervisor. To counter the challenge of subjectivity in the analysis of data the researcher worked with a colleague to code data and there was 80-85 percent agreement of the coding which increased to 95% after discussing our coding.

3.11 Ethical Consideration

Bashir et al (2008) define Ethics as a branch of philosophy that is concerned with the dynamics of decision making concerning right and wrong. The researcher has a responsibility to take care of the participants' safety, dignity, rights, their wellbeing and the various issues that may arise at different stages of the research process (Parveen & Showkat, 2017). To ensure this in this study, I applied for clearance from my University's Human Research and Ethics committee by confirming that this study complies with all the requirements to ensure appropriate consent, anonymity, and confidentiality from the participants. In this study, ethical consideration was carried out in a way that the participants gave consent to be part of the study (Cohen, Morrison & Manion, 2011). Consent was acquired from the participants through consent forms that were given out to the participants (see appendices). The consent form clearly stipulated what the study is about and how anonymity was considered and the principle of voluntary participation was considered. The fundamental nature of anonymity was to ensure that the information provided by the participants will in no way reveal their identity. It was indicated to the participants that they may withdraw from the study at any point (Cohen et al, 2011). In this study pseudonyms were used to ensure anonymity of the participants. The names of the participants were not disclosed and anyone reading the research report and results will not be able to identify the participants. Data collected was only used for research purposes and will not be used in a way that will publicly identify the institution involved.

3.12 Conclusion

This chapter has described my research design and how I collected the data. The descriptions provide a full account of how I carried out my study.

Chapter 4

Data Analysis and Presentation of Findings

4.1 Introduction

This study aimed to investigate the affordances and limitations of microteaching as teaching practice in PGCE teacher preparation programs. The study focused particularly on the PGCE students' competencies when planning and teaching a micro lesson. The study examined the PGCE students' experiences of the microteaching program. In this chapter, I critically analysed the data to identify the competencies of the PGCE student teachers and their experiences of microteaching, and the data was analysed against the background of the reviewed literature and the conceptual framework. The aim was to answer the following research questions:

1. What are the teaching competencies that manifested in PGCE students' on-campus micro-teaching lesson plans?
2. What are the teaching competencies that manifested in PGCE students' on-campus micro-teaching?
3. What were the PGCE students' experiences of on-campus microteaching as teaching experience before qualification?

4.2 Data analysis

As I already indicated in chapter 3, five PGCE students participated in this study. Three forms of data were collected from each of the five students: A lesson plan, a video recording of the lesson aligned with the recorded lesson plan, and interview data of the students' experiences. Below I present the analysis of each data set.

4.2.1 Analysis of lesson plans

This section describes how the lesson plans for the micro-lessons were analysed. The analysis of lesson plans as described in section 3 was followed. Five PGCE students' lesson plans were collected. Each PGCE student chose own topic to teach during micro-lesson, resulting in a wide range of topics chosen by the PGCE students.

One PGCE student chose to teach a grade 9 topic that is related to the Life Sciences curriculum. The other four students all chose topics within the grades 10-12 FET syllabus as prescribed in the Life Sciences curriculum. The difference in the topic chosen had no influence on the results

because the focus of this study was not on the topics chosen by the students, but rather on the competencies that manifested in their planning and teaching of their micro-lesson.

Table 1: Table 1 is a summary of the topic details

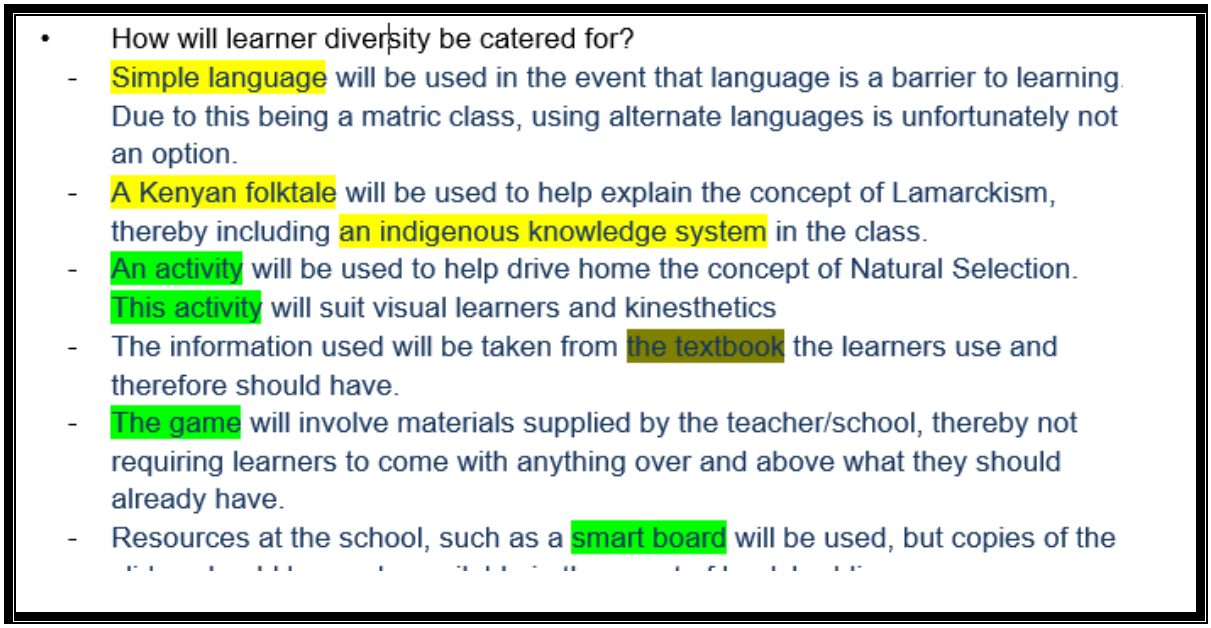
Student	Topic	Grade in which the topic is taught	Number of learners in each class.
Lihle	**Evolution**	12	13
Anna	**Artificial Selection**	12	10
Ronell	**Respiratory Systems**	9	13
Nelly	***Human Nervous System***	12	10
Nomsa	**Homeostasis (Negative feedback-loop)**	12	10

Step 1: Getting acquainted with the lesson plans that were prepared by each participant.

To become acquainted with what was in the lesson plans, I read each plan three times, noting the grade and the topics planned by the PGCE students. While reading through the lesson plans, I would take note of any aspects of interest such as representations or diagrams that the PGCE students would have stated or indicated in their lesson plans. This was useful in the analysis process to note the teaching strategies the PGCE students wanted to use in their micro-lesson.

Step 2: I coded the lesson plans, as described in chapter **3 section 3.4**, the data was coded deductively and inductively. For the deductive coding, I read through each lesson plan and assigning codes that captured what I was noticing in the transcripts; these are the deductive codes that were informed by the literature reviewed and the conceptual framework of this research. I was, however, open to inductively code any other aspects about the planning that I found interesting and relevant to my research questions. After coding, I asked a fellow student friend that is acquainted with the TSPCK framework to code two lesson plans using the same conceptual framework to assess the liability of my coding. There was 95 percent agreement, we then discussed the differences after which I then applied the agreed coding to the rest of the lesson plans. Below is an excerpt **(Picture A)** of the coded lesson plan:

Picture A: showing an example of a coded lesson plan



- How will learner diversity be catered for?
  - Simple language will be used in the event that language is a barrier to learning. Due to this being a matric class, using alternate languages is unfortunately not an option.
  - A Kenyan folktale will be used to help explain the concept of Lamarckism, thereby including an indigenous knowledge system in the class.
  - An activity will be used to help drive home the concept of Natural Selection. This activity will suit visual learners and kinesthetics
  - The information used will be taken from the textbook the learners use and therefore should have.
  - The game will involve materials supplied by the teacher/school, thereby not requiring learners to come with anything over and above what they should already have.
  - Resources at the school, such as a smart board will be used, but copies of the

Green and olive Green* *(Teaching strategies)*, ***Yellow* (*Awareness of prior knowledge).*

Step 3: **Categorising the codes**

After the coding process, I extracted all the different codes that I had used to code the five lesson plans gathered them together. All in all, the number of codes that were formulated across the lesson plans were twenty-five, these are ten of the twenty-five codes I used in the lesson plan:

- ***revision work***
- ***lesson objectives***
- ***use of technology***
- ***pair work***
- ***revision work***
- ***use of examples***
- ***background knowledge***
- ***recap questions***
- ***pair work and class activities***.

After gathering the codes, I grouped them according the five components of my conceptual framework. I used classification reasoning that was informed by my literature review to group the codes together. After the codes were classified, I again asked a friend to check my categorisation. There was 90 percent agreement, we then discussed the differences after which I then applied the agreed categorisation of the codes. The codes and the final categories are as shown below in table **4.4.1.**

4.2.2 Presentation of Findings from analysis of Lesson Plans

In this section, I present the competencies the PGCE students demonstrated while planning a life science lesson, including their teaching strategies

Table 4.4.1 Results of Lesson Plan Analysis

	Nomsa	Anna	Ronell	Lihle	Nelly
Awareness of Learner Prior Knowledge					
	• Revision Work	• Use of examples (covid-19)	• Revision Work	• Use of History • Background Knowledge • Folktale • Simple Language • Revision work (Homework)	• Learner Background knowledge • Use of Examples (Life Orientation PE) • Recap Work
Curricular Saliency					
Stating the lesson Objectives					
	• Not Evident	• Evidence	• Evident	• Evident	• Evident
Representations planned for use					
	• Drawings • Concept Map (mentioned but not evident) • Images and Videos	• Concept Map • Memes	• Mind map • Diagrams • Models	• Concept Map	• Mind Map • Video

Teaching strategies					
Collaborative Approaches					
	• Pair Work • Games (Jumbled cards)	• Small group work • Debates	• Not Used	• Games • Class Activities	• Pair Work
Explanation preparation					
	• Evident	• Evident • Evident		• Evident	• Evident
Questioning Techniques					
	• Question and answer • Probing Questions • Recap Questions	• Recap Questions	• Probing Questions	• Probing Questions • Recap Questions	• Question and answer • Probing Questions • Recap Questions
Instructional Technology					
	• Not specified	• Power-point slides • WhatsApp • Google meets	• Power Point slides	• Smart Board • Power Point	• Power Point slides • Zygote-3D Virtual human demonstration

4.2.3 Discussion of Results

This section discusses the results as presented in **table 4.4.1.** The discussion of results structured using the TSPCK components as suggested in chapter 2 section **2.7.2** of this report.

4.2.3.1 Awareness of learner prior Knowledge

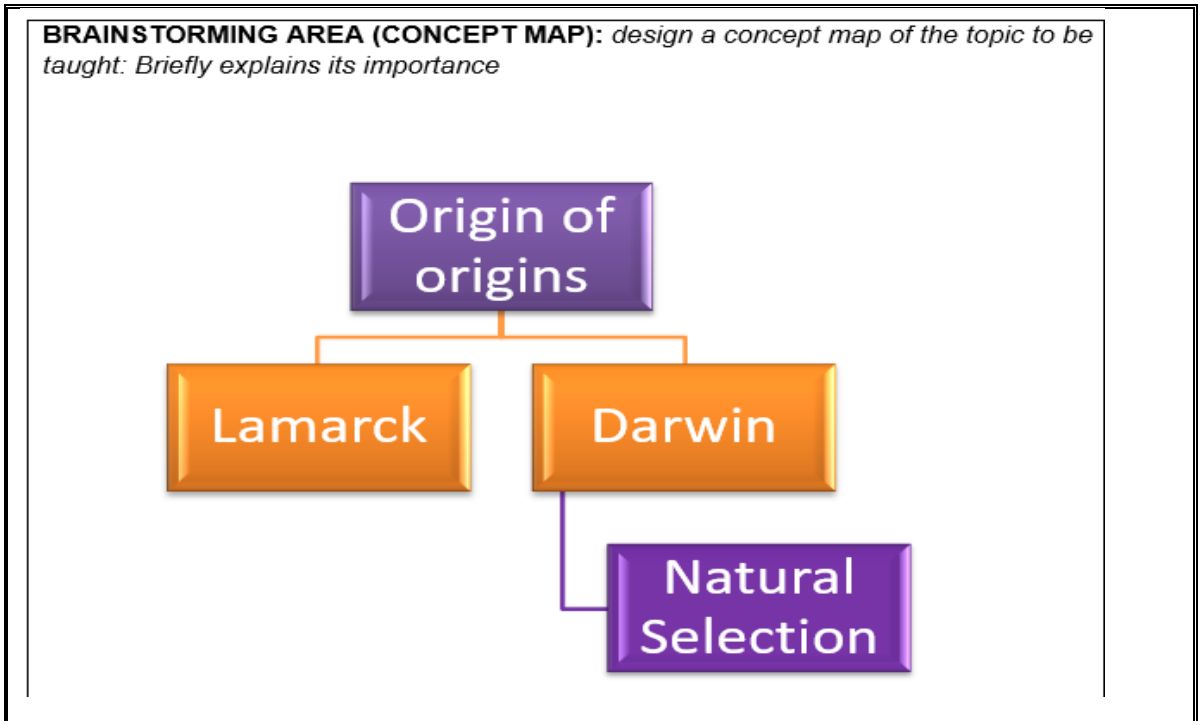
There was evidence of awareness of learner prior knowledge in all five lesson plans. Nomsa, Ronnell and Lihle said in their lesson plans that they would use revision work. The revision work covered work that was done in the previous lesson which this study did not get access to. Lihle stated that the use of revision work will also incorporate the use of a homework activity. Anna stated the examples that she was going to use in her teaching which learners were going to be familiar with which included the Covid-19 pandemic, dog, and mealies because these examples were "pretty common". This shows that Anna is aware of the conceptions and preconceptions that the learners bring into the classroom due to familiarity.

Lihle, in addition of revision work, she also made use of the following strategies: the use of history, background knowledge, folktale and simple language. Lihle stated that a using Kenyan folktale incorporates an indigenous knowledge system. This strategy shows that the student is aware of the context in which she is teaching, though the folktale is not South African the student shows that she is aware she is teaching in the African context. This is also reflected in MRTEQ that a competent teacher must have the knowledge of context and diversity. Being aware of learner prior knowledge is an important competence in planning because it allows teachers note learner misconceptions about the topic thereby putting them in a better position to deal with those misconceptions.

4.2.3.2 Curricular Saliency

There was some evidence of a consideration of curricular saliency in the lesson plans through stating of the lesson objectives. As stated in **section 2.7.2** curricular saliency also includes teacher knowledge of why it is important to teach the topic this relates to lesson objectives. Lihle stated the importance of learners to grasp knowledge on the history of origins, the concept of Lamarckism and the concept of Natural selection. In turn these concepts are used in a mind map to show the relationship between the big Ideas, sub-ordinate concepts **(Linking lesson objectives with the concept map).** The following excerpt B shows Lihle's concept map:

Picture B showing Lihle's mind map



The above mind map shows how the student links the lesson objective with a mind map that shows understanding of the Big Ideas and sub-ordinate concepts of the planned lesson. Although there is consideration of curricular saliency in Lihle's planning there is no evidence of how the concepts are going to be sequenced. While the objectives show what will be looked at and the mind map shows consideration of the big ideas and sub-concepts, the concept map does not show Lihle's extensive understanding of the big ideas and sub-concepts, thus this cannot be measured. As explicitly shown in the MRTEQ, newly trained teachers must show comprehension of the specialized content knowledge, this can also be seen in the teacher's sequencing of content knowledge through concept maps or mind maps. Lihle's concept may suggest a limitation on how to sequence content knowledge and represent it in a form of a concept map.

Anna also showed consideration of curricular saliency by linking the lesson objectives with the mind map. **Picture C**, shows Anna's lesson objectives:

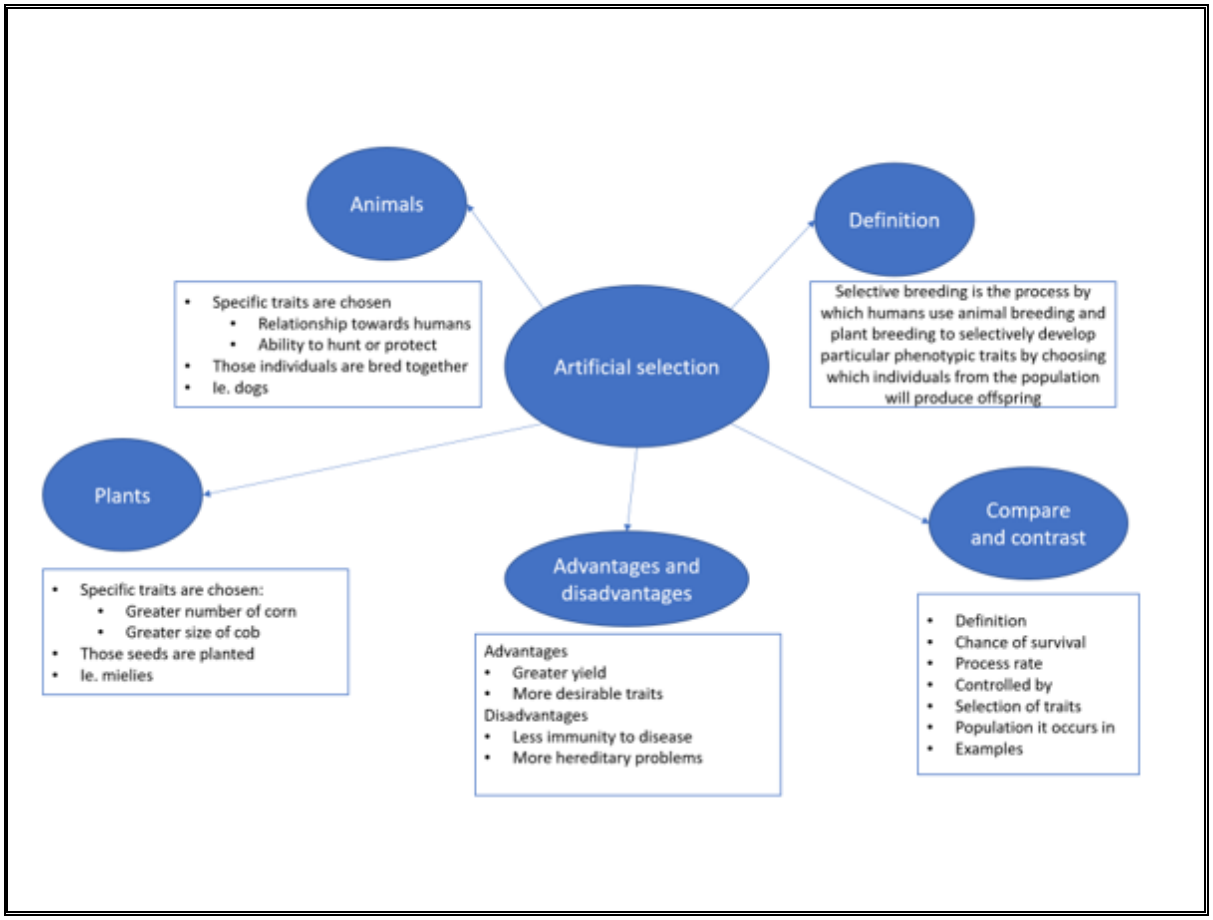
Picture C, showing Anna's lesson objectives

4.4.2. By the end of the lesson the learners should be able to…
(State new knowledge, skills, and values)

- Define artificial selection
- Describe one example of artificial selection in plants and animals
- Describe the advantages and disadvantages of artificial selection
- Compare and contrast artificial selection and natural selection

Picture C shows Anna's lesson objectives, the difference between Lihle and Anna is that Lihle's mind map did not make clear the understanding of the big idea and the sub-ordinate concepts whereas Anna's mind map had concepts, definitions, and examples. Picture D showing Anna's mind map:

Picture D showing Anna's mind map



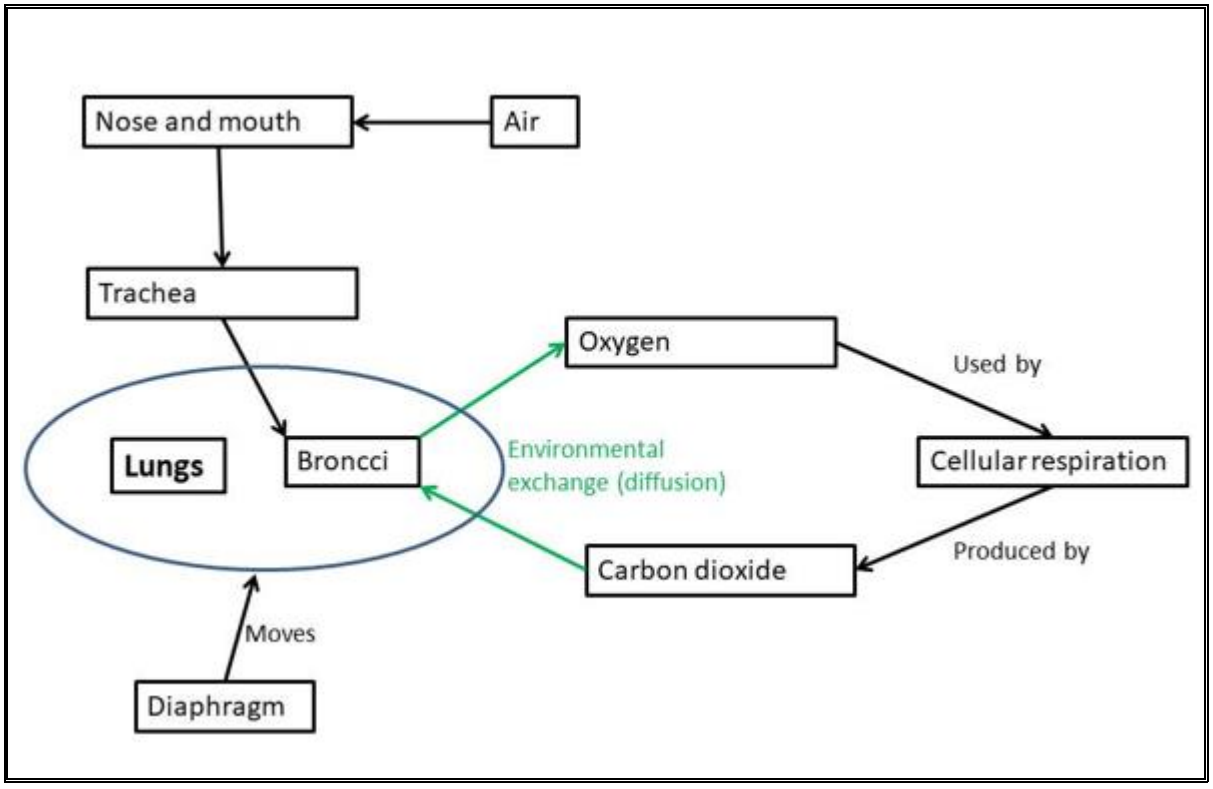
Picture C and **D**, shows that Anna linked the lesson objectives with the mind map, however both **picture D** and **picture C** show a simplified understanding of the relationship between

the Big Ideas and the sub-ordinate concepts. Picture D does not show any relations at all. Both maps do not have linking words to show understanding and linking between the big ideas and sub-ordinate ideas.

Ronnell's lesson plan also showed that there was consideration of curricular saliency through **linking the lesson objectives and the concept map**. However, the lesson objectives did not explicitly state the big ideas and the sub-ordinate ideas the learners were supposed to grasp. Ronnell's concept map shows some understanding between the big ideas and the sub-ordinate ideas through using linking words between the concepts. Note however that the arrow between cellular respiration and carbon dioxide should be pointing in the direction of the concept cellular respiration.

Picture E shows Ronell's concept map:

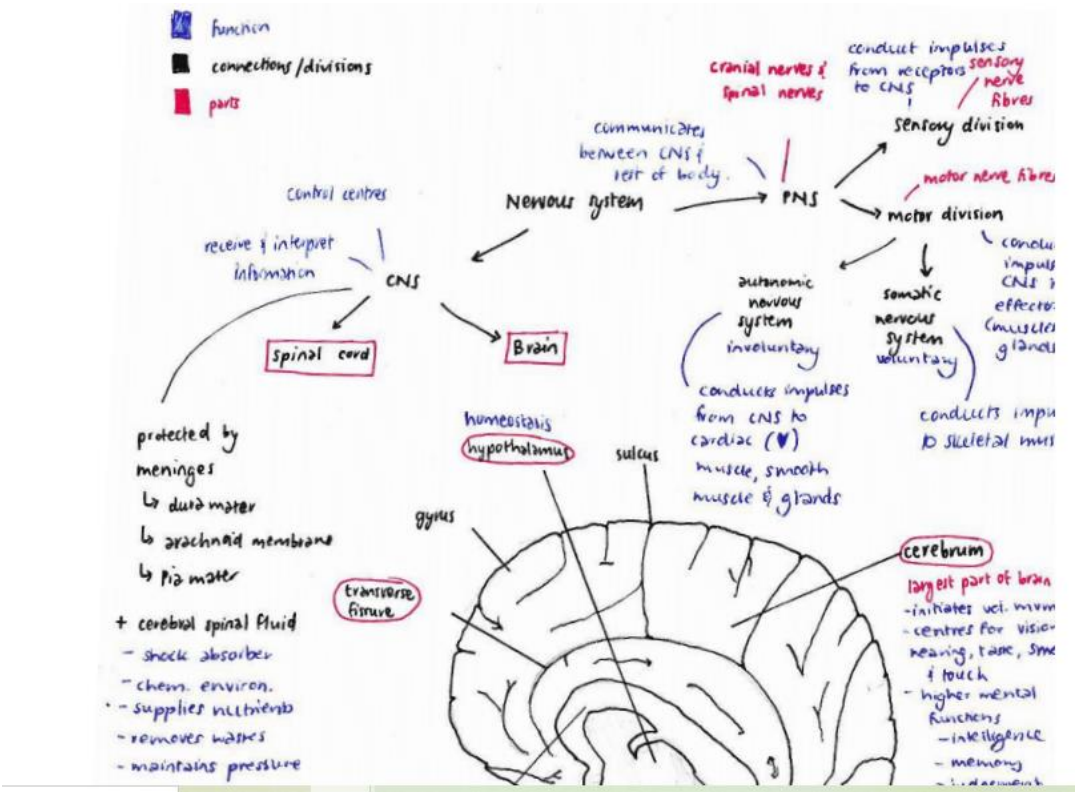
Picture E: Showing Ronell's concept map



Nelly's planning showed consideration of curricular saliency through linking the lesson objectives and the concept map. The concept map was extensive and showed great understanding between the big Ideas and the sub-ordinate ideas. As shown in picture F, Nelly shows and extensive comprehension of the content knowledge she is planning to teach, this shows the competency as suggested by MRTEQ. Teachers who have a greater understanding

of the links between lesson objectives and lesson planning have a greater chance of affecting the learners understanding of a topic in a better way (McKimm and Swanwick, 2009). The following is **picture F** showing Nelly's concept map:

Picture F: Showing Nelly's concept map



4.2.3.3 Representations including analogies

The analysis of lesson plans also showed that a wide range of representations were planned for use in four lesson plans as can be seen in the table of results above. These representations included memes, images, diagrams, concept, and mind maps. The ability of the students to formulate and use relevant representations is a competency explicitly mentioned in the MRTEQ. Anna stated the use of memes as an indication of a teacher's ability to represent and formulate content knowledge using representations that are relevant to the learners.

A study conducted by Tippett (2016) shows that learning with representations facilitates learning and is a useful tool for metacognition. However, Lihle's lesson plan mentions a concept map which is not evident in the lesson plan. While the use of representations provides

learners with meaningful opportunities to learn science content, it can also be the source of misconceptions; however, there is little detail in the planning in terms of PGCE students' awareness of this.

4.2.3.4 Conceptual teaching strategies

Collaborative Work

There was evidence of a range of collaborative activities in four lesson plans. Ronell's lesson plan did not specify use of any collaborative work. The other four lesson plans showed evidence of collaborative activities in their lesson planning. MRTEQ indicates that newly qualified teachers must be able to select appropriate teaching strategies. As suggested by literature in **table 2** of chapter 2, one of the effective teaching strategies in teaching life science topics is the use of collaborative work. Literature suggests the importance of collaborative work in the learning of sciences (Furtak et al, 2012). The knowledge of suitable choice of appropriate activities for collaborative work was very evident as seen in the results.

Questioning Technique

In all the five lesson plans, there was clear indication of the use of questioning techniques. This is likely to impact learning positively as the questioning techniques encourage learner participation and it also allows the teacher to note learner prior knowledge and misconceptions about a specific topic as observed in the micro lessons. Questioning as a teaching technique was widely used, as shown by the fact that it was included in all five lesson plans. As outlined in the competencies in chapter 2, the consideration of using questioning techniques in the planning of the PGCE students is an essential teaching strategy as it incorporates the immediate feedback from the teacher which allows for effective communication between the teacher and the learner as they engage. The MRTEQ also indicates that effective communication is an important competence for newly qualified teachers.

Explanation preparation

In all five lesson plans there was indication of the use of explanations. There is indication of how the PGCE students plan to use explanations in the lessons. In the results the most popular reason was explaining life sciences terminology.

Instructional Technology

Four out of five lesson plans stated the use of Instructional technology which included a wide range of online and technological resources. In four lesson plans the reason stated for the use of instructional technology was to cater for different learner needs and as a tool for supporting explanations. As indicated in MRTEQ high developed technology skills is a highly expected skill for newly qualified teachers. The wide range of the use of technological resources by the PGCE students which shows competence as stated by the MRTEQ. A study by Rakes, Fields, and Cox (2006) found that the limited use of instructional technology was linked to less confidence in teaching using the technological tools. In this case the use of a wide range of the use of instructional technology implies that the PGCE students had a positive look towards the use of technology in teaching Life Sciences.

Conclusion to the presentation of results from the analysis of lesson plans

The following teaching competencies manifested in students' plans. Awareness of learners' prior knowledge, curricular saliency (stating the lesson objectives), Representations planned for use, collaborative approaches, explanation preparation, questioning techniques and instructional technology. In the next section, I analyse audio transcripts of micro-lessons to find out the competencies that manifested during the teaching of the planned lessons.

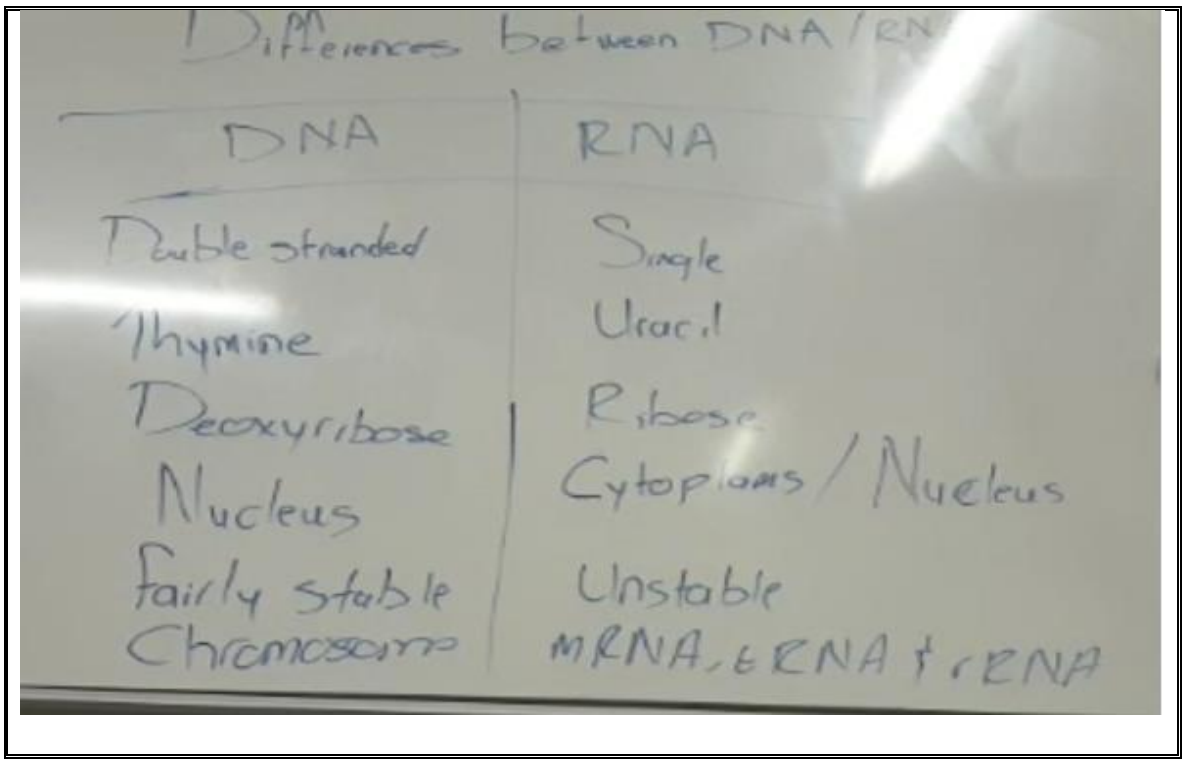
4.3. Analysis of micro-lessons

In this section, I describe the steps I took to analyse the micro lessons data. The analysis followed four steps as described below:

Step 1**: <u>Getting acquainted with the teaching that was done by each participant.</u>**

To become acquainted with the micro-lessons, I watched the lesson video three times, noting the grade and the topics taught by the PGCE students. While playing-back the videos, I would pause and take screenshots of any aspects of interest such as representations that the PGCE students would display on the screen or any diagrams that were used and writings on the white board. The screenshots were used as evidence in noting the teaching methods used by the PGCE students. Some of the screenshots taken are used in the presentation of the findings. Below is an example (**Picture G**) of the screenshot that I took during video-playback.

Picture G: showing writings on a white board

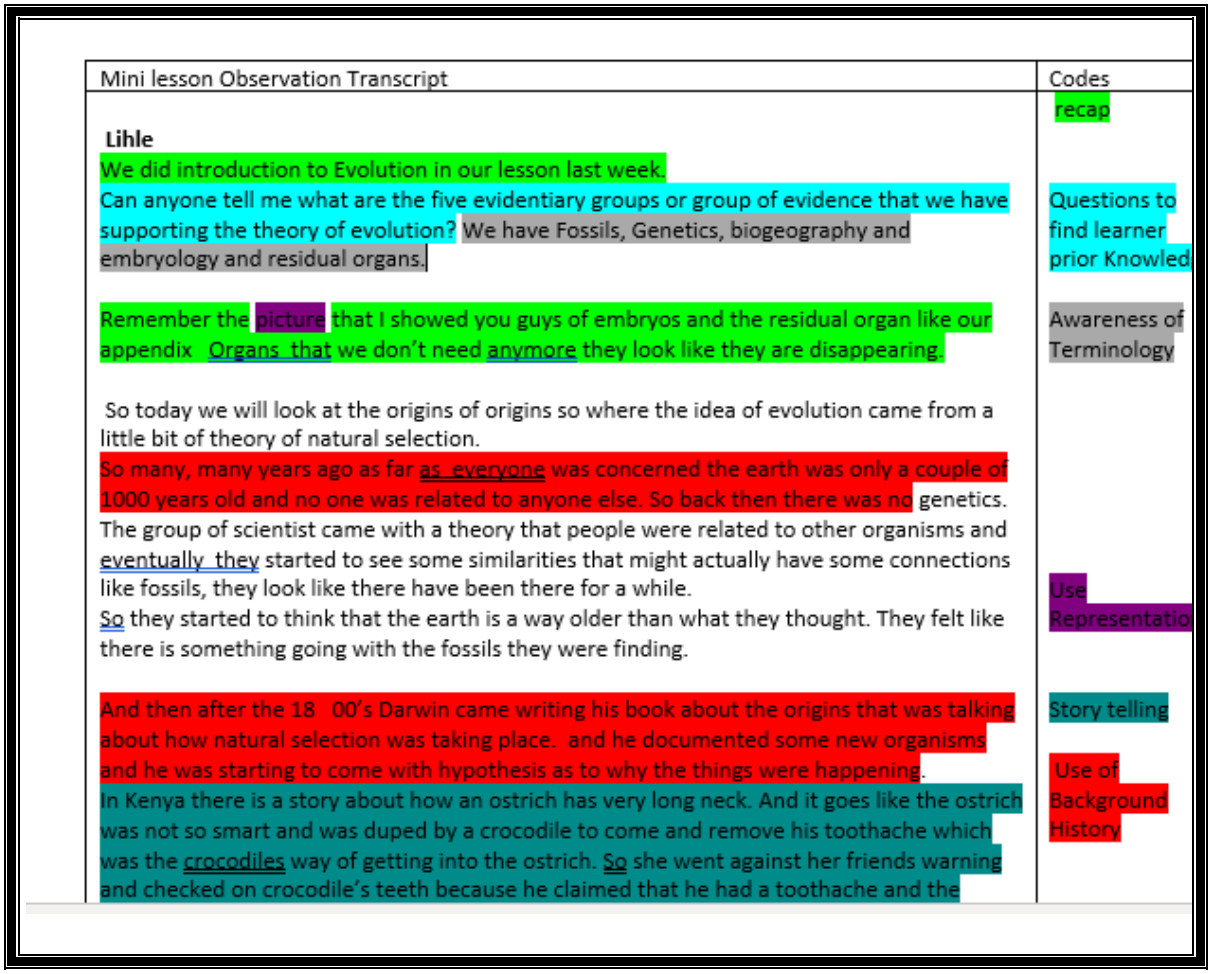


Step 2: I transcribed the audio parts of the videos

I transcribed audios of all five video-recorded lessons. The transcription was time-consuming as each video was 20-25 minutes long. The transcription however, helped me further acquaint myself with what transpired in each lesson.

Step 3: I coded each transcript, as described in chapter **3 section 3.4**, the data was coded deductively and inductively. For the deductive coding, I read through each transcript colour coding what I was noting in the transcripts informed by the literature reviewed and the conceptual framework of this research. I was, however, open to inductively code any other aspects about the teaching that I found inte1resting and relevant to my research questions. The following is **Picture H** showing an example of a colour coded audio transcript.

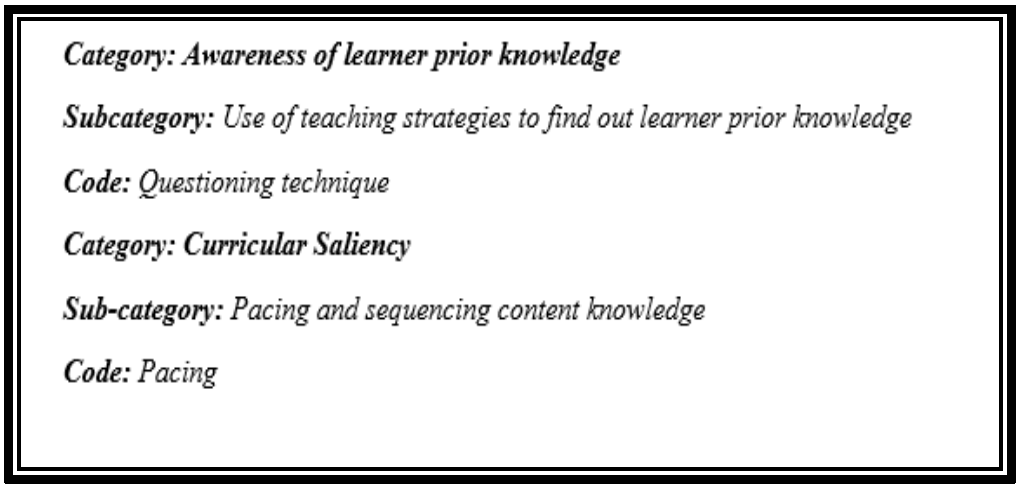
Picture H: Picture showing an example of a coded micro-lesson verbatim.



Mini lesson Observation Transcript	Codes
Lihle	recap
We did introduction to Evolution in our lesson last week.	
Can anyone tell me what are the five evidentiary groups or group of evidence that we have supporting the theory of evolution? We have Fossils, Genetics, biogeography and embryology and residual organs.	Questions to find learner prior Knowled
Remember the picture that I showed you guys of embryos and the residual organ like our appendix Organs that we don't need anymore they look like they are disappearing.	Awareness of Terminology
So today we will look at the origins of origins so where the idea of evolution came from a little bit of theory of natural selection.	
So many, many years ago as far as everyone was concerned the earth was only a couple of 1000 years old and no one was related to anyone else. So back then there was no genetics.	
The group of scientist came with a theory that people were related to other organisms and eventually they started to see some similarities that might actually have some connections like fossils, they look like there have been there for a while.	Use Representatio
So they started to think that the earth is a way older than what they thought. They felt like there is something going with the fossils they were finding.	
And then after the 18 00's Darwin came writing his book about the origins that was talking about how natural selection was taking place. and he documented some new organisms and he was starting to come with hypothesis as to why the things were happening.	Story telling
In Kenya there is a story about how an ostrich has very long neck. And it goes like the ostrich was not so smart and was duped by a crocodile to come and remove his toothache which was the crocodiles way of getting into the ostrich. So she went against her friends warning and checked on crocodile's teeth because he claimed that he had a toothache and the	Use of Background History

Step 4: **Categorising the codes**

I extracted the codes and categorised them using five components of my conceptual framework as the categories. An excerpt (**Picture I)** below shows how the codes were classified: ***Picture I: Showing a categorising coding scheme.***



4.4 Presentation of findings from the analysis of micro-lessons.

In this section, I present the competencies that the PGCE students demonstrated when teaching a Life Sciences topic using the categories or the five components as headings. Note that the use of the five components was to conveniently structure the results, however, the results are presented under each component heading are not mutually exclusive. For example, **under the heading awareness of learner prior knowledge** the PGCE student would use the teaching strategies like questioning, storytelling, or games to find out learner prior knowledge. In this case, the student is already showing competency in terms of teaching strategies. The presentation also highlights the similarities of the competencies that are outlined in MRTEQ and those that are represented in the TSPCK framework as discussed in **section 2.7.**

4.4.1 Awareness of learner prior knowledge

PGCE students showed awareness of the importance of learner prior knowledge. In all five micro-lessons, they used *questioning technique* to find out learner prior knowledge before introducing a topic or concept,

For example, when Lihle taught the topic of Evolution, she started the lesson by asking the learners to name five evidentiary groups of evidence that support evolution, and in turn they named many terms that are related to the topic of evolution and Nelly asked about the concepts of DNA and RNA.

Lihle:
We did introduction to Evolution in our lesson last week. Can anyone tell me what are the five evidentiary groups or group of evidence that we have supporting the theory of evolution?

Nelly:
I just wanna see how much you remember, so this time I am gonna talk about the differences between DNA and RNA. Mpho, may you tell me the differences between DNA and RNA? or at least one difference.

Nomsa did not use questioning but did a recap to remind the students of what they should be knowing into the lesson.

So, on our previous lesson we talked about the importance of maintaining a constant internal environment within nearer limits and we talked about glucose, your PH and your carbon dioxide, right?

It is important to note that the questioning technique which was used to find out learner prior knowledge of specific aspects of the lesson and is a teaching strategy.

4.4.2. Curricular Saliency

Curricular saliency is characterised by the ability of the teacher to identify the big ideas and sub-ordinate concepts of topic, how to sequence them. MRTEQ combines sequencing of content knowledge with pacing. Pacing of a lesson is informed by the content knowledge and how the teacher sequences the content knowledge. Pacing of content knowledge is outlined in TSPCK. Pacing refers to the teacher's rate of exposing learners to new content knowledge and their ability to identify and categorise content knowledge for teaching and learning (Hoadley, 2003; Rollnick & Mavhunga, 2014). There was some consideration of pacing and sequencing of the lesson by the PGCE students when teaching a micro-lesson as presented below:

Pacing

The following teaching episode shows Nomsa's pacing when she used a game as one of her teaching strategies.

Nomsa:

Don't start before I say so that we all have equal chances to play ***(Instructional Pacing).*** *You should have a total of 38 cards. Do not start. So we can all start* ***(Instructional pacing).***

I'll be moving around to help. Remember I said your glucose should have about 10 cards and then your carbon dioxide should have about 10. So you have three minutes remaining. Okay guys your time is up ***(Instructional Pacing).***

Nomsa provides specific instructions to the learners in terms of time in the excerpt above, which I refer to as *instructional pacing*. Nomsa here shows awareness and understanding of time in relation to content learnt through activity (through a game). Here Nomsa, shows competence aligned with the MRTEQ requirements.

The following excerpt of Lihle's teaching shows evidence of instructional pacing:

Lihle:

So you will now need a timer (**Instructional pacing**) someone who's going to time this for you guys. Your time is 20 seconds. For 20 seconds (**Instructional pacing**) your bird is going to try to try and eat as many catalepsy as it can . Remember your bird is going to have bubbles on so your bird cannot see. So the bird is going to look and try to find its prey. Pick it up with the stick if you are struggling you are going to lift the flag. So for 20 seconds you are going to do that. (**Instructional pacing**).

Here Lihle shows competence by using instructional pacing during a game. Lihle's pacing is aligned to the competences as outlined by MRTEQ. Etzel and Le Blanc (1979) argue for the idea of '*pacing instructions*' where a teacher paces the time between the instructions and responding. This means that teachers should give continuous instructions to achieve a required response from the learners. I differentiate Instructional pacing from pacing instruction as the way in which a teacher gives instruction with regards to time which in turn impacts the lesson. Using instructional pacing the PGCE there was evidence of classroom management as the instructions the PGCE students prompted opportunities for active learning and a supportive environment for the learners. Classroom management is aligned to one of the competencies suggested by MRTEQ, the ability of keeping to task and giving out clear instructions is a feature and an indication of classroom management.

4.4.3 Awareness of what makes a topic difficult to teach

During the microteaching lesson, the PGCE students showed knowledge of what makes a topic easy or difficult to teach. The excerpts below show that the PGCE students are aware of the difficulty or what makes a topic easy to teach or learn.

Nomsa: *It is easy to confuse your glucose negative feedback and even in the test what happens with most people is that they confuse glucose, glycogen.* ***(Awareness of what is difficult to learn)***

Nelly: *In this lesson we will explain the function of the epidermis. So, this topic is very hectic there are many things to remember and its important that you know all of this for the upcoming test****.(Awareness of what is difficult to learn)***

The PGCE students used words like 'easy' and 'very hectic' to highlight their awareness of what makes a topic difficult or easy to teach or learn. ***Nomsa*** points out that what makes the topic difficult to learn is the confusion between glucose and glycogen. Nomsa's ability of identifying the aspects that make the topic difficult to learn is an aspect of content knowledge.

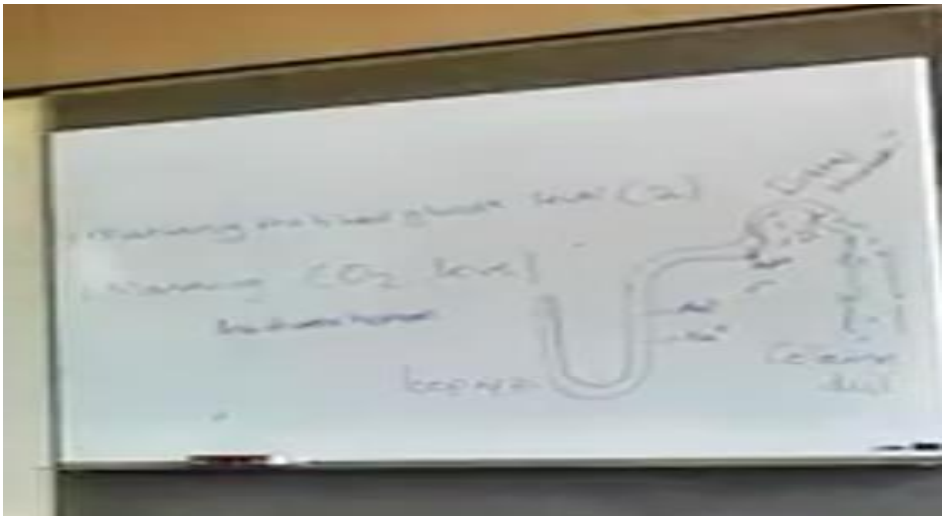
Slisko (1997) argues when teaching a scientific topic there should be a precise use of scientific terminology to avoid confusion or the creation of pseudo-concepts. ***Nelly*** points out that the difficulty of the topic at hand is due to many terms that learners are required to remember. This shows Nelly's competency as outlined by the TSPCK framework. Cimer (2012) supports the notion that the reason Life sciences is perceived as difficult is because of the large number of terms and concepts that must be learnt, and that the curriculum is overloaded. A study conducted by Cimer (2012) suggests that teachers should use representations, teaching through practical work, reducing the content of the curriculum, using various teaching techniques through connecting the topics with daily life.

4.4.4 Representation and Analogies

PGCE students used a range of representations. These representations were images (*pictures including memes*) and diagrams (*writings on the white board and graphs*). The PGCE students therefore displayed competences in terms of knowledge of a wide range of representations and 'How' to teach their subject by representing and formulating content knowledge to be understood by their peer students using *representations* to support their explanations of the concepts they were teaching. This is what was observed across all five micro- lessons when the PGCE students were teaching a micro-lesson. Below are examples of excerpts of explanations and the use of diagrams from students:

Nomsa: *So, as we are taking less water from the tubule into… into this part which means that we are losing more water because we are not taking it in, so we are gonna excrete it into the urea so it's already gonna be diluted. So as less water moves from this part to this part can you see that there are surrounding blood vessels? Those lines that are surrounding the nephrons those are your blood vessels. (**verbal explanation accompanied by use of a diagram)***

Picture H: Showing Nomsa's diagram on the white board

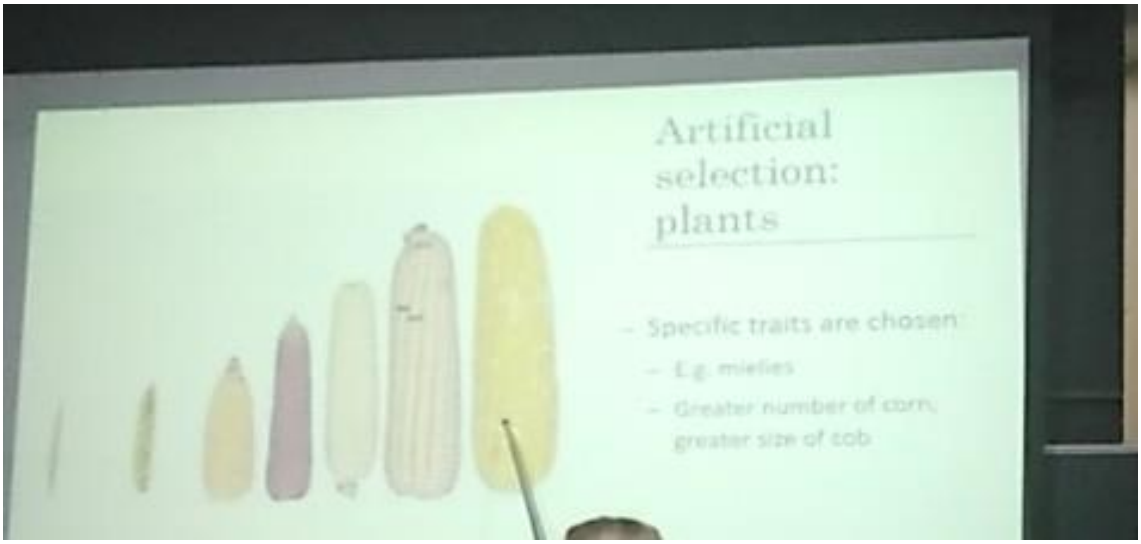


Nomsa was teaching about excretion and there was evidence of the use of representations in the form of diagrams to support the explanations.

Anna: *So our example here is this. So, they chose the corns, they count probably up to 20*

seeds on this little corn here and this one here you cannot count it you don't the time they are so many here. You can see the size increase all the time. they want a greater number and size.
(verbal explanation accompanied by use of an image)

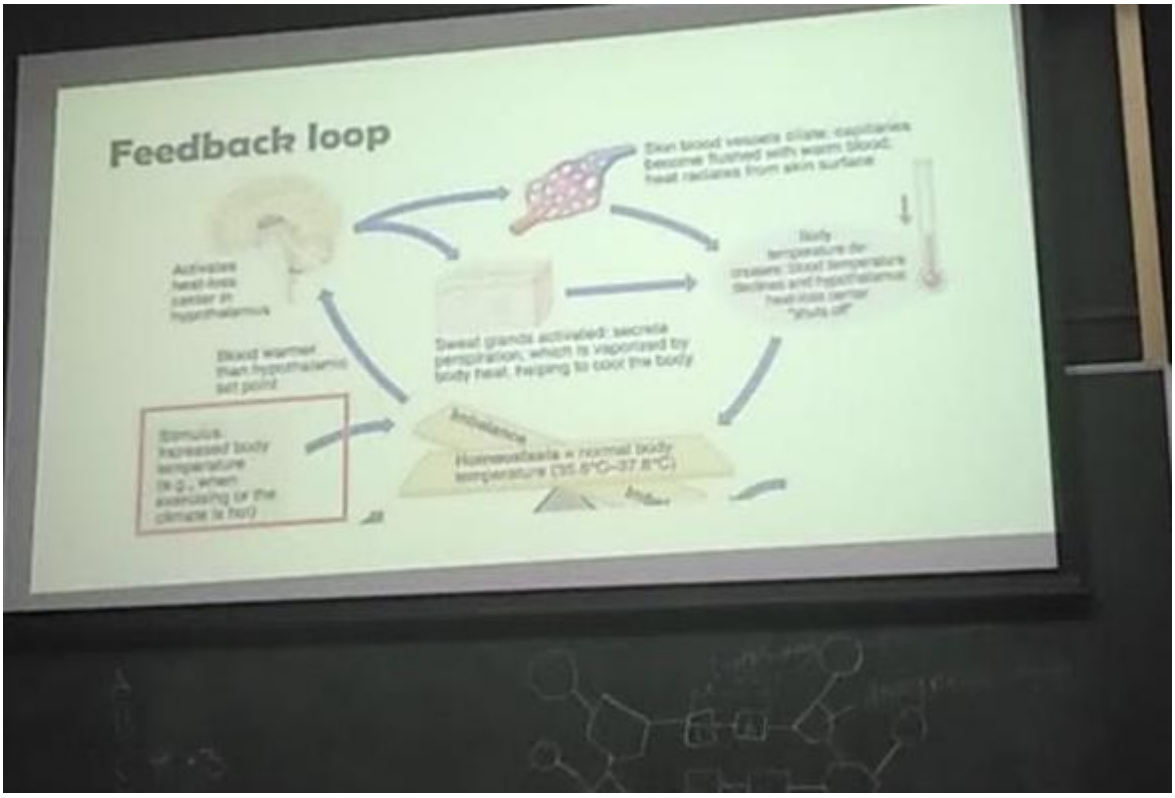
Picture I: Showing Anna's image



Anna was teaching about Artificial Selection and she pointed out to a picture of plants (mealies) on the screen to give an example of a genetically modified organisms and to explain the meaning of terminology.

Ronell: *We are going to start with a bit of a summary does anyone remember what is feedback loop? (**lesson introduction using an image**)*

Picture J: Picture used by Ronell



Ronell used a flow diagram to introduce a lesson topic using a representation shows competence as outlined by MRTEQ. However, it required that teachers should use appropriate teaching strategies when teaching a scientific concept, this includes choosing appropriate representations as well. Ronell's representation of a feedback loop was not suitable for teaching a grade 9 lesson, The image consisted of one of the following words 'hypothalamic set point', 'imbalance' which were not explained by the teacher, this may be the cause of future misconceptions.

Seeing that diagrams are well suited to demonstrate phenomena at various levels of detail and construct mechanistic explanations for phenomena, they play an important role in the teaching and learning of Life Sciences (Sheredos, 2012). Geelan (2012) argues that effective scientific representations include 'verbal+visual' situations. The verbal +situations were evident in all the three lessons as shown above, as the three PGCE students used representations accompanied by explanations while teaching a concept.

4.4.5. Conceptual teaching strategies

The following were the teaching strategies that emerged from the analysis of the video micro-lesson include; *Context based teaching strategies*, *Use of collaborative activities*, *Use of Non-*

Linguistic Strategies, *Assessment strategies including feedback* and *Use of Instructional Technology.*

In this study the PGCE students were not restricted to teaching a particular topic for their micro-teaching lesson instead the micro-lessons varied in all lesson topics and teaching strategies however the listed teaching strategies above emerged across the micro-lessons. I present these strategies and how they were used in the micro-lesson next.

4.4.5.1 Contextualising Learning

The analysis of the micro-lessons from all the five PGCE students shows that they all used contextualising methods to teach a specific topic. Davidsson and Enochson (2021) argue that introducing scientific lesson in a context that is familiar to the learners helps them to become more interested and motivated to learn science. The approaches that the PGCE students used to contextualise the teaching and learning of science was through *Stories* and *use of concrete examples*.

Use of stories

The following shows evidence of the use of stories to connect the scientific knowledge to everyday knowledge.

Lihle:

In Kenya there is a story about how an ostrich has very long neck. And it goes like the ostrich was not so smart and was duped by a crocodile to come and remove his toothache which was the crocodiles way of getting into the ostrich.

So she went against her friends warning and checked on crocodile's teeth because he claimed that he had a toothache and the ostrich could pull out the tooth. And moments when she got into crocodile's mouth, he went snap.

All the animals saw what happened and came to ostrich's aid. the antelope came, the elephant and other animals and they were trying to pull ostrich's head. When they were pulling, crocodile was pulling the ostrich's head into the water and the animals were pulling ostrich's head out of the water. And all the time ostrich felt something funny happening to her, her neck was getting longer and longer. She got a fright and started to run and she waited and she realized her neck was longer. This little fairy-tale is related somewhat to a character by the name of Jean Baptist Lamark's theory that animals could easily adapt to the changes of the environment.

Here Lihle uses a story or a fairy tale to introduce a scientific concept. The story is a Kenyan folktale, textbooks are written in a western context, the use of stories by Lihle is African, this is how Lihle contextualises the content knowledge. This shows competence as outlined by MRTEQ, the PGCE student uses appropriate conceptual teaching strategies to teach scientific concepts. Csikar and Stefaniak (2018) argue that storytelling is an alternative science teaching

method which is essential as it allows learners to improve the contextual meaning behind the knowledge and to help construct necessary schemata to incorporate the new information. In this episode of teaching however Lihle only tells the story once without the learner inputs or engagement to how they interpreted the story and this can sometimes introduce misconceptions. Therefore, while use of a story shows competency of the PGCE student, how the story was used shows the weakness of the PGCE students' competency in terms of how to use it to effectively engage learners. Storytelling as scientific teaching method is effective when learners engage with the linear facts in the story (Csika & Stefaniak, 2018).

4.4.5.2 Use of concrete examples (including explanations)

To contextualise knowledge the PGCE students used analogies and examples to explain the content knowledge that was taught.

Ronell:

Can everyone look at their skin. The first part of the skin, what you see is our epidermis and the second layer underneath will be our Dermis. If you look at the diagram here the top is our Epidermis and everything underneath it is our Dermis.

In this instance Ronell is using what the learners know and are in contact with, their skin. There is also the use of diagrams. This allows the learners to make meaning of the new information (Csika & Stefaniak, 2018). Ronell uses what learners are familiar with which is a competence that is outlined in the MRTEQ. However, reference to learners own skin does not show extensive knowledge of contextual knowledge. Feldman and Herman suggest that extensive contextual knowledge includes knowledge of the communities the learners are part of.

4.4.5.3 Use of games

The PGCE students used a range of activities to capture student interest and the most popular from the observed micro lesson was the use of Games. The following are the instances where the PGCE students used Games in their teaching.

Instance 1

Nomsa

I'm gonna give you jumbled cards right? Out of these jumbled cards, You should be able to make the negative feedbacks that we did last week on how to mainatain glucose levels.

Instance 2

Nelly

And that's almost almost, ok now time is up. Ok very good, you guys did well. Let's see your points. Ok who's going to be from this side, from this side? Oh Juma is in this team, I don't know why.
Student : *I'm in that team?*
Nelly: *Yeah.*
Student*: Juma, We've already won.*
Nelly*: Are you sure it's winning?*
Juma is in that team, there is five points. Group two bathong, group two. Julius is in that team, you guys are fine, you're fine. (inaudible). I gave you time to discuss this, here, just hold it straight and we are starting, just hold it straight, you can come a bit closer if you want to.

Instance 3
Lihle

So we are going to split into 2 groups of 3s, let me see can the 2 of you come to the front. We are going to have some practical fun now. So the process of natural selection is something that you can apply in any scenario. So it doesn't mean that anybody has to know what natural selection is. So we are going to play a game about.

Instance 4
Nomsa

We going to play a game charades, ok? So as I said this is the stuff you should look for in the vocab testthat you supposed to write today, ok.So, rather today we going to play a game as a vocab test substitution, ok? Ok then, protein synthesis, now, what is protein synthesis, we spoke about this briefly, Felicia, what is protein synthesis?

The four instances above show the use of games emerged in the four different micro-lessons where PGCE students used games for teaching and for formative assessment. The use of games for effective teaching and learning has been supported by various researchers. Chow, Woodford and Maes (2011) argue that incorporating games during teaching a science topic stimulates learner interest and provides them with opportunities to actively engage with the lesson and increases understanding.

4.4.5.4 Use of collaborating activities

Throughout the observations there was evidence of collaborative work; the following was observed in the micro-lesson.

- Debates (Discussions)

The PGCE students used debates as a teaching strategy tool to encourage interaction and discussions in the classroom. Brown (2015) identifies debates as a collaborative learning skill that enhance critical skills. The use of debates when teaching promotes active engagement placing the responsibility of learning in the shoulders of learners (Kennedy, 2009). The following are the excerpts of the instances where the PGCE students used debates as a teaching strategy.

Anna's introduction to a debate session

Anna: *There might be a more correct answer and a less correct answer so some aspects may be correct and some aspects incorrect but at the end of the day it is a debate.*

Student 1

Okay ma'am I will kinda like to disagree with Cami if she says that natural selection occurs over some generations I think there's kind of... over generations and natural selection can occur even in a short period of time.
Take for instance we have a natural disaster and they say those with chronic diseases are not likely to survive....

Anna: That's, very true.

Okay I will summarize it Kim I want you to think seriously about this because this is exactly what I was going to say because natural selection can also occur very quickly it doesn't necessary have take generations that natural selection will be starting.
And now that i what is happening with the covid 19 pandemic. If natural selection is occuring then it will be starting.
Yes...

Student 2

I have a question on what Thando said that if natural selection were to take place we have the people with strong immune system so my question is since we are looking the other species so lets the giraffes they have long necks and they passed their genes to their offspring so with immune system can a strong immune system be passed to the offspring also?

From the above teaching episode there is an indication that the teacher and the students have an active discussion and debate using questions and explanations. Kennedy (2009) argues that in addition to developing critical skills, debates also develop learner communication skills. From the above excerpt, there is evidence of effective communication between the teacher and the students.

- Pair Work

The use of pair work was through discussions between two students also between the teacher and the students. Storch and Aldosari (2012) suggest that pairing students is more effective when learners get paired according to their proficiency. A low proficiency learner paired to a low proficiency learner, and a high proficiency learner with a high proficiency learner. In the PGCE teaching lessons the teachers paired students according to the person that was next to them. Even this case some students were not participating or even discussing which may suggest that pair work may not be a useful teaching strategy in a microteaching context.

4.4.5.5 Use of Non-Linguistic Strategies

Non-Linguistic Strategies are strategies that highlight important concepts being taught. Examples include use of symbols and arrows to show relationships. The PGCE students used a range of non-linguistic strategies in their teaching. **Table 4.2** below shows the variety of non- linguistic strategies that were used by the PGCE students.

Table 4.2: Non-linguistic Strategies

Non-Linguistic strategy technique	Example
Symbolic Representation	***Use of Mind Maps*** **Nhlanhla*:*** *For us to do this we have to do a mind map of this lesson.*
Pictures	**An excerpt:** Anna*: Picture* as you see they tried to breed this dog with (inaudible) and it produced this dog. As you see in this *diagram* we have a wolf and when it breaks down we have kinds of dogs we have a...we have the....so specific traits are chosen one of the examples is we use a dog for the example for animals and they often choose the relationship towards humans.
Diagrams	Flow Diagrams Anna: And then at the end you should be able to make the flow diagrams like those that we did last week.

4.4.5.6 Assessment Strategies including feedback

Broadfoot and Black(2004) argue that the role of assessment is to encourage deep learning instead of surface learning. In this study two sub-themes emerged which are *Questioning technique* and *feedback.*

Questioning Technique

The use of questioning was observed throughout the observations. The questioning technique was used for recap purposes, I identify these kinds of questions *as recap questions.* The PGCE students used recap questions to find out what learners remember or know about a specific topic. The following excerpts show instances where recap questions were used:

Nelly:

Mpho, may you tell me the differences between DNA and RNA, or at least one difference.
Students
The DNA is double stranded and RNA is single stranded.
Nelly:
Very good, so DNA is double stranded and RNA is single stranded.

Cotton (1996) groups recap questions in the same category as probing questions that are used by a teacher to check the accuracy of student responses. In this study I differentiate between *probing questions* and *recap questions* through the tenses used when the question is asked. It should be noted that both techniques of questioning aim to find out what the learners know or remember about a specific topic, in this case both questioning techniques serve the same purpose to assess what the learners know about a certain concept.

Wilen (1978) argues that questioning strategies probe thought processes and they challenge learners to reflect on critical issues that they did not think about previously.

Nelly:

Last week we just did a brief intro but today we will look at it in detail. However, as you know, every single lesson should start with a recap, I don't know why I wrote summary but it's the same thing, every lesson needs to start with a recap.

In the above teaching episode Nelly starts by reporting how she is going to start the lesson. In this instance it shows that she does not identify herself as a learner instead of a teacher in this context as she says "However, as you know, every single lesson should start with a recap" she also identifies the students not as learners but as student teachers who should know how a lesson should start or how should every lesson start. This indicates the dual characteristic PGCE students assume in a micro-teaching context. This emerged in other teaching instances where the PGCE students were reporting what they were going to do instead of doing it in that teaching context. The following were observed during the micro lesson the PGCE students see the excerpts below:

Anna
I am gonna bring difference in this lesson is that I am going to use a bit of blending lesson so just to test my skills on diagrams and to see if that I can actively teach with.

Ronell:

So now with all that in mind the whole class remembering at where we are and what we done so far. Now I will give the learners an activity where you will create your own feedback loop and the negative feedback loop specifically to show how the body will respond to various changes in temperature.

So I'll get the loops for each student individually and then they will swap books for marking.

If social distancing allows and if they can't they can mark their own work. So Once they have done that then I will the through the class and answer some questions and just making sure that they are

sticking to the task that they are entrusted and then I will give them this example it doesn't necessarily have to look like this.

The above excerpts indicate that the student teachers not only identified themselves as student teachers but also did not identify their students as learners only but as peer student teachers by explaining the techniques to the student teachers which may not be observed in a traditional context.

There is also indication of the use of the other teaching strategy when questioning strategy students which was used by the PGCE students. See the excerpt below

Nhlanhla

Does it make sense everyone? let me see those mind maps ***(diagram)*** *well done guys. Lets quickly run through all we have done.*

What's the first layer of our skin? ***(Probing Question)***
Student:
Epidermis. ***(Pointing to the diagram)***
Nhlanhla: *And the first layer of our epidermis?* ***(Probing Question + Use of terminology)***
The 3 muscles underneath? ***(Probing Question)***
The third layer of our skin? What was the function of our base layer? ***(Probing Question + Recap Question)***
*When we are shedding ourselves it replaces the damaged cells, what's next we have our dermis right, what was the first aspect of the dermis? (****Probing question +Use of terminology+ recap Question+ explanation****)*
Can you tell me the components of the dermis any component? ***(recap Question+ Probing Question)***
When you cut your skin what's gonna come out? ***Student:*** *Blood*
What are the muscles that we find in our dermis? ***(Probing + Recap Question)***
In this this teaching instance, there is an indication of multiple use of other teaching strategies in a teaching episode. The following questioning techniques are noted in this teaching episode: ***Questioning Technique = Probing question +Use of terminology+ recap Question+ Diagrams+ explanation***

- Oral Feedback

Oral Feedback describes a way that a teacher communicates to their students they include praises and critiques which enhances learning (Chen, Thompson, Kromrey and Chang, 2011).Though feedback can be seen as corrective measure where teachers use many techniques to tell whether or not a learners response is right or wrong and can also be useful for interaction between teacher and oral feedback can also be seen as a crucial interaction between a teacher and a learner carried out for fostering learning (Hawe & Watson, 2008). The following excerpts show instances where PGCE students used oral feedback:

Nhlanhla

Good so here is the answer so body fluid is the fluid that is in the body ***(feedback as a corrective measure),*** *blood plasma, tissue fluid and cytoplasm inside the cells okay. Everyone happy? Homeostasis. Thats the easy one guys. What is homeostasis?*
Student*: It's a constant environment in a human body.*

Nomsa:

But most of you were able to do the carbon dioxide one very correctly. ***(Feedback as a corrective measure)***

What you should have noted is that, it is easy to confuse your glucose negative feedback ***(feedback for fostering learning****) and even in the test what happens with most people is that they confuse glucose, glycogen and glucogon right?* ***(Feedback for fostering learning)***

Nelly:

*Very good, so DNA is double stranded and RNA is single stranded. (****Feedback as a corrective measure)***

However, today we will not write a test because I feel like everyone did very well in the last vocab test, even though nobody got a hundred percent ***(Feedback as a praise****), I thought one person that, but nobody got a hundred percent, most of you got like, ninety percent if that's what I should call it, so everyone did a very good job* ***(Feedback as praise)***

So the first step of it will be the unwinding? Yes, very good, and then Aina, what follows there after?

Student: *It unzips.*
Nomsa:
Very good ***(Feedback as a corrective measure)****. Sureya, what happens there after?*
Student: *No, ma'am, the answer Aina gave is incorrect.*
Nomsa: *Why is it incorrect?*
Student:*The hydrogen bonds have to break first before it unzips.*
Nomsa:
Very good, I was hoping that she was gonna say it but very good, thank so much for pointing that out, very good, and then what happens? ***(Feedback as a corrective measure)***

Three types of oral feedback were identified and they are as follows:

- Feedback as a corrective measure
- Feedback as praise
- Feedback for fostering learning

Other Assessment strategies included

recap tests, mind maps, vocabulary tests.

4.4.5.7 Use of Instructional Technology

Instructional Technology refer to technological tools that teachers use to mediate learning. The following were the instructional technology used by the PGCE students.

- WhatsApp
- Websites
- Google meets
- Simulations
- Power point

During the lesson observation the students mostly used the power points slides in their teaching, WhatsApp and Google meets. The websites and the simulations were mentioned by the PGCE students while teaching. This is an indication that the PGCE students have some awareness of the use of technology for teaching Life Sciences subjects. A study conducted by Cuckle, Clarke and Jenkins (2000) shows that the PGCE students appreciate the technological skills that they gain during their teacher training programme. There was indication of the PGCE student showing that they are practising their technological skill during the micro-lesson. The excerpt below shows Anna's competency of the use of technology as outlined by MRTEQ. The following excerpt shows this:

Anna:
Will just do the continuation from the last of natural selection and the thing that I'm gonna bring differrent in this lesson is that I'm going to use a bit of blending lesson so just to test my skills on Google meets and to see if I can actively teach with.

I will be using good routines because everyone connects with good routine to write the and I am going to be using WhatsApp to communicate with the learners on the lesson and more or less everything is just the same.

4.5 Analysis of Video stimulated recall Interviews

Video-stimulated interviews were done to capture students' experiences of the micro-lessons. The analysis of the interviews were done in the same process as stipulated in section 4.1.1. The steps taken to analyse the interviews are briefly described below;

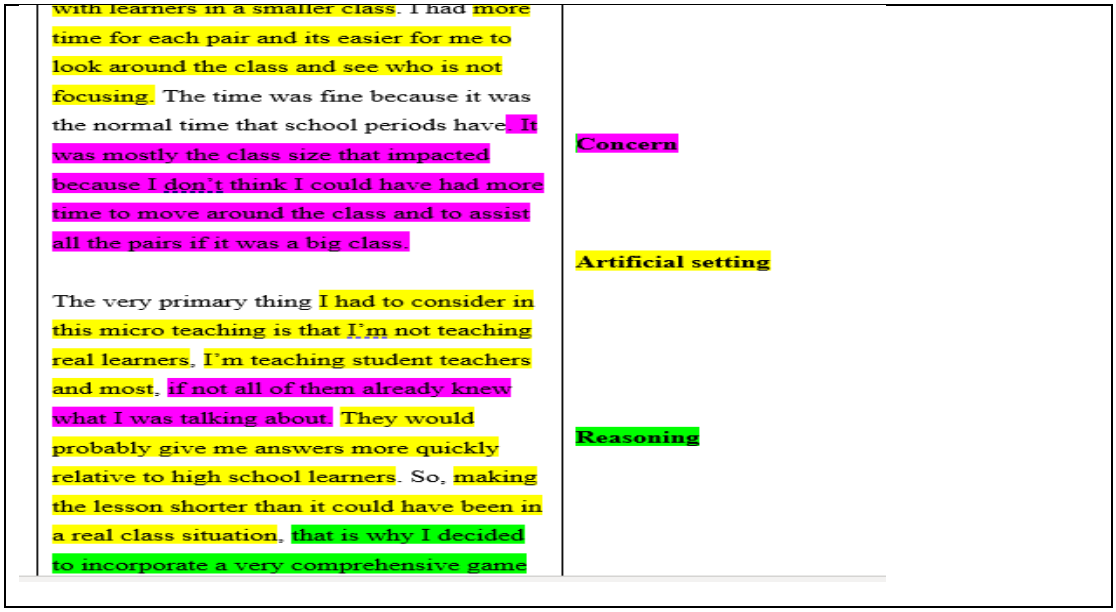
Step 1: <u>Getting acquainted with the interview responses for each participant</u>

To get familiar with the interview responses, I listened to the recorded audio three times, noting the interesting things the PGCE students said that were of importance to my research questions. I would pause and note down what I found as interesting such as ' the reasons the PGCE students raised for choosing specific teaching strategies'.

Step 2: <u>I transcribed the audio of the interviews verbatim.</u>

Step 3: <u>Coding of the interview audio</u>

The process of coding went as discussed in section **4.1.1,** the data was deductively and inductively coded. I read through each transcript and captured what I was noticing in the interview transcripts informed by the literature reviewed and the conceptual framework of this research.



Step 4: Categorising the codes

After gathering the codes, the codes were grouped according to their similarities. The codes were then categorised into three themes namely '*the perspectives of preparedness*', '*concerns of the PGCE students' and students responses about their teaching strategies.*

4.6 Presentation of Findings from analysis of interview

The responses of the PGCE students revealed three themes, according to the study's findings. These four themes are presented in order of the most emergent themes based on the responses of the PGCE students. First, their perspectives of preparedness was discussed in **theme 1**. The next theme being the **concerns of the PGCE students** were discussed in **theme 2**. Finally, **theme 3** discusses **the PGCE students' responses about their teaching strategies (and possible examples from the occurrences of their micro lesson including their lesson plans)**

4.6.1 Theme 1- Perspectives of preparedness

The majority of the PGCE students mentioned their perspective of their preparedness concerning how their micro lesson went. Three out of five students mentioned their perspectives of preparedness. The underlined portions of the excerpts show parts of the responses of the students where I identify the competences according to the MRTEQ. The students 'responses do not extensively reveal whether or not the PGCE students have specific competences according to MRTEQ, but they do show that they are aware of those capabilities.

Anna in response to the question of describing her preparedness for the micro-lesson said:

I felt really prepared for this lesson, I made sure that I knew a lot about what I was teaching so I looked to find extra information ***(knowledge of the content).*** *I did study human physiology so teaching the human brain, I had the content and knowledge there* ***(knowledge of the content****). I also did some extra research matching the knowledge that I have with what the learners needed to know from the CAPS document* ***(knowledge of the curriculum).*** *And in terms of using ICT tools, I also really felt confident in that because I have taught online this past year so I am really used to teaching online and using those sort of technologies which makes it a comfortable experience for me (****technological skills).*** *I think the main thing that made me feel really prepared was that I made sure that I knew what I was talking about* ***(knowledge of the content),*** *I really like to spend a lot of time reading and researching behind the content of this lesson or of any lesson for that matter* ***(knowledge of the content****).*

Being prepared, according to Anna, means having content extensive content knowledge and being well-informed by continuous research and the application of curriculum knowledge. Anna also points out that she was confident to use of technological resources and it made it a 'comfortable experience' to teach a specific lesson. Maclellan (2014) argues that teacher confidence and teacher behaviour influences effectiveness. This implies that achievement in terms of successful teaching and learning is due can be attributed to a teachers' confidence in their content knowledge and confidence of the use of certain resources. As outlined in MRTEQ teachers ought to have adequate knowledge about their subject knowledge including knowledge of the curriculum and the technological skill. There was evidence of curricula saliency in Anna's response when she showed awareness the suitable concepts to be taught to the learners in that grade.

Nelly said:

With me I cannot say I was not prepared because, I mean, I have learned for three years, *I have been hearing about proteins during my undergrad degree* ***(acquiring knowledge of the content),*** *this is not even including in high school. So I feel like I really know the process and I know it even deeper than any high school learner or someone in matric could because I majored in* ***(knowledge of the content),*** *you know,* so I was very very prepared and it's actually a topic that I really do enjoy teaching and learning about. *I enjoy that hence I did it in varsity. So, how was I prepared? I was like very much prepared, and in the sense that it was not just, I am going to walk in and teach the old way.*

Nelly highlights a similar view how content knowledge relates to preparedness as Anna does. Both respondents state the importance of their knowledge of content knowledge acquired in their undergraduate degrees. However, Nelly's view of preparedness includes the teacher's ability to enjoy what they are teaching. There is little evidence about how a teacher's enjoyment of a subject influences how they teach it, which in turn influences student learning in literature. Moreover, both Nelly and Anna's responses show that they had experience and knowledge in both the content knowledge and use of technological resources.

The respondents showed awareness of who they are teaching in terms of their micro lessons when they were asked to share a general sense of how they thought their lesson went.

Ronell:

*No, when I planned the lesson, I planned it in the mindset as if I were teaching an actual class**(knowledge of the learners)** . I did not see the point in catering it for the audience because it was about learning to teach a proper class so I would rather plan for that.*

Ronell's response shows awareness of 'who' the students are in a microteaching context. Ronell identifies the learners taught in a traditional context as 'actual learners. The excerpt above shows that Ronell has the knowledge about the learners as a competence outlined by the MRTEQ however is shows a limitation in the microteaching programme because it is evident that the context of the learners in microteaching impacted the way Ronell planned the lesson.

Though the PGCE students showed to be confident about their preparation of the micro lesson, the PGCE students also state the challenges they encountered while planning their micro lesson.

Nomsa:

*What I found difficult when preparing a lesson was that you know sometimes you could think you want to start the lesson with an icebreaker question, which in a real class situation will get the learners to really think about it and it could be an interesting discussion (**awareness of the learners**). But then you would think that okay these people will give me a straight answer, there is no trial and error. They just know, so they are just going to give one simple clear answer which means the lesson could be faster and less interesting because there would not be those wrong answers which you could build on and try to correct.*

The excerpt above shows that the challenges in planning and choosing appropriate strategies by the PGCE student is related to microteaching. Nomsa points out that the limitation of microteaching is that it is difficult to plan for peer students since their responses are acted out thus making it difficult to choose appropriate teaching strategies. This implies that the artificial nature of microteaching may hinder the PGCE students in developing specific competences which limits the main aim of microteaching of developing student teacher skills. From the above response the challenge that the PGCE student encountered was that it was difficult to plan for their learners in a micro teaching context because they already had the knowledge that was taught which makes the process of teaching and learning not normal. Nomsa believes that this had an impact in her choice of teaching strategies.

Nelly agreed with Nomsa and added that:

Nelly:

But if I were to be in an actual classroom, I would have wanted to receive those essays that they had written and mark them and see truly their understanding truly their skills of writing, and so forth and to also see maybe way they did not understand very well. But like, it is very difficult for me to say it went super, super well and just to toot my own horn, but I would have really liked to see how they had written the work to understand if it went as successful as I wanted it to go.

Nelly also points out that the artificial learning context had an influence in the choice of teaching strategies. The limitation of microteaching that is evident from the two responses by the students is the artificial nature of micro-teaching which in turn impacts how the PGCE students' plan.

4.6.2 Theme 2-Concerns of the PGCE students

In the responses of the PGCE students, the other emerging theme was concern of the PGCE students about their micro lesson including the concerns about the micro teaching programme. Anna raised concerns about not having actual learners which impacted how the lesson went in many instances of her responses.

Anna:

The lesson started by watching a TikTok video and this was a micro lesson, and we did not have actual learners in the class. ***(Actual learners)***

So, then we went through that and if I were in a real class ***(real class)*** *with the learners then I would allow them to look themselves with a little bit more work or a little bit more time rather.So that was then the end of the lesson, it was a short lesson because we were only allocated 20 minutes.****(lesson length)***

Obviously in this lesson, because it was acted out I didn't have any class management ***(acting)*** *but I did try and integrated if it was happening, so that skill probably was not employed as much as it would have been employed in a actual classroom (**Actual class & Employing specific skills)***

Anna's response shows limitations about the microteaching programme in terms of the artificial learning and teaching classrooms.

Nelly also expressed similar concerns about her micro lesson.

Nelly:

*But at the same time you know since this was like so artificial,(**artificial context of learning**) this was not an actual classroom with actual learners **(actual learners & actual classroom)**, it had adults who knew the work because we studied for it , I feel like I cannot take much credit. But if I were to be in an actual classroom (**actual classroom**), I would have wanted to receive those essays that they had written and mark them and see truly their understanding truly their skills of writing, and so forth and to also see maybe way they did not understand very well.*

Nomsa:

*While I was engaging with the learners, some of them were actually not doing the activity. It could have been because they knew that they were not real learners or because (**actual learners)** they had forgotten the topic.*

The concerns the PGCE students have regarding their micro lesson which were emerging in the findings:

- **Artificial Context of learning** (No actual learners + No actual class)
- **Less Duration of the lesson.**
- **Not being able to employ certain teaching strategies**

The above findings show that the PGCE students have both positive experiences and concerns toward their experience of teaching and preparing a micro lesson. This may suggest that may be areas of improvement in the microteaching programme.

4.6.3 Theme 3- PGCE student's responses about their teaching strategies

This section discusses the PGCE students' responses about their teaching strategies and provides possible examples from the occurrences of their micro lesson. The following was the PGCE student's responses about their teaching strategies that emerged from the analysis of the interview responses. One theme emerged from the analysis of the students' responses which was : *relevant to the traditional teaching context.*

Relevant to the traditional context

One of the emerging themes from the PGCE students about the teaching strategies they chose to teach a micro-lesson was that the teaching strategy is relevant to the traditional teaching context.

Nomsa's response to the question why she chose the teaching practices she chose said:

Nomsa:

With the teaching strategies, please refer to the lesson plan. I think I explain them quite clearer there. I believe these teaching strategies are conducive for teaching and learning in a traditional classroom context because my lesson was just simple, I was using the whiteboard and the markers. There was nothing that needed electricity or internet connection, there were not a lot of complications. I think even in a real class situation, it could have went well.

Nomsa's response shows that she chose specific teaching strategies for her micro-lesson because they would also be conducive in a traditional classroom. This shows that the PGCE student uses the micro-teaching classroom as a platform to practice her teaching strategies, which is an affordance of micro-teaching.

Nelly's response to the question whether she would have started the lesson the same way in a traditional teaching context she said

In a traditional classroom context, definitely I would have started the lesson in the same way. I cannot emphasize the importance of a recap. It's really beyond me and relevant because when I look back from

my high school days, there were lessons whereby we had recapped and I could really easily connect the information from yesterday's information with that of todays, and those that did not, I don't even remember half of the things that we learned in that particular subject. So, I would definitely. Recap is not even something that you need special tools for, you know, you just reminding the learners and you don't even have to be speaking, you as a teacher, for the recap the whole time you can ask questions.

Nelly's reasoning for choosing her choice of teaching strategies was because of the relevancy of the teaching strategy, not only to the traditional context but also due to her prior experience of the use of the same teaching strategy. This shows that prior experience of a specific teaching strategy may influence the choice of a PGCE student to use the same teaching strategy.

This theme also emerged during the micro-lesson, while the PGCE students were teaching and reported what teaching strategy they would use in a traditional classroom. For instance Ronell said:

Ronell:

Like I am doing now, in the classroom I would give the learners an activity. You will create your own feedback loop and the negative feedback loop specifically to show how the body will respond to various changes in temperature.

The excerpt above is an utterance said by Ronell explains a teaching strategy that would also be relevant to a traditional learning context. This shows that Ronell chose the teaching strategy for the micro-lesson because he would use it in a traditional teaching classroom. Like Ronell, there was evidence of reasoning in Nelly's micro-lesson when she said:

Nelly:

However, as you know, every single lesson should start with a recap, I don't know why I wrote summary but it's the same thing, every lesson needs to start with a recap.

Here Nelly states that she started the with a recap lesson because every lesson starts with a recap, this shows that Nelly's reason for using this teaching strategy is due to it being relevant to her previous experience of learning and relevancy to the traditional teaching context. This shows both an affordance and limitation of the microteaching programme. The affordance here is that Nelly is developing the skill of the use of recap to start a micro-lesson however her mentioning why she is using a recap during a micro-lesson may suggest the awareness of the learners being artificial whereas in an in-school teaching context mentioning the reason of choosing a specific teaching strategy by a teacher may not be observed, this is a limitation of a microteaching programme.

The table **(Table 5)** below summarises the findings concerning the affordances and the limitations of microteaching.

Table 5: A table showing affordances and limitations of microteaching.

Affordances	**Limitations**
Provides students with opportunities to develop planning and teaching competences	Hinders development of specific teaching strategies due to acted out responses by peer students
Develops students teaching strategies relevant to traditional teaching contexts	Difficulty to plan and teach peer students since they have knowledge about what is taught.
Develops a variety of teaching strategies	Less teaching duration

4.7 Conclusion

The analysis of lesson plans showed that the PGCE students have a wide range of competencies as outlined by the MRTEQ. The competencies include awareness *of learner prior knowledge, curriculum saliency, representations including analogies and conceptual teaching strategies.* The competences evident in planning show that the microteaching program provided opportunities for the PGCE students to apply and develop their knowledge of teaching and planning lessons of teaching a life sciences topic. However, the limitation of the lesson plans that 3 out of five lesson plans showed basic concept maps and had no clear objectives which suggest that there is improvement required here.

The analysis of the micro-lessons also showed a wide range of teaching competencies by the PGCE students their *awareness of prior knowledge, curricular saliency, awareness of what makes a topic difficult to teach, representations and analogies and conceptual teaching strategies*. These competencies showed affordances of microteaching as it provided opportunities for PGCE students to practice teaching and develop their teaching skills however the most common limitation evident in the analysis of the micro-lessons is the inability of the PGCE students to use certain teaching strategies due to the artificiality of the microteaching classroom. Other competencies that could not be measured as outlined by the MRTEQ are class-room management, professionalism and reflection, these competencies were not clear in the micro-lesson. Features of class-room management were evident as the PGCE students were able to keep to task through pacing instructions and features of professionalism in the micro-lesson when the PGCE students showed elements of organising the lessons and being punctual. However, it should be noted that these features of class-room management including professionalism would not be observed the same way in a traditional teaching context. The

analysis of the interviews showed that the PGCE students had a concern about the artificial context of learning of the microteaching programme which is a limitation.

Chapter 5

CONCLUSIONS, REFLECTIONS AND RECOMMENDATIONS

5.1 Introduction

This study sought to determine the affordances and limitations of using on-campus microteaching as an alternative to in-school teaching practice in preparing PGCE students to teach Life Sciences in high school. This chapter summarizes the findings from the study.The aim of the study was to address the following key research question: *What are the affordances and limitations of on-campus microteaching as an alternative to the traditional in-schools teaching practice in preparing PGCE students for teaching life sciences after qualification?* To help answer the main research question, the following sub-questions were asked:

1. What are the teaching competencies that manifested in PGCE students' on-campus micro-teaching lesson plans?
2. What are the teaching competencies that manifested in PGCE students' on-campus micro-teaching?
3. What were the PGCE students' experiences of on-campus microteaching as their final teaching experience before qualification?

The minimum requirements for teacher educator qualifications as presented in the MRTEQ documents and the TSPCK framework were used to understand the affordances and limitation of microteaching by investigating the competences that manifested in the lesson plans and micro-lesson of five PGCE students. By interviewing the participating PGCE students, I was able to gain insight into students' microteaching experiences. Below I begin with a summary of the study's findings, I then answer the research questions followed by recommendations and the study's limitations.

5.2 PGCE students' competences when planning to teach a micro-lesson

In this study, I analysed five lesson plans that were planned by five PGCE students for a micro-lesson. The analysis revealed evidence of teaching competences as outlined in the MRTEQ documents. These competencies include: 1) stating the lesson objectives, 2) representations planned for use, 3) collaborative approaches 4) explanation to be used, 5) questioning

techniques and 6) instructional technology. The analysis of the five lesson plans shows that the PGCE students planned appropriate teaching strategies to teach a life sciences topic. The PGCE students planned to use a wide range of teaching strategies and showed a variety of competences as suggested by the MRTEQ. These results show that on-campus microteaching provides PGCE students with opportunities to practice planning lessons. However, the ability to plan a coherent unit of lessons could not be ascertained as students were expected to plan only two lessons during the two-week micro-teaching period which could be on two different topics.

To answer my first research sub-question, the analysis of lesson plans from five PGCE students showed that the PGCE students have a wide range of competencies as required by the MRTEQ which were practiced and such developed during the on-campus microteaching context. Although it was a short on-campus microteaching, PGCE students were afforded opportunities to plan and follow all the steps required for lesson planning thus developing their skills, this is an affordance of the microteaching program. The PGCE students also showed in their responses that they would use the same planning in a traditional teaching classroom. However, some of the chosen teaching strategies to teach a small group of learners and peer students may not work in a traditional teaching context where there are many learners. The artificiality of micro-teaching may be a limitation, even in planning a lesson.

5.3 PGCE students' competences when teaching a micro-lesson

To answer research question two: what are the teaching competences that manifested in PGCE students' on-campus microteaching, I analysed five recorded 20 minute micro-lessons and the audio transcripts. The analysis revealed manifestations of a wide range of teaching competencies. These competencies included awareness of the importance of finding out and how to determine learners' prior knowledge, ability to pace teaching instructions and to sequence the lessons, awareness of what makes a topic easy or difficult to teach, ability to use representations and analogies, conceptual teaching strategies (*contextualising learning, use of concrete examples, use of games, use of collaborating activities, use of Non-linguistic strategies, Assessment strategies and instructional technology).* The PGCE students had a range of competencies while teaching a life sciences topic as outlined by MRTEQ.

These results show that the on-campus microteaching provides the PGCE students with opportunities to practice some teaching competences and not others. For example, some teaching practices like group work and discussions which were used by the PGCE students

were not effective in the on-campus microteaching context due the kind and number of learners. The limited number of learners was not the only limitation but also that being peers the PGCE students had to act out their learner roles, thus not assisting the PGCE students to apply other teaching strategies. The PGCE students were also not exposed to dealing with learning situations to some extent as the peer students were acting. This means that the PGCE students' responses during question and answer sessions were acted out making it an artificial learning context and hence a limitation of microteaching.

5.4 What were the PGCE students' experiences of on-campus microteaching as their final teaching experience before qualification?

To answer my research question, I analysed the transcribed audio parts of the interview responses from five PGCE students. The analysis revealed the PGCE students had a variety of experiences of the on-campus microteaching context: feelings of preparedness, concerns of the PGCE students, PGCE responses about their teaching strategies. The findings show that being prepared is having adequate content knowledge about the lesson topic taught. Having thorough knowledge of the lesson topic has potential to promote effective learning and teaching of life sciences. Adequate knowledge of the content is a characteristic of a competent teacher as outlined by MRTEQ.

Findings from the analysis of the interview responses showed that the PGCE students had some concerns about the on campus micro-teaching. The analysed interview responses showed that the concerns the PGCE students had highlight limitations of the microteaching programme. The following was identified as the PGCE concern:

- **The artificial teaching context of microteaching** was the most prevalent concern of the PGCE students. The concerns were on the micro-lessons not having actual learners and actual classrooms, no opportunities for practicing other professional duties such as marking registers, class management, giving tasks, marking and giving feedback . The findings suggest that the artificial nature of the micro-teaching is a limitation in developing certain teaching and professional skills including the less duration of the lesson.

5.5 Limitations of the study

There were limitations to this study. Although the PGCE students had two lesson plans and taught two lessons, and although I collected both lesson plans, I only managed to analyse one

lesson plan from each PGCE student. The lesson plans that I analysed were those for the micro-lessons that I observed and recorded. The reason for this was due to the time constrains. This is a limitation because the ability to plan a coherent unit of lessons by the PGCE students could not be captured.

Another challenging part of the study was that some of the lesson plans were not detailed in specifying the chosen teaching strategies and lesson objectives. This made it difficult to determine the competencies of those PGCE students in terms of their ability to choose appropriate teaching strategies and stating the lesson objectives. This challenge further showed the limitations that were imposed by analysing just a single lesson for each student. More lesson plans could have revealed a deferent picture. The other limitation of this study is that this micro-teaching was done under strict health protocols due to the covid-19 pandemic which may have impacted the pair discussions and group work activities given by the PGCE student while teaching, so the results might not have been properly captured as they would have in a normal circumstance of on-campus microteaching.

5.6 Reflections on my research journey

In this section, I reflect on my research journey in conducting this study. During the early stages of this research project my initial research topic was "*An Investigation of the PGCE students' level of readiness to teach Life Sciences in high school: A case study*". My initial plan was to follow PGCE students during the 6-week teaching experience and observe them to determine their readiness to teach. However due the covid-19 pandemic and the subsequent lockdowns, the study plan was abandoned. The PGCE students were now required to participate in a microteaching programme to fulfil part of the requirements of the teaching practice. My supervisor and I had to re-think the study. We viewed this significant move to on-campus microteaching as an opportunity to study the "*Affordances and limitations of on-campus microteaching as an alternative to the traditional in-schools teaching practice in preparing the PGCE students for teaching Life Sciences after qualification: A case study".* It was very challenging to shift focus to a new interest of study after a lot of work and effort was put into my initial study and starting to work on a new research topic with little time. Time constrains were a huge challenge in this study and which led to me analysing only five lesson plans when I had collected 10 lesson plans. The challenges did not only provide negative experiences of being discouraged and a feeling of disappointment, I learnt to be optimistic, to be passionate, to be resilient. I got to learn that even in the midst of seemingly unprecedented

challenges are opportunities. This positive attitude and new perspective enabled me to pull off this challenge. Anything can be possible when one is passionate and positive.

5.8 Conclusion

This study investigated the affordances and limitations of on-campus microteaching with the 2020 cohort of South African PGCE student teachers. Micro-teaching was a beneficial method for building teacher competency, as evidenced by several affordances. However, the limitation of on-campus microteaching experience was largely a result the artificial nature of microteaching which appeared to have limited classroom interactions, limited development of specific teaching skills which require real teaching situations e.g., group work, discussions. In the meanwhile, considering the limitations, it is crucial to reinforce PGCE students' microteaching experience with kinds of school practice that give students opportunities to experience real-life teaching settings that are critical for competency development.

References

Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, *26*(2), 1665-1685.

Adhikari, Y. N. (2020). Trainee Teachers' Perspectives on Microteaching. *Journal of NELTA Gandaki*, *3*(1-2), 108-118.

Adhabi, E., & Anozie, C. B. (2017). Literature review for the type of interview in qualitative research. *International Journal of Education*, *9*(3), 86-97.

Akdemir, Ö. A. (2019). Student Teachers' Preparedness to Teach: The Case of Turkey. *International Education Studies*, *12*(3), 90-96.

Anderson, C. (2010). Presenting and evaluating qualitative research. *American journal of pharmaceutical education*, *74*(8).

Ammenwerth, E., Iller, C., & Mansmann, U. (2003). Can evaluation studies benefit from triangulation? A case study. *International journal of medical informatics*, *70*(2-3), 237-248.

Allen, D. W., & Eve, A. W. (1968). Microteaching. *Theory into practice*, *7*(5), 181-185.

Al Darwish, S., & Sadeqi, A. A. (2016). Microteaching Impact on Student Teacher's Performance: A Case Study from Kuwait. *Journal of Education and Training Studies*, *4*(8), 126-134.

Bassey, M. (1999). *Case study research in educational settings*. McGraw-Hill Education (UK).

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, *13*(4), 544-559.

Bashir, M., Afzal, M. T., & Azeem, M. (2008). Reliability and validity of qualitative and operational research paradigm. *Pakistan journal of statistics and operation research*, 35-45.

Bell, N. D. (2007). Microteaching: What is it that is going on here? *Linguistics and 1Education*, *18*(1), 24-40.

Benton-Kupper, J. (2001). The microteaching experience: Student perspectives. *Education*, *121*(4).

Boudersa, N. (2016). The importance of teachers' training programs and professional development in the Algerian educational context: Toward informed and effective teaching practices. *Expériences Pédagogiques*, *1*(1), 1-14.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative research journal*.

Brown, Z. (2015). The use of in-class debates as a teaching strategy in increasing students' critical thinking and collaborative learning skills in higher education.

Broadfoot*, P., & Black, P. (2004). Redefining assessment? The first ten years of assessment in education. *Assessment in Education: Principles, Policy & Practice*, *11*(1), 7-26.

Carlson, E., Lee, H., & Schroll, K. (2004). Identifying attributes of high-quality special education teachers. *Teacher Education and Special Education*, *27*(4), 350-359.

Canlı, E. (2020). Prison Heterocissexual Complex: Sociospatial Politics of Queer Incarceration and the Case of Turkey. *The SAGE Handbook of Global Sexualities*, 313.

Chu, M. W., Craig, H. L., Yeworiew, L. B., & Xu, Y. (2020). Teachers' unpreparedness to accommodate student needs. *Canadian journal of school psychology*, *35*(3), 210-224.

Çıldır, S. (2019). Opinions of teacher candidates upon the use of effective communication skills when teaching sciences. In *SHS Web of Conferences* (Vol. 66, p. 01038). EDP Sciences.

Chen, Y. H., Thompson, M. S., Kromrey, J. D., & Chang, G. H. (2011). Relations of student perceptions of teacher oral feedback with teacher expectancies and student self-concept. *The Journal of Experimental Education*, *79*(4), 452-477.

Christie, F., Conlon*, T., Gemmell, T., & Long, A. (2004). Effective partnership? Perceptions of PGCE student teacher supervision. *European journal of teacher education*, *27*(2), 109-123.

Chowdhary, R. (2019). Microteaching in India: Features and Importance. *Global Initiatives for Sustainable Development: Issues and Strategies*, 154.

Chow, A. F., Woodford, K. C., & Maes, J. (2011). Deal or No Deal: using games to improve student learning, retention and decision-making. *International journal of mathematical education in science and technology*, *42*(2), 259-264.

Clift, J. C., Batten, H., Burke, G., & Malley, J. (1976). Structure of the skill acquisition phase of a microteaching programme. *British Journal of Educational Psychology*, *46*(2), 190-197.

Cohen, L., Manion, L., & Morrison, K. (2011). Planning educational research. *Research methods in education. New York: Routledge Editors*.

Combs, D. R., Adams, S. D., Michael, C. O., Penn, D. L., Basso, M. R., & Gouvier, W. D. (2006). The conviction of delusional beliefs scale: Reliability and validity. *Schizophrenia research*, *86*(1-3), 80-88.

Cotton, K. (1996). School size, school climate, and student performance.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Cimer, A. (2012). What makes biology learning difficult and effective: Students' views. *Educational research and reviews*, *7*(3), 61.

Csikar, E., & Stefaniak, J. E. (2018). The utility of storytelling strategies in the biology classroom. *Contemporary Educational Technology*, *9*(1).

Davids, M. N. (2016). Student experiences of microteaching: promoting reproductive or innovative learning?. *South African Journal of Higher Education*, *30*(1), 106-122.

Davidson, R. J., Sherer, K. R., & Goldsmith, H. H. (Eds.). (2009). *Handbook of affective sciences*. Oxford University Press.

Davidsson, E., & Enochson, P. G. (2021). Teachers' way of contextualising the science content in lesson introductions. *Science Education International*, *32*(1), 46-54.

Daniel, M. M., Molwus, J. J., Nkup, J. T., & Wuyokwe, N. G. (2020). Addressing Socio-technical Issues in Built Environment Research: A Philosophical Premise. *Urban Development Issues*, *65*(1), 45-52.

Department of Education 2003. National Curriculum Statement Grades 10-12: Life Sciences. Pretoria: Government Printer.

Diaz, K. V. L. T. (2017). Prior Knowledge: Its Role in Learning. *University of the Philippines Los Baños. DOI*, *10*.

Dredge, D., Benckendorff, P., Day, M., Gross, M. J., Walo, M., Weeks, P., & Whitelaw, P. (2011). Conceptualising the perfect blend in the tourism and hospitality curriculum space. In *CAUTHE 2011: National Conference: Tourism: Creating a Brilliant Blend* (p. 171). University of South Australia. School of Management.

Dos Reis, K. M. (2012). *Challenges pre-service teachers face while learning to teach Accounting in the context of mentoring* (Doctoral dissertation, Cape Peninsula University of Technology).

Edwards, N. (2015). Multimodality in science education as productive pedagogy in a PGCE programme. *Perspectives in Education*, *33*(3), 159-175

Elias, S. K. (2018). Pre-service teachers' approaches to the effectiveness of micro-teaching in teaching practice programs. *Open Journal of Social Sciences*, *6*(5), 205-224.

Ekanayake, A. (2011). Validity and Reliability in Case Study Research in Accounting: A Review and Experience.

Ergönenç, J., Neumann, K., & Fischer, H. E. (2014). The impact of pedagogical content knowledge on cognitive activation and student learning. *Quality of instruction in physics*, 145-160.

Even, R. (1993). Subject-matter knowledge and pedagogical content knowledge: Prospective secondary teachers and the function concept. *Journal for research in mathematics education*, *24*(2), 94-116.

Etzel, B. C., & LeBlanc, J. M. (1979). The simplest treatment alternative: The law of parsimony applied to choosing appropriate instructional control and errorless-learning procedures for the difficult-to-teach child. *Journal of Autism and Developmental Disorders*, *9*(4), 361-382.

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching.

Fernandez, M. L. (2010). Investigating how and what prospective teachers learn through microteaching lesson study. *Teaching and Teacher Education*, *26*(2), 351-362.

Ferreira, J. G. (2011). Teaching Life Sciences to English second language learners: What do teachers do?. *South African Journal of Education*, *31*(1).

Fox, N. (2009). Using interviews in a research project. *The NIHR RDS for the East Midlands/Yorkshire & the Humber*, *26*.

Fontana, A., & Frey, J. H. (2000). The interview: from structured questions to negotiated text. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (2nd ed.) (pp. 645–672). Thousand Oaks, CA: Sage.

Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. *Review of educational research*, *82*(3), 300-329.

Geelan, D. (2012). Teacher explanations. *Second international handbook of science education*, 987-999.

Gödek, Y. (2016). Science teacher trainees microteaching experiences: A focus group study. *Educational Research and Reviews*, *11*(16), 1473-1493.

Gomba, D. (2017). *Leadership and political administrative interface in the Gauteng Department of Human Settlements* (Doctoral dissertation).

Hanifah, M., Mohmadisa, H., Yazid, S., Nasir, N., & Balkhis, N. S. (2019). Professional and pedagogical competencies of geography teachers in Malaysia. *Review of International Geographical Education Online*, *9*(2), 304-318.

Hatefi, S., Smith, F., Abou-El-Hossein, K., & Alizargar, J. (2020). COVID-19 in South Africa: lockdown strategy and its effects on public health and other contagious diseases. *Public Health*, *185*, 159.

Harling, K. (2012). An overview of case study. *Available at SSRN 2141476*.

Hawe, E., Dixon, H., & Watson, E. (2008). Oral feedback in the context of written language. *Australian Journal of Language and Literacy, The*, *31*(1), 43.

He, C., & Yan, C. (2011). Exploring authenticity of microteaching in pre-service teacher education programmes. *Teaching Education*, *22*(3), 291-302.

Higgins, A., & Nicholl, H. (2003). The experiences of lecturers and students in the use of microteaching as a teaching strategy. *Nurse Education in Practice*, *3*(4), 220-227.

Hillier, J. (2013). How does that work? Developing pedagogical content knowledge from subject knowledge. *Teacher Education and Practice*, *26*(2), 323-341.

Hoadley, U. (2003). Time to learn: Pacing and the external framing of teachers' work 1. *Journal of Education for Teaching*, *29*(3), 265-277.

James, M., & Pedder, D. (2006). Beyond method: Assessment and learning practices and values. *The Curriculum Journal*, *17*(2), 109-138.

Kallenbach, W. W., & Gall, M. D. (1969). Microteaching versus conventional methods in training elementary intern teachers. *The Journal of Educational Research*, 136-141.

Kathirveloon, P., Piteh, M., & Matematik, F. S. (2014). Effective teaching: Pedagogical content knowledge. In *Proceeding of International Joint Seminar, Garnt, Indonesia*.

Kennedy, R. R. (2009). The power of in-class debates. *Active learning in higher education*, *10*(3), 225-236.

Khwaja, C. C. (2006). The role of subject knowledge in the effective teaching of primary science. *Educate~*, *2*(1), 8-22.

Kiggundu, E. M., & Nayimuli, S. T. (2009). Teaching practice: *A make or break phase for student teachers. South African journal of education*, *29*(3).

Kind, V. (2009). Pedagogical content knowledge in science education: perspectives and potential for progress. *Studies in science education*, *45*(2), 169-204.

Koross, R. (2016). Micro Teaching an Efficient Technique for Learning Effective Teaching Skills: Preservice Teachers' Perspective. *IRA International Journal of Education and Multidisciplinary Studies*, *4*(2), 289-299.

Laslett, R., & Smith, C. (2002). *Effective classroom management: A teacher's guide*. Routledge.

Ledger, S., & Fischetti, J. (2020). Micro-teaching 2.0: Technology as the classroom. *Australasian Journal of Educational Technology*, *36*(1), 37-54.

Lepareur, C., Cross, D., & Munier, V. (2017). Characterizing PCK in a teacher training program.

Loyalka, P., Popova, A., Li, G., & Shi, Z. (2019). Does teacher training actually work? Evidence from a large-scale randomized evaluation of a national teacher training program. *American Economic Journal: Applied Economics*, *11*(3), 128-54.

Mahmud, I., & Rawshon, S. (2013). Micro teaching to improve teaching method: An analysis on students' perspectives. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *1*(4), 69-76.

Manav, F. (2016). The concept of experience in John Dewey's philosophy of education. *The Journal of Turk & Islam World Social Studies*.

Maclellan, E. (2014). How might teachers enable learner self-confidence? A review study. *Educational Review*, *66*(1), 59-74.

Mannathoko, M. C. (2013). *Does Teaching Practice Effectively Prepare Student-Teachers to Teach Creative and Performing Arts? The Case of Botswana*. *International Journal of HigherEducation*, *2*(2), 115-121.

Martínez, G., & Mellado, V. (2016). The importance of pck in the education of secondary school physics teachers: Acase studyon teaching electric fields. *Secondary Education: Perspectives, global issues and challenges*, *133*.

Maryati, M., Prasetyo, Z. K., Wilujeng, I., & Sumintono, B. (2019). MEASURING TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE USING MANY-FACET RASCH MODEL. *Jurnal Cakrawala Pendidikan*, *38*(3), 452-464.

Marques, M. M., Loureiro, M. J., & Marques, L. (2015). Science teaching strategies developed in an online community of practice: a case study. *International Journal of Web Based Communities*, *11*(3-4), 305-321.

Mavhunga, E., & Rollnick, M. (2013). Improving PCK of chemical equilibrium in pre-service teachers. *African Journal of Research in Mathematics, Science and Technology Education*, *17*(1-2), 113-125.

Mavhunga, F., & Kibirige, I. (2018). Tapping the tacit knowledge of playfield swings to learn physics: a case study of childhood reflections by pre-service teachers. *African Journal of Research in Mathematics, Science and Technology Education*, *22*(2), 221-230.

Mavhunga, E. (2020). Revealing the structural complexity of component interactions of topic-specific PCK when planning to teach. *Research in Science Education*, *50*(3), 965-986.

McKimm, J., & Swanwick, T. (2009). Setting learning objectives. *British Journal of Hospital Medicine (2005)*, *70*(7), 406-409.

Mergler, A. G., & Tangen, D. (2010). Using microteaching to enhance teacher efficacy in pre-service teachers. *Teaching Education*, *21*(2), 199-210.

Murtiana, R. (2012). A journey of a thousand miles of future teachers begins from a single step in a microteaching class. In *6th International Seminar of Research in Teacher Education: What, How, and Why* (pp. 459-476).

Nair, P., & Ghanaguru, S. (2017). Owning the Classroom: Student Teachers' Experiences and Concerns during Practicum. *English Teacher*, *46*(3).

Nilsson, P., & Karlsson, G. (2019). Capturing student teachers' pedagogical content knowledge (PCK) using CoRes and digital technology. *International Journal of Science Education*, *41*(4), 419-447.

Ogeyik, M. C. (2009). Attitudes of the Student Teachers in English Language Teaching Programs towards Microteaching Technique. *English Language Teaching*, *2*(3), 205-212.

Panhoon, S., & Wongwanich, S. (2014). An analysis of teacher feedback for improving teaching quality in primary schools. *Procedia-Social and Behavioral Sciences*, *116*, 4124-4130.

Phurutse, M. C. (2005). *Factors affecting teaching and learning in South African public schools*. HSRC press.

Prescott, F. J. (2011). Validating a long qualitative interview schedule. *WoPaLP*, *5*, 16-38.

Quick, G., & Siebörger, R. (2005). What matters in practice teaching? The perceptions of schools and students. *South African Journal of Education*, *25*(1), 1SS-4.

Ralph, E. G. (2014). The effectiveness of microteaching: Five years' findings. *International Journal of Humanities Social Sciences and Education*, *1*(7), 17-28.

Rands, M. L., & Gansemer-Topf, A. M. (2017). The room itself is active: How classroom design impacts student engagement. *Journal of Learning Spaces*, *6*(1), 26.

Rahman, M. S. (2020). The advantages and disadvantages of using qualitative and quantitative approaches and methods in language "testing and assessment" research: A literature review.

Rashad Ali Bin-Hady, W., & Abdulsafi, A. S. T. (2018). How Can I Prepare an Ideal Lesson-Plan?. *International Journal of English and Education ISSN*, 2278-4012.

Rakes, G. C., Fields, V. S., & Cox, K. E. (2006). The influence of teachers' technology use on instructional practices. *Journal of Research on Technology in Education*, *38*(4), 409-424.

Reddy, K. R. (2019). Teaching how to teach: microteaching (a way to build up teaching skills). *Journal of Gandaki Medical College-Nepal*, *12*(1), 65-71.

Richards, J. C., & Farrell, T. S. (2011). *Practice teaching: A reflective approach*. Cambridge University Press.

Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (Eds.). (2013). *Qualitative research practice: A guide for social science students and researchers*. sage.

Rosenkranzer, F., Stahl, E., Hörsch, C., Schuler, S., & Rieß, W. (2016). The didactic knowledge of student teachers to promote systemic thinking: conceptualization, operationalization and survey method. *Journal of Science Didactics* , *22* (1), 109-121.

Rollnick, M., & Mavhunga, E. (2014). PCK of teaching electrochemistry in chemistry teachers: A case in Johannesburg, Gauteng Province, South Africa. *Educación química*, *25*(3), 354-362.

Russell, T., & Martin, A. K. (2014). Learning to teach science. In *Handbook of Research on Science Education, Volume II* (pp. 885-902). Routledge.

Sa'ad, T. U., Sabo, S., & Abdullahi, A. D. (2015). The Impact of Micro-Teaching on the Teaching Practice Performance of Undergraduate Agricultural Education Students in College of Education, Azare. *Journal of Education and Practice*, *6*(26), 109-115.

Sheredos, B. (2012). Reductio ad bacterium: the ubiquity of Bayesian "brains" and the goals of cognitive science. *Frontiers in psychology*, *3*, 498.

Shulman, L. S. (1986). Those who understand: A conception of teacher knowledge. *American Educator*, *10*(1).

Shin, D., & Wang, Z. (2015). The experimentation of matrix for product emotion. *Procedia Manufacturing*, *3*, 2295-2302.

Showkat, N., & Parveen, H. (2017). In-depth interview. *Quadrant-I (e-Text)*.

Simons, H. (2009). Evolution and concept of case study research. *Case study research in practice*, 12-28.

Smith, K., & Lev-Ari, L. (2005). The place of the practicum in pre-service teacher education: The voice of the students. *Asia-Pacific Journal of Teacher Education*, *33*(3), 289-302.

Smith, J., & Firth, J. (2011). Qualitative data analysis: the framework approach. *Nurse researcher*, *18*(2), 52-62.

Slisko, J., & Dykstra Jr, D. I. (1997). The role of scientific terminology in research and teaching: Is something important missing?. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *34*(6), 655-660.

Spear, M., Lock, N. D., & McCulloch, M. (1997). The written feedback mentors give to student teachers. *Teacher Development*, *1*(2), 269-280.

Starman, A. B. (2013). The case study as a type of qualitative research. *Journal of Contemporary Educational Studies/Sodobna Pedagogika*, *64*(1).

Stevens, A. (2006). Technology teacher education in South Africa. In *International handbook of technology education* (pp. 505-514). Brill Sense.

Storch, N., & Aldosari, A. (2013). Pairing learners in pair work activity. *Language teaching research*, *17*(1), 31-48.

Tippett, C. D. (2016). What recent research on diagrams suggests about learning with rather than learning from visual representations in science. *International Journal of Science Education*, *38*(5), 725-746.

Vail Lowery, N. (2002). Construction of teacher knowledge in context: Preparing elementary teachers to teach mathematics and science. *School Science and Mathematics*, *102*(2), 68-83.

Van Driel, J. H., & Berry, A. (2012). Teacher professional development focusing on pedagogical content knowledge. *Educational researcher*, *41*(1), 26-28.

Verbeek, C. (2014). Critical reflections on the PGCE (Foundation Phase) qualification in South Africa. *South African Journal of Childhood Education*, *4*(3), 37-51.

Volman, M. (2005). A variety of roles for a new type of teacherEducational technology and the teaching profession. *Teaching and Teacher education*, *21*(1), 15-31.

Wilen, W. W., & Clegg Jr, A. A. (1986). Effective questions and questioning: A research review. *Theory & Research in Social Education*, *14*(2), 153-161.

Williams, D. D., Cook, P. F., Quinn, B., & Jensen, R. P. (1985). University class size: Is smaller better?. *Research in Higher Education*, *23*(3), 307-318.

Yin, R. K. (2003) Case Study Research Design and Methods, Sage, Beverly Hills, CA.

Zainal, Z. (2007). Case study as a research method. *Jurnal kemanusiaan*, *5*(1).

Zondi, M. F. (2018). *Exploring the relationship between the pre-service teachers' nature of TSPCK acquired in planning and that enacted in classroom practice* (Doctoral dissertation).

Appendices: Interview Schedules

Appendix I

Scheduled Interview Questions

1. What was in mind when planning the lesson? What did you consider?
2. Describe how the lesson you taught went?
3. What teaching strategies did you use to teach the lesson topic?
4. Why did you choose those teaching strategies? In a traditional classroom context, would you have used the same strategy?
5. How would you describe the 'level' of preparedness you had to teach the lesson topic?
6. What skills did you use for the micro-teaching lesson?
7. To what extent would you say the lesson went well?

Video stimulated interview questions

1. In the lesson I observed, at the beginning you mentioned that you were going to start the lesson with a Surprise test, why did you think it was important in your lesson?
2. In a traditional classroom context, would you have started the lesson the same way?
3. You allowed the learners to work in pairs, why was it important?
4. I also observed that you were engaging with the learners as they were doing the activity, what did you notice as you engaged with them?
5. In the lesson you allowed the learners to work in pairs, how did this impact the lesson?
6. Would you use the same strategy in a traditional classroom context?
7. I also observed that in your lesson you allowed interaction between you and the learners, would you say real learning was occurring?
8. In the lesson your peer students acted as learners, how do you think this impacted the lesson? How did this impact your planning?
9. Do you think teaching the mini lesson impacted your planning and teaching?
10. What did you find as difficult when preparing for the lesson?
11. What did you find as difficult when teaching the lesson?
12. Are there any misconceptions that you picked up during the lesson?
13. What would you change if you had to teach the topic again in a school context ?

Appendix II: Interview schedule

Scheduled Interview Questions

1. What was in mind when planning the lesson? What did you consider?
2. Describe how the lesson you taught went?
3. What teaching strategies did you use to teach the lesson topic?
4. Why did you choose those teaching strategies? In a traditional classroom context, would you have used the same strategy?
5. How would you describe the 'level' of preparedness you had to teach the lesson topic?
6. What skills did you use for the micro-teaching lesson?
7. To what extent would you say the lesson went well?

Video stimulated Interview Questions

1. In the lesson i observed, at the beginning you used a feedback loop puzzle to start off the lesson, what was the reason for that?
2. In a traditional classroom context, would you have started the lesson the same way?
3. I also observed that you were moving around the classroom to interact with the students who acted as your learners, what did you notice as you engaged with them?
4. In the lesson I observed that you allowed learner to learner engagement as they were working with the feedback puzzle loop, what is the importance of this?
5. Would you use the same strategy in a traditional classroom context?
6. I also observed that you used a worksheet to assist the learners to highlight the parts they did not understand, what was the importance of this?
7. In the lesson your peer students acted as learners, how do you think this impacted the lesson?
8. In the lesson you mentioned that in the previous lesson you gave the students a worksheet on the feedback loop for when it's hot, looking at your peer students responses how do you think this impacted the lesson and you're planning?
9. What did you find as difficult when preparing for the lesson?
10. What did you find as difficult when teaching the lesson?
11. Are there any misconceptions that you picked up during the lesson?
12. What would you change if you had to teach the topic again in a school context?

Appendix III: Interview schedule

Scheduled Interview Questions

1. What was in mind when planning the lesson? What did you consider?
2. Describe how the lesson you taught went?
3. What teaching strategies did you use to teach the lesson topic?
4. Why did you choose those teaching strategies? In a traditional classroom context, would you have used the same strategy?
5. How would you describe the 'level' of preparedness you had to teach the lesson topic?
6. What skills did you use for the micro-teaching lesson?
7. To what extent would you say the lesson went well?

Video stimulated Interview Questions

1. At the beginning of the lesson you mentioned that you will be using blended lessons strategy, please describe what you meant by this?
2. To start the lesson you used past question paper, why was this significant in teaching Natural Selection?
3. In a traditional classroom context, would you have started the lesson the same way?
4. During the lesson one of the learners pointed out how Covid- 19 can be related to Natural Selection, you allowed learners to argue and discuss their thoughts, Why was this important in the lesson?
5. In a traditional classroom context, would you have used the same strategy?
6. During the lesson you instructed the learners to take notes while you teach, what was the reason for using this strategy?
7. In the lesson your peer students acted as learners, and I observed that you allowed them to engage with you and with each other, why was this important? How do you think this impacted the lesson?
8. In a traditional classroom context, would you have used the same strategy?
9. I observed that you used the Covid-19 pandemic as an example in your teaching of natural selection, why did you use this example? How did it impact the lesson?
10. To explain artificial selection you used pictures to teach, why was this important?
11. Would you have done the same in a traditional lesson?
12. You gave learners a table to fill in, why was this important for your lesson.
13. At the end of the lesson you mentioned that you will collect the worksheets, why was this important in your micro-lesson.

Appendix IV: Interview schedule

Scheduled Interview Questions

1. What was in mind when planning the lesson? What did you consider?
2. Describe how the lesson you taught went?
3. What teaching strategies did you use to teach the lesson topic?
4. Why did you choose those teaching strategies? In a traditional classroom context, would you have used the same strategy?
5. How would you describe the 'level' of preparedness you had to teach the lesson topic?
6. What skills did you use for the micro-teaching lesson?
7. To what extent would you say the lesson went well?

Video stimulated Interview Questions

1. At the beginning of the mini- lesson you mentioned what you covered the previous day (which was the thermoregulation & the structure of the skin) why was this important at the beginning of lesson?
2. In a traditional teaching classroom were you going to do the same?
3. When you asked the learners remember what feedback loop was, which was a topic you covered you also mentioned that you will pretend that the classroom was engaging and you will state what answers to expect from the learners, What made you say this?
4. Why was it important for you to find out what the learners know about the blood vessels?
5. During the mini-lesson you mentioned that you will in a traditional teaching context you will give learners an activity of the negative feedback loop for them to complete why was this important for your lesson?
6. During the lesson you mentioned that talking to the learners about examples they have on how the body regulates its temperature is crucial, why was this important?
7. I also observed that you used a variety of diagrams in your powerpoint, why was this important?
8. Why did you think it is important for you to start off the lesson with a summary?
9. If you were to teach this lesson in a traditional classroom context, would you teach it in the same way?
10. In the mini-lesson were your peers acting as learners? How did this impact your lesson and your planning?

Appendix V: Interview schedule

Scheduled Interview Questions

1. What was in mind when planning the lesson? What did you consider?
2. Describe how the lesson you taught went?
3. What teaching strategies did you use to teach the lesson topic?
4. Why did you choose those teaching strategies? In a traditional classroom context, would you have used the same strategy?
5. How would you describe the 'level' of preparedness you had to teach the lesson topic?
6. What skills did you use for the micro-teaching lesson?
7. To what extent would you say the lesson went well?

Video stimulated interview questions

1. In the lesson I observed, at the beginning you mentioned that you were going to start the lesson with a recap, why did you think it was important in your lesson?
2. In a traditional classroom context, would you have started the lesson the same way?
3. You allowed the learners to work in pairs, why was it important?
4. I also observed that you were engaging with the learners as they were doing the activity, what did you notice as you engaged with them?
5. In the lesson you allowed the learners to work in pairs, how did this impact the lesson?
6. Would you use the same strategy in a traditional classroom context?
7. I also observed that in your lesson you allowed interaction between you and the learners, would you say real learning was occurring?
8. In the lesson your peer students acted as learners, how do you think this impacted the lesson? How did this impact your planning?
9. Do you think teaching the mini lesson impacted your planning and teaching?
10. What did you find as difficult when preparing for the lesson?
11. What did you find as difficult when teaching the lesson?
12. Are there any misconceptions that you picked up during the lesson?
13. What would you change if you had to teach the topic again in a school context ?

Appendix VI: Information Sheet

Information Sheet

School of Education
University of the Witwatersrand

Dear Sir / Madam,

My name is Mary Nkuna and I am a Masters student in Science Education at the University of the Witwatersrand, Johannesburg. As part of my studies I have to undertake a research project and I am investigating the **investigation of the affordances and limitations of on-campus microteaching as an alternative to the traditional in schools teaching practice in preparing PGCE students for teaching life sciences after qualification** under the supervision of Dr Eunice Nyamupangedengu. The objective of the study is to find out the limitations and affordances of the on-campus microteaching teaching experience as an alternative to prepare PGCE students to teach Life Sciences in high school by finding out 1) How they plan to teach 2) how they teach during their micro-teaching lessons.

As part of this project, I would like to invite you to take part in the study by 1) giving me access to the lesson plans that you will prepare for your Teaching Experience on campus. 2) Participating in a semi structured interview over the phone which will be informed by the contents of your lesson plans and 3) giving me consent to video record the lesson of your micro-teaching. The interview will take around 10 minutes. With your permission, I would also like to record the interview using a digital device.

There will be no personal costs to you if you participate in this project, You will not receive any direct benefits from participation but there are no disadvantages or penalties if you do not choose to participate or if you withdraw from the study. You may withdraw at any time or not answer any question if you do not want to.

The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information and the information you give will be held by me securely and will not be disclosed to anyone else. For the microteaching video anonymity and

confidentiality will be ensured as the video will be only viewed by me and will be kept safe in a password protected device. If you do not wish to be part of the video and you do not give consent, your face will be blurred and your voice obscured using software to ensure anonymity and confidentiality.

I will be using a pseudonym (false name) to represent your participation in my final research report. If you experience any distress or discomfort at any point in this process, we will stop the interview or resume another time.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. Data collected from this research will be stored and kept in a password protected computer and will be kept for 3-5 years.

If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,

Mary Nkuna

Researcher: Mary Nkuna, 1175797@students.wits.ac.za.

Supervisor: Dr Eunice Nyamupangedengu, 011 717 3752

Appendix VII: Consent Form

Topic: An investigation of the affordances and limitations of on-campus microteaching as an alternative to the traditional in schools teaching practice in preparing PGCE students for teaching life sciences after qualification.

Name of the Researcher: Mary Nkuna

I, ……(Name and Surname) agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:
(Please circle the relevant options below).

I agree that the micro-teaching can be video recorded	YES	NO
I agree that the researcher may use anonymous quotes in his / her research report	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	YES	NO
I give permission for the use of my lesson plans	YES	NO

…… (Signature)
…… (Name of participant)
…… (Date)

Appendix VIII: Permission Letter HOS

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | WSoE Wits School of Education

04 September 2020

Mary Nkuna
1175797@students.wits.ac.za

Re: Permission to conduct research

Dear Ms Nkuna

Permission is granted for you to undertake this study at the Wits School of Education on condition you secure ethical approval from the university.

All good wishes
Felix



Professor Felix Maringe
Professor of Higher Education and Head of School
Wits School of Education
Email: Felix.Maringe@wits.ac.za

Appendix IX: Permission letter registrar

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

OFFICE OF THE DEPUTY REGISTRAR

24 December 2020

Mary Nkuna
Student number (1175797)
Master of Education by Coursework and Research
Wits School of Education

TO WHOM IT MAY CONCERN

"An Investigation of the PGCE students' level of readiness to teach Life Sciences in high school: A case study"

This letter serves to confirm that the above project has received permission to be conducted on University premises, and/or involving staff and/or students of the University as research participants. In undertaking this research, you agree to abide by all University regulations for conducting research on campus and to respect participants' rights to withdraw from participation at any time.

If you are conducting research on certain student cohorts, year groups or



courses within specific Schools and within the teaching term, permission must be sought from Heads of School or individual academics.

Ethical clearance has been obtained: (Protocol number: **2020ECE023M**)

Research Duration: (One Year)

Nicoleen Potgieter

University Deputy Registrar

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Appendix X: Ethics clearance

WITS SCHOOL OF EDUCATION

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF EDUCATION ETHICS COMMITTEE

CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: 2020ECE023M**
PROJECT TITLE	An Investigation of the Post Graduate Certificate in Education students' level of readiness to teach Life Sciences in high school: A case study
INVESTIGATOR	Mary Nkuna
SCHOOL/DEPARTMENT OF INVESTIGATOR	WITS SCHOOL OF EDUCATION
DATE CONSIDERED	17 August 2020
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	Date of submission of the project report

ISSUE DATE OF CERTIFICATE 27 August 2020 CHAIRPERSON



(Dr Paul Goldschagg)

cc: Supervisor: Dr Eunice Nyamupangedengu

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** emailed to the Ethics Office: Matsie.Mabeta@wits.ac.za .

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

_____

Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix A: Lihle's Lesson plan

LESSON PLAN

Date: 16 September 2020 **Grade:** 12

Lesson plan number: _____2____ **Topic: Evolution:** Origins and Natural Selection

Time: 40 Minutes **Number of learners:** 60

Colour coding keys

Coding	Colour
Instructional Technology	Olive green
Learner Prior Knowledge	Yellow
Lesson Objectives	Blue
Representations	Red
Collaboration	Violet
Explanations	Green
Questioning Techniques	Purple

1.1. TYPE OF LESSON:

(Tick the relevant box)

√	Theory
	Experimental/laboratory/
√	Field work/practical
	Application
	Other (*Specify*): ……

The lesson will involve a brief coverage of the history of evolution, followed by a game designed to help learners apply the concept of Natural Selection.

3. INTEGRATION WITH OTHER SUBJECTS: *(How does this lesson integrate with other subjects for cross-curricular teaching*

This lesson can be considered as integrating this history, but the nature of the topic is that it is a Life Sciences topic. This lesson can tie in with future zoology studies, should the learners wish to study a Bachelor of Science degree in the future.

4.4 LESSON OBJECTIVES/ OUTCOME(S):

Formulate the lesson outcome(s) yourself, in your own words,

- Learners must gain a brief overview of the history of origins
- Learners must know and understand the concept of Lamarckism
- Learners must know, understand, and be able to apply the concept of Natural Selection

At the start of this lesson the learners should already know… and can do…

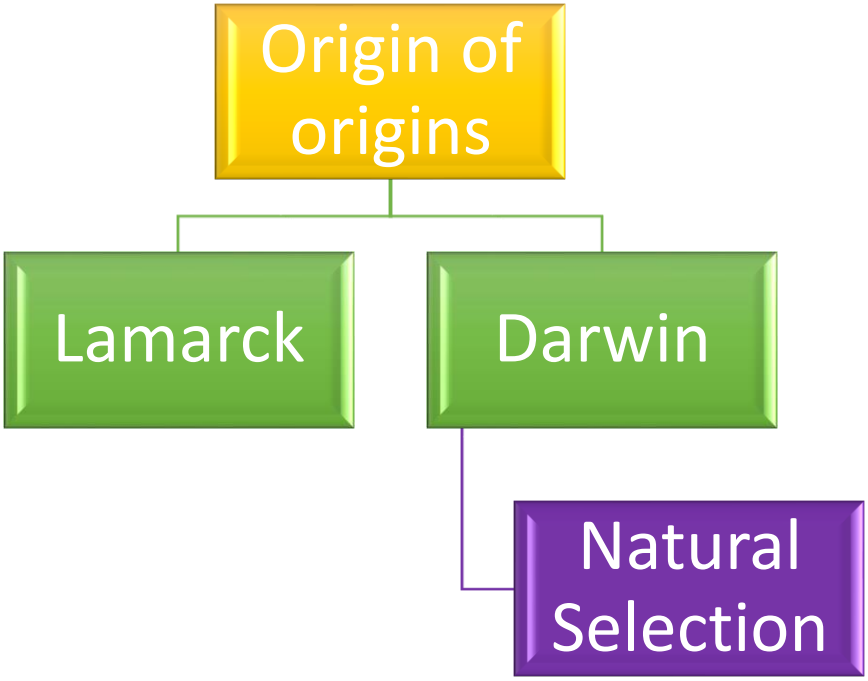
(state existing knowledge, skills and values)

- Learners should understand that evolution is a theory
- Learners should know what evidence supports the theory of evolution
- Learners should know that variation leads to evolution
- Learners need to draw on their knowledge of inheritance from the topic of genetics they had done earlier in the year.

4.4.2. By the end of the lesson the learners should be able to…
(State new knowledge, skills and values)

- Learners must be able to identify and apply the process of Natural Selection

BRAINSTORMING AREA (CONCEPT MAP): *design a concept map of the topic to be taught: Briefly explains its importance*



5.3. TEACHING STRATEGIES AND TECHNIQUES *(used… to meet the lesson outcomes. Indicate why you chose the particular strategies you will use here*)

❑ Direct instruction (transmission): ❑ **Question and answer** . ❑ Explanations ❑ Theory/model ❑ Drill work	❑ Guided discovery: ❑ Inquiry-based learning ❑ Cooperative learning ❑ Pair work ❑ Small group work ❑ Role-play	❑ **Solving real life challenges** (no guidance)	❑ Combination of strategies: *(Specify)* _____ _____ _____ _____	❑ Other: *(Specify)* _____ _____ _____ _____

Justify your choice(s):

Consider the following aspects as well:

- How will learner diversity be catered for?
  - Simple language will be used in the event that language is a barrier to learning. Due to this being a matric class, using alternate languages is unfortunately not an option.
  - A Kenyan folktale will be used to help explain the concept of Lamarckism, thereby including an indigenous knowledge system in the class.
  - **An activity** will be used to help drive home the concept of Natural Selection. This activity will suit visual learners and kinesthetics
  - The information used will be taken from the textbook the learners use and therefore should have.
  - **The game** will involve materials supplied by the teacher/school, thereby not requiring learners to come with anything over and above what they should already have.
  - Resources at the school, such as a smart board will be used, but copies of the slides should be made available in the event of loadshedding.

- How will learners be engaged in the lesson?
  - Learners will be told a Kenyan folktale as part of the lesson in order to introduce Lamarckism.
  - Learners will play a game. The game should engage learners and help them apply the concept of Natural Selection, along with revising genetics.

7. LESSON PHASES breakdown:

7.1 THEME (Context; big idea):

(What theme will you use to contextualise your lesson, link it to learners' real world and introduce your topic? Give your theme a short and inspiring name, e.g. "Friendships", "Our amazing planet" or "Holiday destinations")

Evolution: The origin of origins and Natural Selection

7.2 INTRODUCTION (Time allocated: 5 min)

(Capture attention, create learning atmosphere, teacher-learner dialogue, awaken prior knowledge. Explain how you will use your theme in to introduce the lesson)

The class will be welcomed and do a brief recap of the previous lesson, covering the evidence for evolution and variation. Learners will be told that homework from the previous lesson will be taken in along with homework from this lesson in the following lesson. Time is of the essence for now. The learners need go over the evidence for evolution briefly, but the knowledge of variation is key to this lesson's concepts.

7.3 DEVELOPMENT (Time allocated: 30 min)

(Continue teacher-learner dialogue to start with new knowledge, learner-centred activities, applicable content, consider questions to guide learners towards critical thinking, show sequence of teaching events, scaffolding activities, etc.):

- What science content will be taught?
- What societal aspects will be taught?

What resources will be used?

Learners will over the topic of the origin of origins. This topic is a brief overview of the history of the science of evolution. Learners will be told a Kenyan folktale as part of the lesson to help illustrate to concept of Lamarckism.

Lamarck's hypothesis will be briefly discussed. Lamarck hypothesized that an organism could undergo change in its lifetime and pass that change onto its offspring. The use and disuse of body parts will be mentioned. Lamarck's hypothesis failed to take genetics, which had not been discovered yet, into account.

The history of Darwin's work will be explained prior to covering Natural selection. Darwin had travelled extensively, carefully documenting and studying geography, biogeography fossils of each place.

Natural selection, which involves 7 steps, will be covered.

1. More offspring are produced than are required
2. There is natural variation amongst the offspring
3. A change in the environment will lead to competition
4. Some offspring will have a favourable trait that allows them to adapt to the changed environment and will be more likely to survive.
5. Organisms without the favourable trait are less able to adapt and may die.
6. Organisms that survive will reproduce and are more likely to pass on their favourable trait to their offspring

7. Over time, all the individuals of the population will have the favourable trait and evolution will have taken place.

When the concept of Natural Selection is covered, a game will be used to illustrate parts of natural selection. *Explain the game*

Learners will be divided into four groups. They will be handed an activity sheet. They will be issued with 1 pair of safety goggles, some bubble wrap, a pair of tweezers, two sheets of coloured paper, a cup, 10 beige toothpicks, 10 dotted beige toothpicks and 10 coloured toothpicks.

- Spread out your 40 caterpillars (40 toothpicks) onto the yellow paper.
- Place the cup the distance of the length of a sheet of paper away from the yellow paper with the caterpillar toothpicks.
- One group member must put on the goggles covered in bubble wrap and take the tweezers.
- Another group member will act as the timekeeper.
- The "blinded" group member represents the olive thrush bird.
- For 20 seconds, the "olive thrush" will try to "eat" as many caterpillars as possible by picking up the toothpicks one by one with the tweezers and placing them in the cup.

Learners will tabulate the remaining toothpicks and use punnet squares to determine several more generations. The learners will change the colour paper on which they work from the second round to represent a change in the environment. The intent is for learners to visually see evolution.

Learners will briefly discuss the application of natural selection to the COVID-19 virus and to humans.

During the lesson, slides will be used as a teaching aid. The textbook used is the Grade 12 Mind Action Series textbook. Other resources include the items for the game mentioned above.

7.4 CONSOLIDATION (Time allocated: 2 min)

(Consider ways to ascertain that learners have achieved the outcomes, recapping of main teaching points, assessment, wrap up):

Learners will be given the rest of the activity for homework. Questions asking them about work from the previous lesson and the application of Natural selection will be asked.

8. Evidence of Formative assessment:

The game learners will play will help the teacher identify whether or not learners have grasped the concept.

Evidence of Summative assessment:

Learners will be issued with homework asking learners to consolidate some of the work they have learnt thus far.

9. CLASSROOM MANAGEMENT

(e.g. encouragement rather than control; climate of trust; responsibility in group work; etc.)

Include: *discipline measures*

Learners will be asked to work together and will be encouraged and helped. If learners misbehave, they may be asked to sit out the activity and will be marked down, as part of the work is classwork.

10. Lesson Reflection *(This section is filled in after the lesson presentation)*

Include the important aspects considered when reflecting on your lesson

Appendix B: Ronell's LESSON PLAN

Date: 06/02/2020 **Grade :** 9

Lesson plan number: 1.13 **Topic:** The respiratory system

Time: 10:30

Colour coding keys

Coding	Colour
Instructional Technology	Olive green
Learner Prior Knowledge	Yellow
Lesson Objectives	Blue
Representations	Red
Collaboration	Violet
Explanations	Green
Questioning Techniques	Purple

1.1. TYPE OF LESSON:

(Tick the relevant box)

- [✓] Theory
- [✓] Experimental/laboratory/
- [ ] Field work/practical
- [ ] Application
- [ ] Other (*Specify*): ……

Theory explanations, with the use of models, was used in order for the teacher to clearly explain the content while addressing misconceptions as they arise while also using the model to demonstrate the theory concepts.

3. INTEGRATION WITH OTHER SUBJECTS: *(How does this lesson integrate with other subjects for cross-curricular teaching?)*

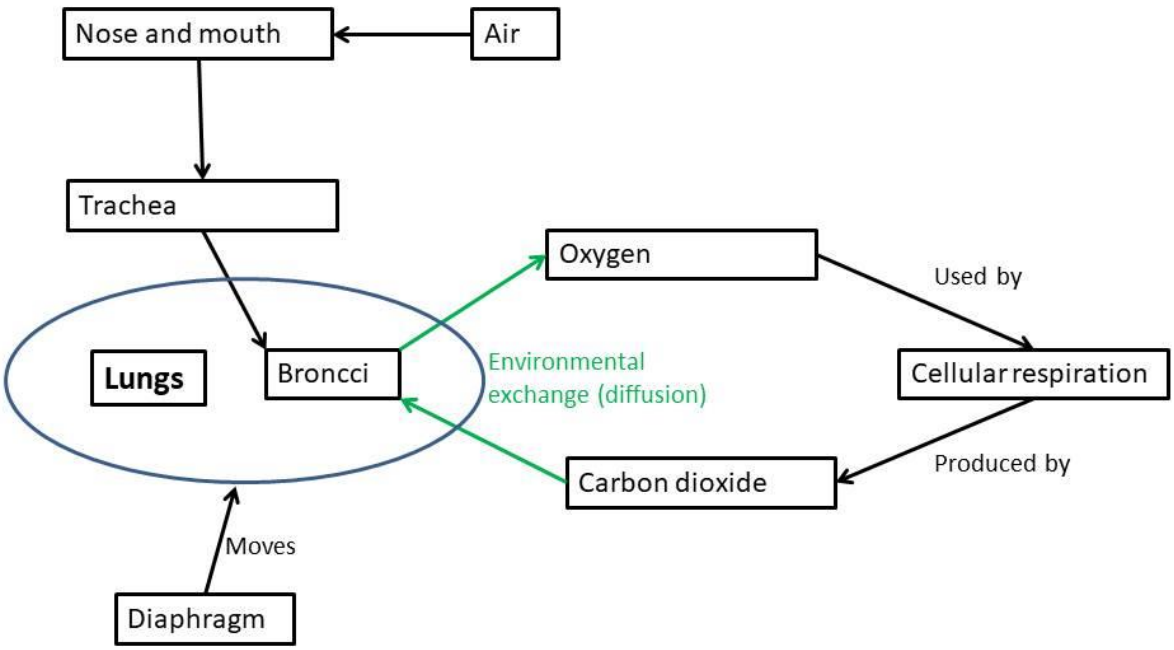
Grade 8 NS: Respiration
Grade 8 NS: Types of microorganisms

4.4 LESSON OBJECTIVES/ OUTCOME(S):

At the start of this lesson the learners should already know that humans require oxygen for respiration and produce carbon dioxide. Viruses and bacteria are microorganisms as well as basic properties of each. From this section the learners should also know what a system is within the body.

By the end of the lesson the learners should understand the purpose of the respiratory system, the functions of the main components of the respiratory system and identify key respiratory diseases.

BRAINSTORMING AREA (CONCEPT MAP):



1115.3. TEACHING STRATEGIES AND TECHNIQUES

☑ Direct instruction (transmission): ❑ Question and answer ❑ Explanations ☑ Theory/model ❑ Drill work	❑ Guided discovery: ❑ Inquiry-based learning ❑ Cooperative learning ❑ Pair work ❑ Small group work ❑ Role-play	❑ Solving real life challenges (no guidance)	❑ Combination of strategies : *(Specify)* _____ _____ _____ _____	❑ Other: *(Specify)* _____ _____ _____ _____

Justify your choice(s):

By using models alongside theory explanation the teacher can ensure various learning styles are catered for as well as relating the content to learners' personal experiences (since all people breath and can relate to the process). The use of models, diagrams and a model will also engage learners in the lesson, especially the model which learners find 'fun' and see as a break from usual learning.

7. LESSON PHASES breakdown:

7.1 THEME (Context; big idea):

Why we breathe.

The lesson will explain to learners how the respiratory system functions as well as the importance of the system in the body.

7.2 INTRODUCTION (Time allocated …….min)

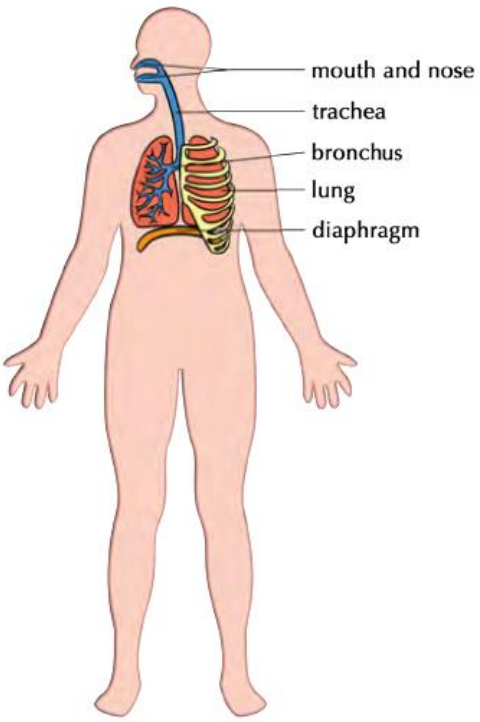
The lesson will begin with the teacher briefly revising the circulatory system while emphasising the transport of oxygen and carbon dioxide. The teacher can then link the transport of oxygen and carbon dioxide to the respiratory system by questioning learners on their understanding of how we get oxygen and excrete carbon dioxide, this will also inform the teacher of possible misconceptions that the learners may have. Possible misconceptions the teacher may encounter are:

- **Physiological respiration and cellular respiration are not the same.** People sometimes use the word "respiration" to refer to the process of cellular respiration, which is a cellular process in which carbohydrates are converted into energy. The two are related processes, but they are not the same.
- **We do not breathe in *only* oxygen or breathe out *only* carbon dioxide.** Often the terms "oxygen" and "air" are used interchangeably. It is true that the air we breathe in has more oxygen than the air we breathe out, and the air we breathe out has more carbon dioxide than the air that we breathe in. However, oxygen is just one of the gases found in the air we breathe. (In fact, the air has more nitrogen than oxygen!)
- **The respiratory system does not work alone in transporting oxygen through the body.** The respiratory system works directly with the circulatory system to provide oxygen to the body. Oxygen taken in from the respiratory system moves into blood vessels that then circulate oxygen-rich blood to tissues and cells.

7.3 DEVELOPMENT (Time allocated ……min)

Once the learners have come to the conclusion (with guidance from the teacher) that the lungs help get oxygen from the air and excrete carbon dioxide (any other respiratory organs mentioned by the learners should be praised and referenced further by the teacher as the explanation continues) the teacher can then begin to describe the function of the respiratory system using the correct terminology: " The respiratory system is responsible for supplying the body's cells with oxygen and for removing carbon dioxide".

The teacher will then give the learners a hand-out containing the below diagram of the respiratory system) before going over the individual organs within the respiratory system and highlighting the function of each organ (the learners will follow the explanation of each organ and take notes regarding each organ.



The following is a guide as to what the teacher should emphasise and the learners should note:

1. Mouth and nose

   Oxygen rich air enters the body through the mouth and nose where it is warmed.

2. Trachea (also called the windpipe)

   The trachea is a tube that enters the chest and allows air to flow from the mouth into the bronchi and from there into the lungs. It is kept open by cartilage rings. When dust particles and germs in the air enter the trachea during inhalation, the mucus lining the trachea traps these particles and the **cilia** work together to move them out of the body. When you sneeze or cough you expel the mucus and foreign particles from your body.

3. Bronchi

   The trachea splits into two air tubes, called bronchi that connect to each of the lungs. These tubes divide even further into smaller and smaller tubes that connect with the tiny air bags (alveoli) of the lungs.

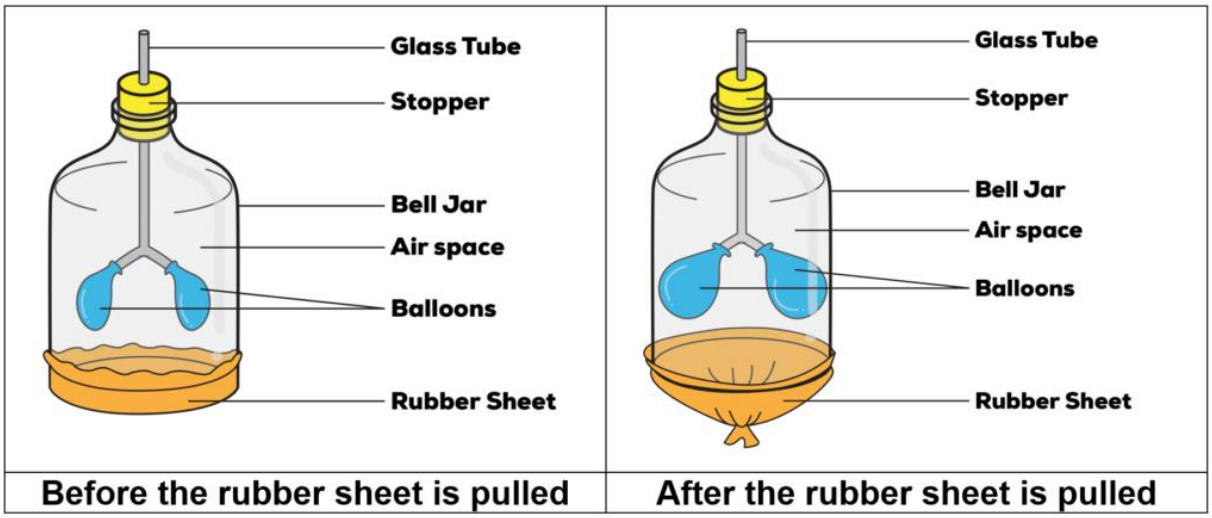
4. Lungs

   The main organs of the respiratory system are the lungs. The tiny alveoli or air bags in the lung are surrounded by small capillaries where gaseous exchange takes place.

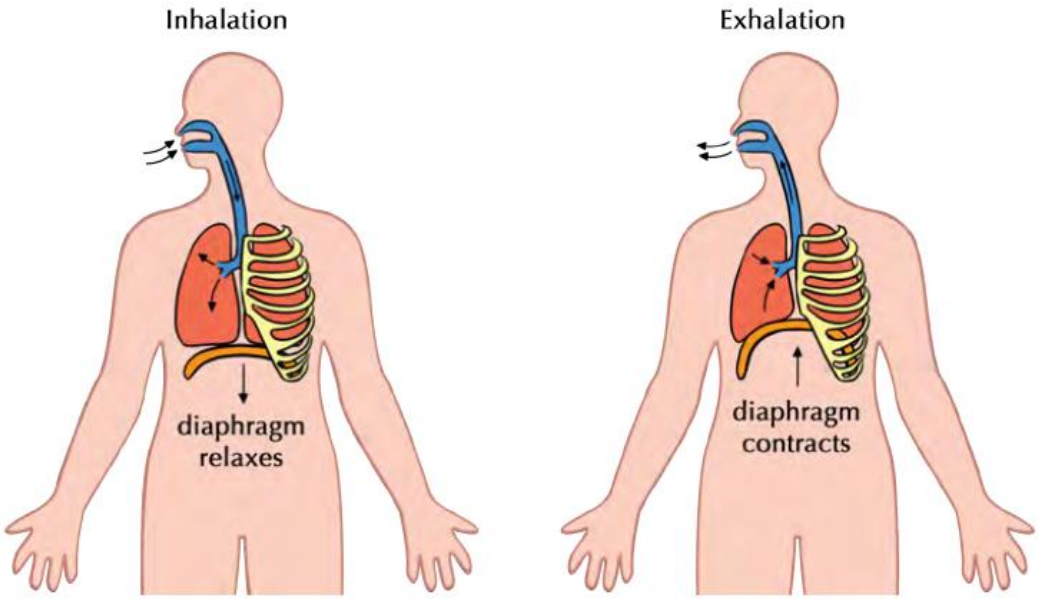
5. Diaphragm

   This dome shaped muscle below the lungs enables you to breathe. When it contracts, it moves downwards and your lungs fill with air. When it relaxes again it moves upwards and forces the air out of your lungs. This is the main muscle used for breathing.

The teacher will then demonstrate to the learners how the diaphragm helps inflate the lungs by demonstrating the following model:



While using the following diagram to explain how the parts of the model relate to the organs within the respiratory system:



When using the model the teacher must be careful to emphasise that the model only demonstrates how the diaphragm helps inflate the lungs and does not relate in every way to the actual structure of the lungs.

The teacher will then go over the three main processes of the respiratory system, highlighting the following points:

1. Breathing occurs when we take oxygen into the body (lungs) and push carbon dioxide out of the body. Breathing therefore occurs in two phases:
   – Inhalation - drawing air in
   – Exhalation - pushing air out
2. Gaseous exchange takes place at two locations by a process called diffusion:

– In the alveoli, oxygen diffuses into the blood from the lungs and carbon dioxide diffuses from the blood back into the lungs
– At the body tissues oxygen diffuses from the blood into the cells and carbon dioxide from the cells diffuses into the blood

3. Cellular respiration occurs within the mitochondria of cells to release the chemical energy in food.

7.4 CONSOLIDATION (Time allocated ……min)

The teacher will use the diseases of the respiratory system as a way to consolidate the lesson as well as help the learners relate the topic to their everyday lives. The following diseases should be covered, although the teacher should be open to suggestions of other respiratory diseases that the learners may suggest or want to discuss (these could include emphysema, lung cancer, etc.):

- **Asthma**: caused by allergies that inflame and narrow the airways
- **Lung cancer**: a disease that mostly results from smoking or severe air pollution
- **Bronchitis**: swelling of the lining of the bronchi due to infection which causes coughing and makes it difficult to get air into their lungs
- **Pneumonia**: an infection in the lungs where the alveoli fill with fluid
- **TB (Tuberculosis)**: an infectious disease caused by the bacteria, *Mycobacterium*
- **Covid-19:** a viral infection that causes shortness of breath, difficulty breathing and possibly death (emphasis on the recent Covid pandemic)

The learners will then be given an activity to complete until the end of the lesson or for homework if not completed during the class.

8. Evidence of Formative assessment:

The teacher will use the discussion at the beginning of the lesson, regarding the learners' prior knowledge, and contrast that to the discussion regarding the diseases of the system (checking that the learners have used the correct terminology and thinking processes).

Evidence of Summative assessment:

At the end of the Topic the **learners will be asked to place all the systems** covered on a blank diagram of the human body and annotate the function of each part within the system. This will serve as the summative assessment of the entire topic. Learners will be informed of this task (as well as specific outcomes and the rubric) at the start of the topic so that they are aware of the expectations.

9. CLASSROOM MANAGEMENT

By using explanations alongside diagrams and the model the teacher can appeal to a wide variety of learning styles as well as encourage learner interest (as models tend to promote more interest that just explanations of facts). The teacher should make sure to encourage engagement during the discussion sections of the lesson while making sure that learners stay on topic.

10. Lesson Reflection

Appendix C: Nomsa's Lesson Plan

1.1. TYPE OF LESSON:

- [x] Theory
- [ ] Experimental/laboratory/
- [ ] Field work/practical
- [ ] Application Other
- [x] This lesson is primarily theory because it is following an introductory lesson of a new topic; therefore learners still require knowing the underlying theory or concepts of homeostasis in humans. Learners will also need to prove they understood the previous lesson by applying what they were taught the previous lesson in today's revision activity which will be done in pairs.

4.4 LESSON OBJECTIVES/ OUTCOME(S):

4.4.1 At the start of this lesson learners should be able to and/ or know

- Define homeostasis
- List the factors that need to be kept constant in the tissue fluid
- Discuss the negative feedback mechanism involved in
  - Maintaining the blood glucose level
  - Maintaining Carbon dioxide level
- Learners must be able to identify the stimulus, control centre and response involved in each of the above negative feedbacks
- How does the brain work with the kidney to decide how yellow or how clearer should your urine be?
- The structure and labels of the Kidney nephrons

4.4.2 **BY THE END OF THE LESSON LEARNER'S SHOULD BE ABLE TO:**

- Explain the negative feedback when there is higher than normal water level in the blood
- Explain the negative feedback when there is lower than normal water level in the blood
- Explain the negative feedback when there is higher than normal salt level in the blood
- Explain the negative feedback when there is lower than normal water level in the blood
- Apply content learnt in this lesson in the following lesson
- Explain how aldosterone regulates water level in the blood

The following concept map helps the teacher to be able to visualise the flow of the lesson. To also see how the concepts in the lesson links together.

5.3. TEACHING STRATEGIES AND TECHNIQUES

Question and answer

- To promote active learner participation
- To identify misconceptions as learners answer
- To see if learners understand what is being taught in this lesson **Explanations**

They are to promote cumulative learning. When the teacher explains, she can move from the high part of the semantic wave (complex concepts), take a downshift by making examples or relatable everyday experiences before moving on to the next complex concept. Explanations are an opportunity for learners to understand the concepts being taught and ask questions where they do not understand. Explanations are more effective for auditory learners. The clearer the explanation is, the better they understand.

Using images (figures)

The teacher has given leaners figures to assist visual learners to effectively follow what the teacher is saying. The teacher will also draw a nephron structure on the board to promote learning of visual learners.

Working in pairs

In the revision activity at the beginning learners will be working in pairs.This will promote productive arguments, the pairs will correct each other, teach each other and learn to listen to one another. Some learners learn best when their peer is the one explaining the concepts, so this is an opportunity for such learner to ask their partner for clarifications.

Inquiry based learning (For Homework)

A student- centred approach, which encourages learners to read ahead. It will also help them to develop basic skills related to science which is trying to find answers to a given problem. Those with internet will be advantaged. However, learners are allowed to borrow the limited schoolbooks from the teacher during break and after school, but they can't take them home. This way everyone has an opportunity to be ahead in the next lesson.

7.1 THEME

Sodium and water, the coin and magnet

- Sodium is like a magnet to water, when there is high salt concentration in the blood, more water will be re-absorbed from the tubules into the blood.

7.2 INTRODUCTION 17 minutes

This revision activity takes longer because it is intended to also serve as a formative assessment. The teacher will be walking around to assist learners.

Revision of lesson 1 of 4, teacher explains the revisions activity:

Learners will be divided into pairs

Each pair will be given a batch of 35 jumbled cards. These cards should be arranged into three negative feedback loops, namely, maintaining the blood CO_2 level, maintaining the blood glucose level (loop A), and maintaining the blood glucose level (loop B). The pair that will finish first will get 5 merits.

Maintaining the blood CO_2 level- 10 cards
Maintaining the blood glucose level- 12/ 13 cards
Maintaining the blood glucose level- 13/ 13 cards

Crucial factors that should be kept constant in the internal environment include:

Glucose
CO_2
pH
Water
Salt
Temperature

Today's lesson will cover water and salt

Grade 11 revision (teacher reminds learners)

- Urine production is primarily to remove waste products like urea and creatinine
- However, essential components like glucose, sodium and water also get filtered out of the blood during glomerular filtration
- The essential components must be re-absorbed
- Ascending loop of Henle blocks water from moving out of the nephron
- Sodium is actively pumped out of the loop of Henle

Teacher asks: what will happen to the water potential in the medulla tissue fluid? Answer: decreases because the sodium decreases free movement of water

- The amount of water that will move from the distal convoluted tubule and collecting duct will depend on Antidiuretic hormone (ADH).

7.3 DEVELOPMENT 20 min

Learner will have to fill in the missing words on the given notes as the teacher explains them. The missing words on learners notes are the ones underlined

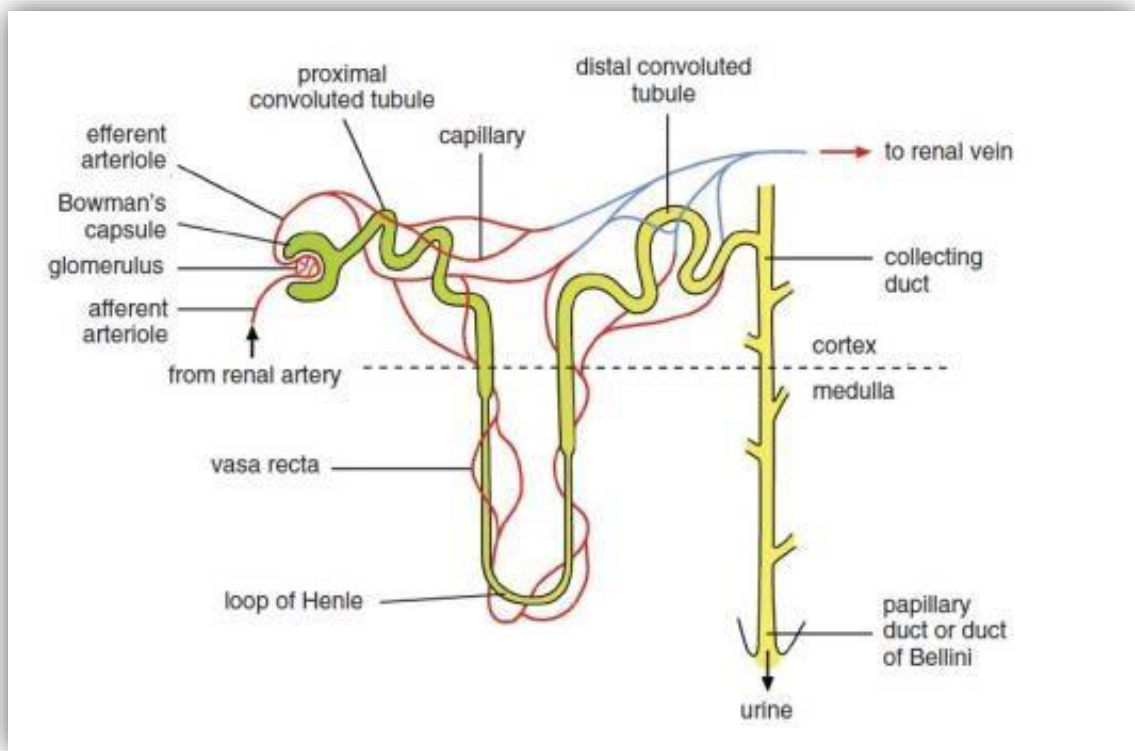


Figure 1. Nephron and associated blood vessels

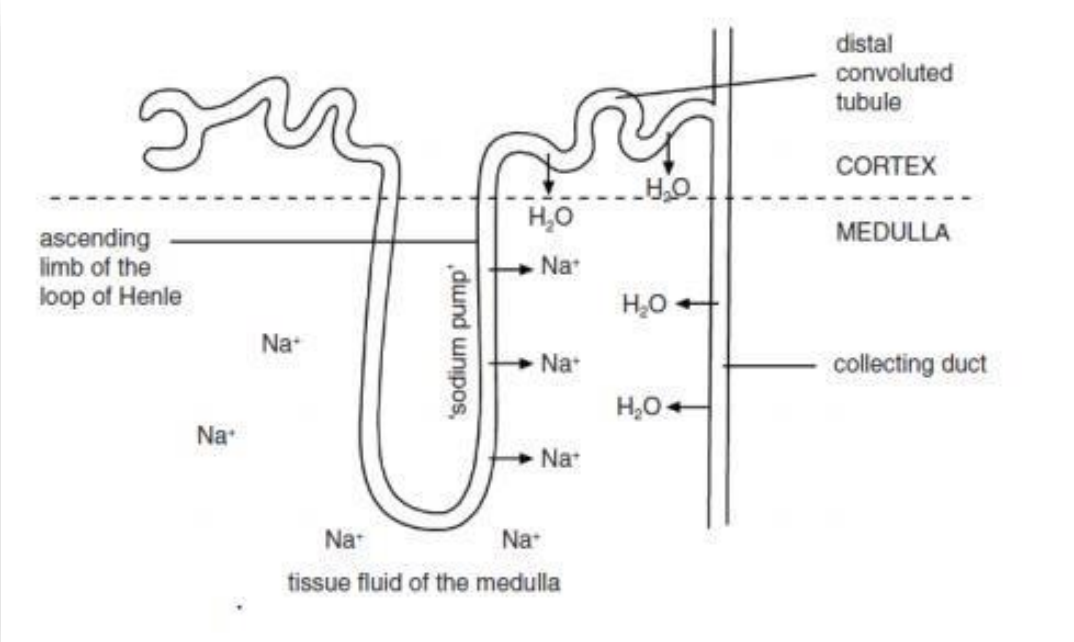


FIGURE 2. Kidney nephron. Sodium is actively pumped out of the loop of Henley and into the medulla tissue fluid. The medulla become hypertonic (very salty). The water potential becomes low.

MAINTAINING WATER LEVELS (OSMOREGULATION)

When the body has too much water

- Due to low temperature, large intake of fluids or inactivity
- Water volume in the blood increases
- Osmoreceptors in the hypothalamus are stimulated
- The message is sent to the pituitary gland
- Pituitary gland will secrete less ADH into the blood
- Reduced level of ADH causes the walls of the distal convoluted tubule and the collecting duct to become less permeable to water
- Less wat er will leave the tubule by osmosis to enter the medulla tissue fluid
- Less water will be re -absorbed into the surrounding capillaries
- This means more water has remained in the tubule and will be excreted forming a very dilute urine
- Water level in the blood decreases to normal

When the body has too little water

- Due to high temperature, lows intake of fluids or strenuous activity
- Water volume in the blood decreases
- Osmoreceptors in the hypothalamus are stimulated
- The message is sent to the pituitary gland
- Pituitary gland will secrete more ADH into the blood
- Increased level of ADH causes the walls of the distal convoluted tubule and the collecting tubule to be more permeable
- More water will leave the tubule by osmosis to enter the medulla tissue fluid
- More water will be re-absorbed into the surrounding capillaries
- This means less water has remained in the tubule and less water will be excreted forming a very concentrated urine
- Water level in the blood increase to normal

MAINTAINING SALT LEVELS

When there is a shortage of sodium in the blood

- The adrenal gland secretes more aldosterone
- More sodium will be re-absorbed by the blood capillaries at the distal and collecting tubules
- Less sodium ions will be excreted
- The amount of sodium will then increase back to normal

When there is an excess of sodium ions in the blood

- The secretions of aldosterone from the adrenal gland decreases
- Less sodium will be re-absorbed by the blood capillaries at the distal and collecting tubules
- Thus, more sodium ions will be excreted
- The amount of sodium will then decrease back to normal

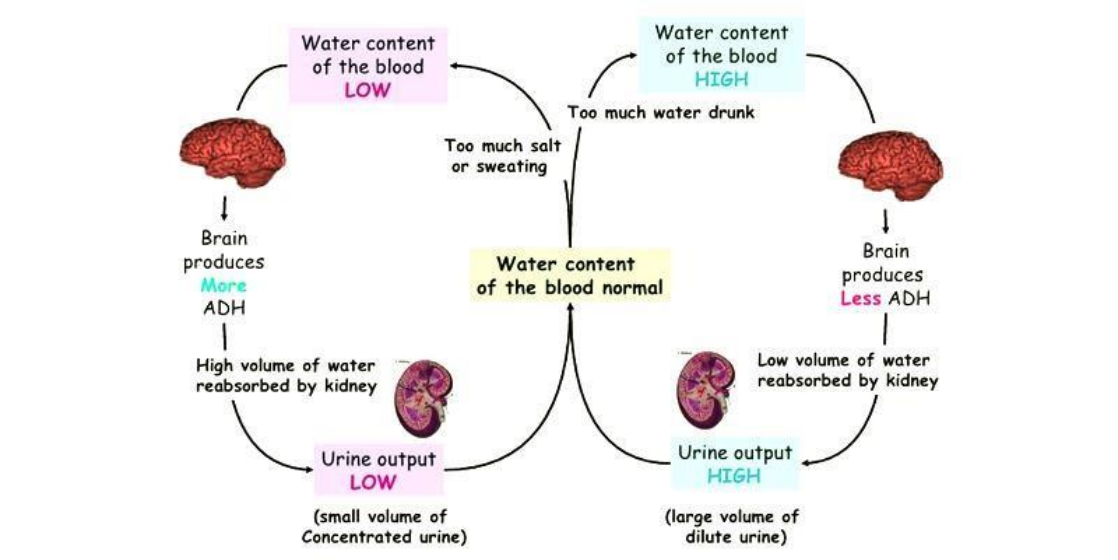


FIGURE 3. Maintaining the blood water level

7.4 CONSOLIDATION 3 min

Teacher summarises the relationship between aldosterone and water retention

HOMEWORK

Learners must go and find out how is the human skin adapted for temperature regulation

RESOURCES

- White board
- White board marker
- Printed noted for learners
- Grade 12 textbook

CLASSROOM MANAGEMENT

- A learner must raise his/ her hand before speaking
- A learner will get demerits if they persist on being unruly

MEMORANDUM FOR THE REVISON ACTIVITY (next page)

References

41.4B: Nephron: The Functional Unit of the Kidney. Biology LibreTexts. (2020). Retrieved 15 September 2020, from https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/41%3A_Osmotic_Regulation_and_the_Excretory_System/41.4%3A_Human_Osmoregulatory_and_Excretory_Systems/41.4B%3A_Nephron%3A_The_Functional_Unit_of_the_Kidney.

osmoregulation - Liberal Dictionary. Liberal Dictionary. (2020). Retrieved 15 September 2020, from https://www.liberaldictionary.com/osmoregulation/.

Salt and Sodium. The Nutrition Source. (2020). Retrieved 15 September 2020, from https://www.hsph.harvard.edu/nutritionsource/salt-and-sodium/.

Isaac, T. (2013). *Understanding life sciences* (pp. 160-169). Pulse Education Services.

Appendix D: Nelly's Lesson Plan

Date: 18 May 2020 **Grade:** 12A (streamed class)

Lesson plan number: 2 **Topic:** Human Nervous System

Time: 20 minute lesson

Type of lesson: Theory **Number of Pupils:** 30

Pupils' background, traits and other information:

- All learners have experienced an instant reaction (reflex arc)
- Relate lesson to how their brain works every day for them
- Learners play sport, sing or write (apply the functions of the brain to actions that pupils do every day)

Integration with other subjects:

- Consider explaining how the brain is activated during Physical Education (PE in Life Orientation)

Lesson Objectives and Outcomes:

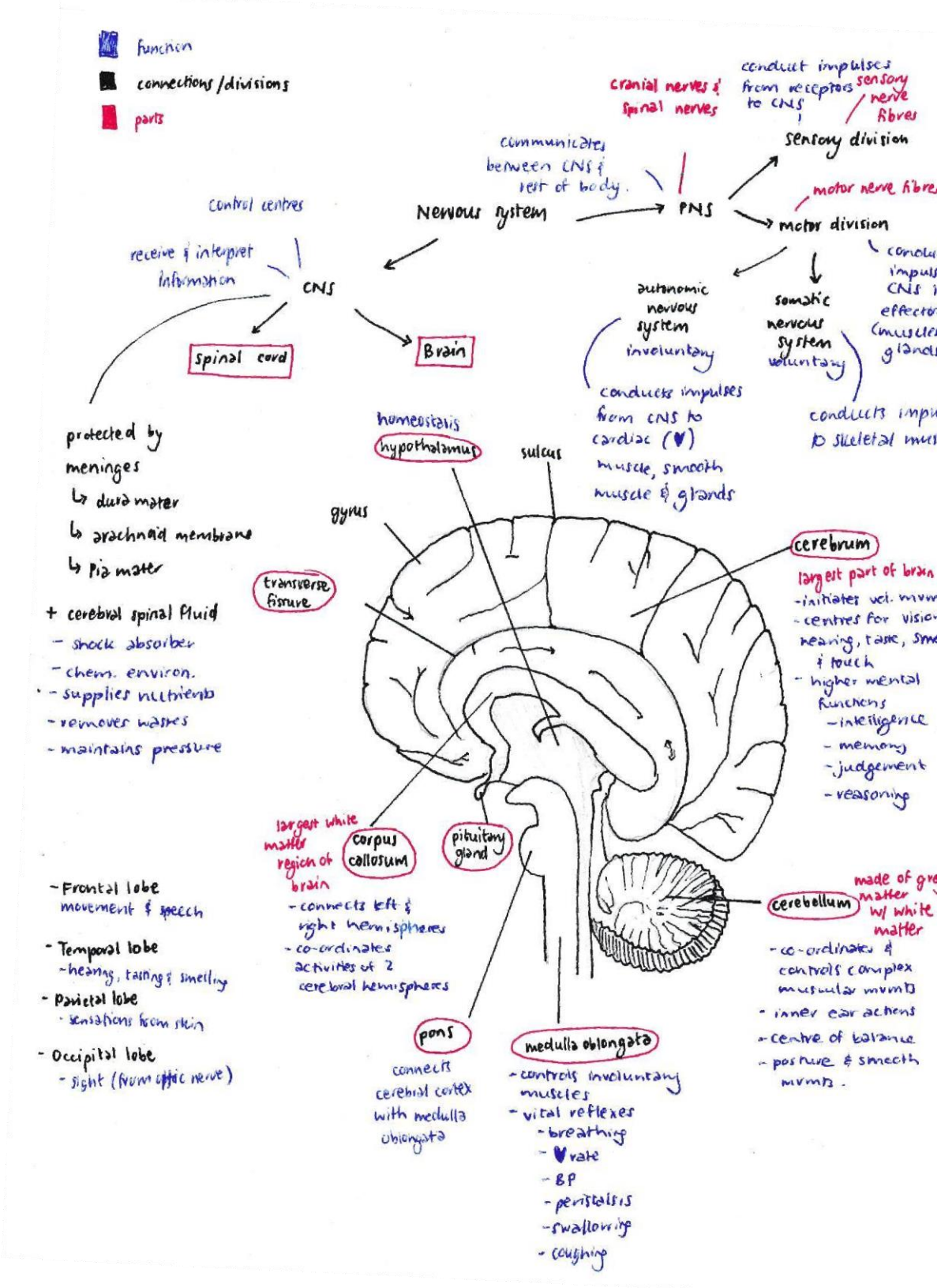
At the start of this lesson, learners should already know:

- The human brain is the control centre of the body
- Humans are able to react to their environment through hormone and nervous systems At the end of this lesson, learners should have learnt:
- Human nervous system is broken into CNS and PNS
- To identify parts of the brain and their respective functions as listed below
- To identify the lobes of the brain

Specific aims from CAPS document:

- Knowing of the subject (theory)
- Doing science through practical work (will be covered in the following lesson where learners observe the spinal cord)
- Understanding the applications of LS in everyday life (knowing what will happen if certain areas of the brain or spinal cord are damaged)

Concept Map:


function
connections / divisions
parts
Nervous system
CNS
PNS
control centres
receive & interpret information
communicates between CNS & rest of body.
cranial nerves & spinal nerves
conduct impulses from receptors to CNS
sensory nerve fibres
sensory division
motor nerve fibre
motor division
spinal cord
Brain
protected by meninges
↳ dura mater
↳ arachnoid membrane
↳ pia mater
+ cerebral spinal fluid
- shock absorber
- chem. environ.
- supplies nutrients
- removes wastes
- maintains pressure
autonomic nervous system involuntary
somatic nervous system voluntary
conducts impulses from CNS to cardiac (♥) muscle, smooth muscle & glands
homeostasis
hypothalamus
sulcus
gyrus
transverse fissure
cerebrum
largest part of brain
- initiates vol. mvmt
- centres for vision, hearing, taste, smell & touch
- higher mental functions
- intelligence
- memory
- judgement
- reasoning
largest white matter region of brain
corpus callosum
- connects left & right hemispheres
- co-ordinates activities of 2 cerebral hemispheres
pituitary gland
cerebellum
made of grey matter w/ white matter
- co-ordinates & controls complex muscular mvmts
- inner ear aches
- centre of balance
- posture & smooth mvmts.
pons
connects cerebral cortex with medulla oblongata
medulla oblongata
- controls involuntary muscles
- vital reflexes
- breathing
- ♥ rate
- BP
- peristalsis
- swallowing
- coughing
- Frontal lobe
movement & speech
- Temporal lobe
- hearing, tasting & smelling
- Parietal lobe
- sensations from skin
- Occipital lobe
- sight (from optic nerve)

Resources required:

- Textbook
- Zygote 3-Dimensional Virtual body website found at https://www.zygotebody.com/#nav=1.37,82.74,281.42,0,0,0,0&sel=p;;h;;s;;c:0;p:0&layers=1,1,7271
- Internet connection
- PowerPoint presentation on the Human Nervous System White board and markers

TPACK: Zygote-3D Virtual human demonstration

Teaching strategy and techniques:

Lecture-based with observation of 3-dimensional virtual human body

Inquiry-based learning

Misconceptions that may arise (or already be present):

- Brain is responsible for thinking (cognition) but not for physical actions
- Coughing and swallowing is voluntary
- The brain is physically separated into different regions for different functions
- Involuntary functions (eg. Digestion, circulation and respiratory systems) are not controlled by the brain, because they are involuntary (they just happen)

LESSON PHASES

Topic: Human Nervous System

Theme: The Brain

Big Idea: The brain is made up of many parts that collectively control involuntary, voluntary and cognitive actions

Teacher's role:	Learners' role:
Recapping from last lesson (allocated 1 minute)	
Finished paternity testing, DNA fingerprints etc.	Listen
Introduction (allocated 2 minutes)	

Video –

- What is happening in this video?
- I saw you all jump!
- Discussion on reflexes and why we react like we do

Answering questions (conversational)

Development (allocated 10 minutes)

Human Nervous system allows us to react to the environment.

Discuss the hierarchy of the nervous system

See concept map for more detail of the lesson

Discuss the following (structure & function)

CNS

- Cerebral spinal fluid
- Meninges
- Brain and spinal cord ○ Corpus collosum ○ Cerebrum ○ Cerebellum ○ Hypothalamus ○ Pituitary gland ○ Medulla oblongata ○ Spinal cord

Identify different parts of the brain

Describe functions of the parts of the brain

Look at 3D virtual brain and discuss the parts and their function (form of recap)

- Gyrus
- Sulcus
- Transverse fissure
- Pons varolii
- Lobes of the brain (on coloured brain) ○ Frontal

Listening and asking questions

○ Temporal ○ Parietal ○

Occipital (discuss optic nerve)

Assessment of learning (allocated 5 minutes)	
Ask questions relating to brain's function Allow learners to identify parts of the brain on the virtual brain.	Table-creation List the functions of parts of the brain in the table

Consolidation (allocated 2 minutes)	
Coming back to the bigger picture of the nervous system. Remind pupils that the brain is not literally separate parts Brain's function in reacting to the ball in the video	Listening

Evidence of Formative assessment:

- Learners need to create a table listing all the parts of the brain that were discussed along with their functions.
- Learners should also be able to identify the parts of the brain and list their respective functions

Evidence of Summative assessment:

Summative assessment will take place at the end of the topic in the form of a cycle test (also known as a control test.) Exams will also take place in November where the year's work will be assessed

Classroom Management:

As the lesson starts with an exciting video, pupils are likely to be engaged and enthusiastic. Encourage pupils to become involved in the discussion, provided their comments are in line with learning about reactions and the brain. This lesson can occur with large classes as the projector will allow for large display of the brain. Alternatively, the model is available on smart phones. This would require more classroom discipline and awareness.

Lesson Reflection

What went well?

Technology use is really useful for visualising human body parts, especially the brain which is so complex. I enjoyed the little class interaction and was pleased to see that some pupils remembered what was covered last week.

What went badly?

Time ran away! I did not cover all the work I wanted to cover. However, I do not think this is a bad thing because the sections we did cover were in depth. Time could be saved by having slides pre-prepared rather than writing on the board, especially if you are able to use a projector. Furthermore, this lesson was limited to 20 minutes and I prepared more than 20 minutes' worth of work.

What could be improved?

Rather than writing up notes which takes time, use the projector with prewritten slides. This will also make it easier for learners to copy down information and key points.

How could I improve as an educator?

Be confident in the knowledge that you have. I often stutter and repeat words that I do not need to repeat.

References

Education, D. o. (2011). *Curriculum and Assessment Policy Statement (CAPS) Life Science.* Pretoria: Department of Education.

Mehterell, A., & Crisp, K. (2017). *Ace It! Life Sciences 12.* Pietermaritzburg: Shuter and Shooter Publishers.

Appendix E: Anna's LESSON PLAN

Lesson plan template:

Date: 17 September 2020 **Grade :12**

Lesson plan number: week 2, lesson 1 **Topic: artificial selection**

1.1. TYPE OF LESSON:

(Tick the relevant box)

x	Theory
	Experimental/laboratory/
	Field work/practical
x	Application
	Other (*Specify*): ……

The lesson will include the content to be learned with discussions to promote understanding. There will be a small amount of application in the table where similarities and differences are explained.

3. INTEGRATION WITH OTHER SUBJECTS: *(How does this lesson integrate with other subjects for cross-curricular teaching?)*
This is integrated with the grade 9 natural science as they do a small amount of selective breeding of crops, agriculture as selective breeding of crops is a very important agricultural tool and life orientation as the covid-19 pandemic will still be discussed in the beginning. There will also be a small amount of English as we will be looking into the definitions of certain key terms.

4.4 LESSON OBJECTIVES/ OUTCOME(S):

Formulate the lesson outcome(s) yourself, in your own words,

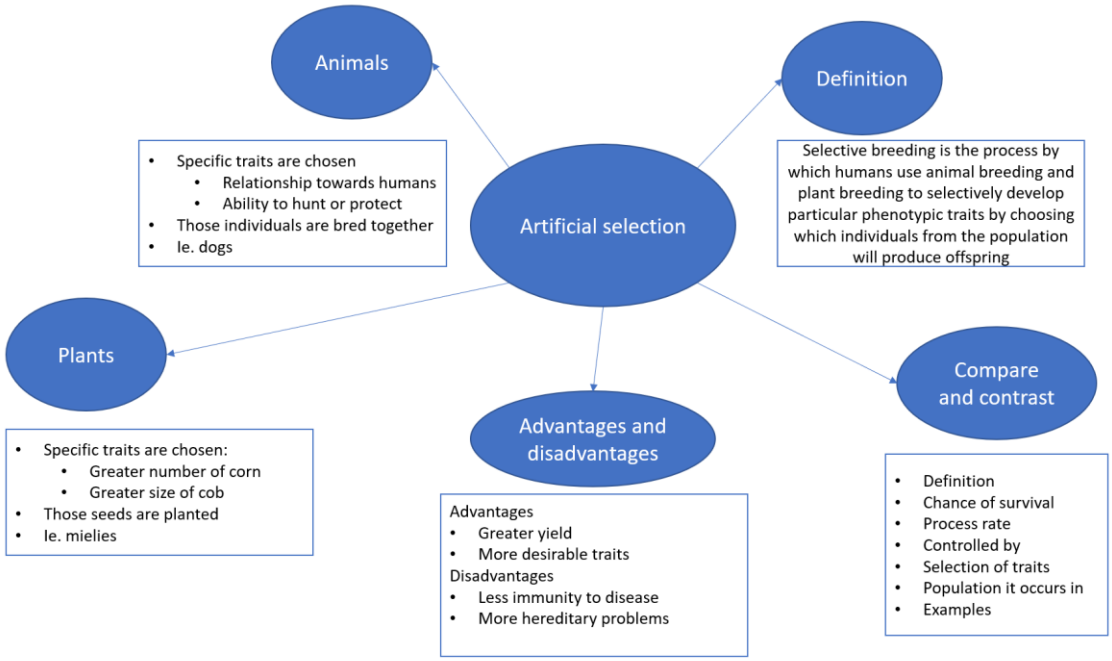
At the start of this lesson the learners should already know… and can do…
(state existing knowledge, skills and values)

- Define natural selection
- Explain how competition for food, competition for reproduction and competition for survival lead to natural selection
- Describe the different forms of genetic variation
- Explain whether or not the Covid-19 pandemic will result in natural selection

4.4.2. By the end of the lesson the learners should be able to…
(State new knowledge, skills, and values)

- Define artificial selection
- Describe one example of artificial selection in plants and animals
- Describe the advantages and disadvantages of artificial selection
- Compare and contrast artificial selection and natural selection

BRAINSTORMING AREA (CONCEPT MAP): *design a concept map of the topic to be taught: Briefly explains its importance*



5.3. TEACHING STRATEGIES AND TECHNIQUES *(used… to meet the lesson outcomes. Indicate why you chose the particular strategies you will use here*)

❑ Direct instruction (transmission):	❑ **Guided discovery:**	❑ Solving real life challenges (no guidance)	❑ Combination of strategies : *(Specify)*	❑ Other: *(Specify)*
❑ **Question and answer X** ❑ **Explanations** ❑ Theory/model ❑ Drill work	❑ **Inquiry-based learningX** ❑ **Cooperative learning** ❑ **Pair workX** ❑ **Small group workX** ❑ **Role-playX**		_____ _____ _____ _____	_____ _____ _____ _____

Justify your choice(s):

Consider the following aspects as well:

- How will learner diversity be catered for?

There is no telling what circumstances my learners will experience outside my classroom, however, I want to ensure that they all have equal opportunities to learn and that none feel excluded. I have used a variety of mechanisms to do this.

– I have ensured that the examples I use are ones that my learners will be familiar with, dog and mielies is pretty common.

– The homework I have assigned is partly optional. It is perfectly acceptable to complete the work in class and hand it in after the lesson. This means that learners who have an unstable home environment won't have that negatively influence their ability to do homework. If there's no power at home or if they have other household duties, then they will still be able to get good marks for the homework assignment.

– I have used limited red and green in my presentation to help people with red green colour blindness.

– I have also included a debate which will help learners with different learning styles interact in the class more. Additionally if the learner has difficulty with the LOLT the discussion may help them express their views with the help of other languages.
– The final task will be completed in class the following day and can be done in groups to help promote deep learning.
• How will learner context and/or background be catered for?
Due to the age of the learners, 17 to 19 (in theory), the learners will hopefully have a greater sense of responsibility as the exams are coming up soon, hopefully this will allow them to focus better in class as they know what is at stake.
For this lesson we will assume that some learners cant attend and therefore we will be doing a blended lesson with some learners listening online and responding on WhatsApp. We will be using google meet as all you need is a Gmail email address to use it, and then we will be using WhatsApp. I will assume that one of my learners doesn't have the internet capacity at home to use google meet and as such I will be recording the lesson to send it to the class on WhatsApp so that the other learner can catch up later.
We will begin the lesson by finishing the discussion we had the previous week. This was done purposefully to encourage the learners to think about the topic more deeply. There will be a short discussion that will be concluded with a graph of the deaths of Covid by age. After that we will move on to the new topic, starting at a high semantic wave when going through the definition, then moving to a downward curve by looking at some examples.
Finally we will do a worksheet that will be done in groups.
• How will learners be engaged in the lesson?
– What are the main idea/s and most important things to know about this topic?
The main topic for this lesson is artificial selection. It is not as commonly asked but still important to know. They must understand the different factors that contribute to AS and be able to explain this in an essay style question.
– What ways of thinking and doing are important for learning this topic?
It is important to remember that AS is controlled by humans.
– How do these inform the design of learning tasks and sequencing of lesson steps?
We start the lesson with revision questions of the previous topic, this is to remind them what they learned about NaS the previous week, then we will finish he discussion on NaS. Then we will go through an official definition of AS. From there we look at the different examples of AS taking the sematic wave a bit lower. According to CAPS they need to know one plant and one animal example of AS. Then we build the semantic wave back up by looking at the advantages and disadvantages. From there we have more integrated learning by going through a worksheet with friends. This requires the application of the content that they have learned.

7. LESSON PHASES breakdown:
7.1 THEME (Context; big idea):
(What theme will you use to contextualise your lesson, link it to learners' real world and introduce your topic? Give your theme a short and inspiring name, e.g. "Friendships", "Our amazing planet" or "Holiday destinations")

The dangers of artificial selection**.** This will be focused on by looking first at the meme of the wolf, then after that it will be looked at in the discussions. For example, how diseases will affect the crop worse or how pugs cant breath. That will then be contrasted with natural selection which is advantageous for the organism.

7.2 INTRODUCTION (Time allocated 15 to 20 min)
(Capture attention, create learning atmosphere, teacher-learner dialogue, awaken prior knowledge. Explain how you will use your theme in to introduce the lesson)

There is a large amount of time allocated to the introduction as it includes revision of the last lesson and the conclusion of the debate about Covid. This was done purposefully. The lesson will start with 2 past exam questions about natural selection, then we will continue the debate. I spread the debate out as it will give the learners time to sit with the question o what really is natural selection. What makes it happen. I will give the class between three to 5 comments before I guide them through the graph about the age of the deaths of Covid 19 victims. From there we will hopefully come to the conclusion that covid-19 does not cause natural selection. From there we will move on to this lessons topic, artificial selection. We will then go through the objectives for artificial selection.
In addition in this period I will also hand back the learners marked study notes from the previous day.

7.3 DEVELOPMENT (Time allocated 15 to 20 min)
(Continue teacher-learner dialogue to start with new knowledge, learner-centred activities, applicable content, consider questions to guide learners towards critical thinking, show sequence of teaching events, scaffolding activities, etc.):

We will start by going through the definition of artificial selection, starting on a high semantic wave, from there we will move on to the examples of artificial selection, going on a downward curve, facilitated by the meme about a wolf. This will also be a form of a autonomy tour as we all know and love dogs and memes. From there we will have a discussion about how the wolf was selectively bred to make the pug, or another dog. Then we will move on to the plant example where we will talk about how mielies were artificially bred to make them big and meaty. From there we will briefly go through the advantages and disadvantages as they will already have been mentioned in the discussion on previous slides.

• What science content will be taught?

Artificial selection in plants and animals

- What societal aspects will be taught?

Continuation of Covid – 19 discussion with a brief mention of SA life expectancy

What resources will be used?

PowerPoint presentation, WhatsApp for the memo for the study notes, WhatsApp for the classmates who aren't able to attend, google meet for the classmates who aren't able to attend. White board and chalk for the multiple choice question review.

7.4 CONSOLIDATION (Time allocated ……min)

(Consider ways to ascertain that learners have achieved the outcomes, recapping of main teaching points, assessment, wrap up):

The consolidation will be the table they have to fill in. This will be classwork, extended into the next lesson. It will be revision of the previous lesson and this lesson and I will be a combination of knowing and applying the content they have learned.

8. Evidence of Formative assessment:

The formative assessment will be in the form of the class discussion and answering the revision multiple choice question in the beginning of the lesson. In addition the table they fill it will be marked by their peers and will be a form of formative assessment.

Evidence of Summative assessment:

The summative assessment will once again be the study notes they take in class. It worked very well at the end of the previous lesson, it an easy way to boost the learners confidence and increase their marks. The other summative assessment will come as the end of section test, to be given at the end of the week or beginning of the following week, often termed a cycle test.

9. CLASSROOM MANAGEMENT

(e.g. encouragement rather than control; climate of trust; responsibility in group work; etc.)
Include: *discipline measures*

I will try ensure that the learners take notes during class. I will try encourage this by telling them it is for marks. During the class discussion we will put up our hands if we want to talk and contribute, there will not be shouting. This will also help me guide the discussion.
As I did in the last lesson, cell phone use will not be allowed, I will encourage the learners to not use their cell phones by picking on the ones who are to answer questions.

10. Lesson Reflection *(This section is filled in after the lesson presentation)*
Include the important aspects considered when reflecting on your lesson

For the previous lesson I was very worried about the use of the study notes, but I found that they worked very well, and I hope to use them in my teaching. They only took a few minutes to mark, and it encouraged participation. I was surprised at what good notes the learners took in class.
The discussion with Covid went well and my fellow classmates complimented me on it's effectiveness. This week the topic will be even more sensitive as we are talking about the deaths caused by Covid.
In the previous weeks lessons I found that people liked it when class started with a short test so I have included that in this week. I will see how it goes.
My experiment for this week will be the blended learning. I like to challenge myself and so this week I will be saying that a certain number of the learners are in isolation and so we will be doing a blended lesson using WhatsApp and google meet. Hopefully that will go well.

Micro-lesson Observations

Appendix F: Lihle's observation

Micro-lesson Observation Transcript	Codes
Lihle We did introduction to Evolution in our lesson last week. Can anyone tell me what are the five evidentiary groups or group of evidence that we have supporting the theory of evolution? We have Fossils, Genetics, biogeography and embryology and residual organs. Remember the picture that I showed you guys of embryos and the residual organ like our appendix Organs that we don't need anymore they look like they are disappearing. So today we will look at the origins of origins so where the idea of evolution came from a little bit of theory of natural selection. So many, many many years ago as far as everyone was concerned the earth was only a couple of 1000 years old and no one was related to anyone else. So back then there was no genetics. The group of scientist came with a theory that people were related to other organisms and eventually they started to see some similarities that might actually have some connections like fossils, they look like there have been there for a while. So they started to think that the earth is a way older than what they thought. They felt like there is something going with the fossils they were finding. And then after the 18 00's Darwin came writing his book about the origins that was talking about how natural selection was taking place. and he documented some new organisms and he was starting to come with hypothesis as to why the things were happening. In Kenya there is a story about how an ostrich has very long neck. And it goes like the ostrich was not so smart and was duped by a crocodile to come and remove his toothache which was the crocodiles way of getting into the ostrich. So she went against her friends warning and checked on crocodile's teeth because he claimed that he had a toothache and the ostrich could pull out the tooth. And moments when she got into crocodile's mouth, he went snap.all the animals saw what happened and came to ostrich's aid. the antelope came, the elephant and other animals and they were trying to pull ostrich's head. When they were pulling, crocodile was pulling the ostrich's head into the water and the animals were pulling ostrich's head out of the water. And all the time ostrich felt something funny happening to her, her neck was getting longer and longer. She got a fright and started to run and she waited and she realized her neck was longer. This little fairytale is related somewhat to a character by the name of Jean Baptist Lamark's theory that animals could easily adapt to the changes of the environment. So if the giraffe needed to get high leaves,they'll just stretch and their necks will get longer. He also pose a theory that the lesser animals used their organs the smaller they became and if they used a certain organ, the stronger it became. No the problem with the Larmark's theory is he assumes that the changes that animals undergo through its lifetime can be passed on to the organs of their offspring's. So if you take your textbook, it uses the example of a body builder. If you are a body builder and you go to the gym and you building all this muscles, you are obviously getting stronger because you are using your arms, you are using your legs and you are picking up weights. But the problem is that when you have a child they will not come out with those muscles, they need to build them up for themselves.	Lesson recap Questions to find learner prior Knowledge Awareness of Terminology Awareness of Prior Knowledge Use Representation Story telling explanation

The Larmark's theory stating that the organ responding in the environment is not entirely incorrect. But the problem is that he assumed that the changes in the organ can be passed on to the next offspring but in genetics it does not exist, her did not understand how genetics works. And his theory was hick up I mean his hypothesis was hick up. Remember the difference between hypothesis and theory?	
Then along came Charles Darwin our very own famous Darwin. Now Charles was a minister who went on a long long exploration of the earth and he traveled to all sorts of new countries and he documented the geologies and how the place looks, the rocks, the formation of the land, the biology and the organisms living in a specific area . when he finally returned, he spent like 25 years trying to come up with an explanation. He also experimented ducks and pigeons, eventually he came up with the theory of natural selection we gonna go through that now. And he published his book the origin of species and now there was some big offer when he finally published it. But we can see with our own natural selection that Darwin's theory is correct. In your spare time the is a web site called the Darwin's .....in the web site it looks at how some people extinguishes themselves out of the.....	Use of termilogy Use of History & Background Online tool Analogy Analogy
If i may take an example, a lady decided to drive into the floods on her scooter and she was swept away but she was rescued. when they came to her rescue she drowned. The lady should have seen that there is danger. We will discuss how this is related to natural selection. So Darwin's theory of natural selection poses that there are more organisms born than what the environment needs to perpetuate the existence of its own. So in other words, there are 10 rabbits born and a couple of them dies but there are enough rabbits to reproduce and form another generation of rabbits. So lets take one of Darwin's natural selection. So there is this variation when we look around we will see the variation around us. some of us are tall, some of us short, some of us have brown eyes, some of us have blue eyes and some of us have multicolored eyes. There is natural variation amongst us species. So now a change in the environment occurs, all of a sudden the sun gets 10 times brighter. What will happen to the people with light colored eyes? Unless they have sunglasses on they are going to turn blind because everyone could turn blind if they look at the sun. So what happens to the organisms when they no longer see,cannot avoid any sort of contact they come upon disaster and they end up dying out. Now they can no longer reproduce. So if they trade with other organisms with a favorable trait so other organisms would have allowed them to carry on to reproduce and make other generations. So the ones so the ones out of favor are not gonna make it. The organisms with the most favorable traits will survive and reproduce. the next generation will carry that trait over and over and will have that trait in their genes and many many generation will find that the non-favorable trait does not exist and that the favorable trait is still living.	terminology Knowledge of the Learners Contextual knowledge
Lets take a look into covid, the covid virus itself will undergo natural mutation. The virus remember how it reproduce? Its gonna set its self as a..... So now we as humans might not be immune to covid as it is now. So now the covid virus went through natural mutation. The environment in which covid found itself in is no longer favoravle, but when covid 19 find that i have a gene on the lump and it goes into a cell and it reproduces and now we no longer see the original covid but we see this stronger mutated virus. The same thing with people. Does anyone knows what are the biggest chronics the biggest chronics when it comes to covid 19? Yes Kgomotso...Diabetics. Does anyone knows what are the 2 types of Diabetics? Type 1 and type 2. And what is special about type 1? its inherited. Unfortunately people with type 1 diabetics are adversely affected with covid 19. Type 1 diabetics is genetic its passed on from parent to child. So what covid is gonna do is	Knowledge of the Learner Questioning Prior Knowledge Analogy Analogy

mhhh you have type 1 diabetic and now I'm going to make you sick and because you have type 1 diabetic you are more likely to die which means you are less likely to reproduce. its not the prettiest version of natural selection but unfortunately its our reality. People with type 1 diabetics are dying which means many of them cannot have children. Which means their gene of type 1 diabetics cannot be carried over. So covid may end up getting rid of type 1 diabetics……but that's simply how natural selection works. The people without type 1 diabetics and the people without diabetics are more likely to survive and as a result, the gene for type 1 diabetics will be cut out and we will no longer have that mutation because in this condition its not the most favorable traits. So speaking of natural selection favorable traitsis not having type 1 diabetics in this example.okay. So seeing how covid 19 is having natural selection played out whether you are ill or extinguished from……and we will eventually see the new generation of people who are more resistant to covid 19. That is when the favorable trait of natural selection then comes in. Once again this is nature. Nature is not gonna look at you and say oh you are such a wonderful person and I'm going to keep you around, Nature will say can you survive with what I'm gonna throw at you if you can't then you will die. So we are going to split into 2 groups of 3s, let me see can the 2 of you come to the front. We are going to have some practical fun now. So the process of natural seklection is something that you can apply in any scenario. So it doesn't mean that anybody has to know what natural selection is. so we are going to play a game about....in your group your are going to receive a timer, you are going to receive a twizzer and you will receive colored toothpicks, normal toothpicks with a black dot in it. Each of you will receive 2 colored piece of paper. One paper is yellow and the other paper matching the color of your toothpick. So you guys must remain socially distanced. As you can see in your activity we are going to combine genetics. We are going to look at inheritance as part of natural selection but remember we are speaking of favorable traits. ……is attached into a gene of the organism. So you need to remember that we are studying biology and everything is about linked. So any favorable trait that an organism has is going to be linked to its genome. So do you guys remember how evolution takes place? Can you guys tell me? **Students :** Variation, **Teacher :** yes variation there we go. In what 3 ways does evolution occurs? 1. Meiosis. Another way in which evolution takes place? 2. Mutation what is the third way in which evolution takes place? 3. Transfertilization Remember from reproduction there are million of sperm cells created by the male reproductive organ. The genome that happen to be in the egg and the genome that happen to be on the sperm meet. So in terms of variation, we mention that mutation can take place okay? You guys are going to be working with toothpicks catalepsy. Some of the toothpick underwent mutation as a result of this mutation some of the toothpick comes out in funky colors. the normal color is Beige so I am going to hand you guys some plain toothpicks now. The plain toothpicks represents the toothpick that hasn't gone through mutation at all. So remember from genome from the topic of genetics, if you say you have a dominant gene we will usually use a capital letter when we are doing the catalepsy for beige.	Group Work Games Represantation Instruction Blending Topic Group Work Representation Representation

So in this case the dominant gene for the catalepsy is beige or the dominant is fore beige color. So we are going to say that it is B. the problem is that this mutation in this scenario is a recessive gene so which means we are going to use a small b. so catalepsy that comes out in a beige color can either have the genes that homozygous for the beige gene or heterozygous for the beige gene because for the beige gene is dominant they can still be heterozygous but they will still come out beige. in other words, their genome will show 2 capital letter G. and you need right now 10 of those on your yellow paper our plain toothpicks with a black dot are heterozygous. Hetero means different hormones. The heteroziders hormone willbe calculated with a baby b and you will need 10 of those on your yellow piece of paper. Just spread them randomly and your colored toothpick will homoziders for the recessive gene so they will have 2 baby letter b's and you are gonna need 20 of those. Make sure you got all of those on your piece of paper. Each of you guys will see that you have received a pair of bubbles with bubble wrap on. You are going to pick a bird...which of your group members will be that bird? The bird is a predator for this little catalepsy and your bird bird needs to have bubbles and a pair of tweezers. If you guys need a sanitizer for your bubble raise your hand and i will bring it. Anyone who needs a sanitizer for the bubbles? Make sure you do not get that in your eyes. So you will now need a timer someone who's going to time this for you guys. Your time is 20 seconds. Take your piece of paper, you see you have blue cups make sure they are empty right now. Take your piece of paper and put it right next you they gotta be next to each other like this and put the cups on the other side. Your cup needs to be a width distance apart your yellow sheet of paper. For 20 seconds, your bird is going to try to try and eat as many catalepsy as it can . remember your bird is gonna have bubbles on so your bird cannot see. So the bird is gonna look and try to find its prey. Pick it up with the stick if you are struggling you are going to lift the flag. So for 20 seconds you are going to do that. You are going to eat as many as catalepsy as you can. Remember the length is a long distance, its a width of the paper.	

Appendix G: Anna's micro-lesson observation

Mini lesson observation	
Anna Good morning class so we are gonna change things a little bit not necessarily changing things but we just gonna mess it up a bit. Will just do the continuation from the last of natural selection and the thing that I'm gonna bring differrent in this lesson is that I'm going to use a bit of diagrams so just to test my skills on ....diagrams and to see if that I can actively teach with. I will be using good routines because everyone connects with good routine to write the..... and iam going to be using whattsup to communicate with the learners on the lesson. and more or less everything is just the same So good morning class....	Representation Pedagogical Reasoning Routines Online Tool Pedagogical Reasoning
Students morning.	
Anna So i know that we are a little bit stressed today because of the assignment we have to submit today. But we are not gonna concentrate on that.	Teacher Identifies as student
Unfortunately today some of my learners are in isolation so we are going to do a blend of the lesson so that they can be able to access the content of the lesson.	Blended lesson Online tool
Please switch off your cell-phones or put them on silent because you will be receiving messages on our community of whattsapp . I'm gonna send through the link so that everyone could join. Okay cool the link has now been sent to the group so that everyone can join at google meets. So let me show the screen oh boy am i right technology this might take a moment, so in the meantime I'm just hand out the papers no name..	Pedagogical Reasoning
	Instruction

.yes some of them have no name you guys must remember to write your names on your work. So if someone is not okay with their marks you are welcome to come to me so that we can remark. Who likes to write in pencil? Does anyone have a question about what i sent to you or about the marks you have received can come to me after the lesson and the memo has been posted on the group and the link for the for google meets have been posted on the group and i hope everyone who needs to join have also joined. So last week we did natural selection so i want us to do a quick test. So please answer the questions below and let me know what you think the answerers are and you have few seconds. Does anyone has the answers? Yes. Hands up for a, hands up for D, hands up for C so its one person who thinks the answer is C. hands up for D. 6 people for D. So I'm gonna check up the whastaap group. So in the whatsapp group we have another one for c and one for b so the correct answer is d. **Student:** Ma'am who is Jean Baptist? Anne: Clearly you didn't do your revision for the test because we did this last week. He was one of the first theorists for the evolution. They were the peolpe who did the DNA we did it in the beginning of the year. So Jean the Baptist he was the one who thought that when the giraffe it was based on what the animals wanted to do and the feelings about it. So the giraffe continues to try and stretch its neck and he passes it to its offspring and we know that's not how it works. That's why we have d this the paper 2 for november 2016. So next question we gonna do it the same way we did the first one.	Questioning Technique Quick Test Recap method Assessment technique Online tool Terminology Background History Recap Technique

Does anybody has the answer? Yes. Okay who says A? who says B? C? oh well everyone says c.	Online Tool
so I'm gonna check the whattsapp group as well. So seems like the guys on the whastapp group got D. so with these kinds of questions when we work with multiple choice questions are mostly correct answers but one answer will be more correct than the other ones so you must always choose the answer that is more correct.	Recap Technique Questioning
So can anyone why C is the correct answer? Yes Thandeka, that's because the picture that shows certain species that are...some of them has stripes and some of them doesn't have stripes. Yes that's correct.	Representation Terminology
So now do you guys remember our discussion from last week? I know it feels like its been like 2 weeks since i was with you guys. So do you guys remember our topic about the covid 19 pandemic? **Students**: Yes.	Time frame
Anna: So have you guys found time to think about what you believe is whether or not the covid 19 pandemic will cause natural selection or not?	Questioning Technique Questioning
What do you guys think?	Prior Knowledge
Yes Jim. **Jim**: Ma'am I think in a while that is natural selection because it targets those that have very weak immune system which means. I think it has caused natural selection because when we look people who are dying are those who are old age. so another thing that we can also say there are those with chronic diseases and that doesn't depend on age others have chronic diseases on their young age.	Terminology Analogy
So corona virus also attacks those and if they don't reproduce natural selection occurs. **Anna:** So what **Mpho(pseudonym)** said here that's the most important points of this discussion and she has nailed is that there is no correct answer that's why in the class we debates because there's no correct or wrong answer.	Debate Prior Knowledge and misconceptions

They might be a more correct answer and the less correct answer so some aspects may be correct and some aspects incorrect but at the end of the day it is a debate.	Discussion
Yes Jack... **Anna** Ma'am but now if you take this points that were discussed earlier but now if that was not there will that be form of natural selection? Or does the medical assistance count as our new nature? They do.... We have adapted to our environment like creating medical equipment's that will help us survive.	Terminology Explanations
Gama did you have something to say? Yes, I just wanted to add on natural selection.	Discussion
Yes Nomsa....I'm thinking about my original opinion that ... and what i thought about is that natural section occurs on many many generations it doesn't just happen over one generation. So considering covid 19 pandemic its very new and they are currently saying that its gonna be with us for couple of years and i thin 2 more years is not enough time for natural selection to occur or for it to be natural selection.	Explanation
So does anyone have something to say? Yes **Vee:** also with natural selection.....so what is the type of human that will stop existing? The type of human that will stop existing are people who are not resistant to covid 19. But it's affecting all people.	Interrogative questions Terminology Prior Knowledge Explanation
Certain people are resistant to covid 19. My mother in law got infected and she lives in a same place with my father in law so she had close contact with him and he was in the same situation and he is a smoker and we were very worried that he can get infected so thats something to consider that the is ...	Contextual Background

So these are the last two points. Okay Ma'am I will kinda, like to disagree with Candice if she says that natural selection occurs over some generations I think there's kind of...	Debate
Over generations and natural selection can occur even in a short period of time.	Terminology
Kim: Take for instance we have a natural disaster and they say those with chronic diseases are not likely to survive....	Analogy
Anna : That's very true.	
Kim: Okay i will summarize it,	
Anna: Kim I want you to think seriously about this because this is exactly what I was going to say because natural selection can also occur very quickly it does not necessary have take generations that natural selection will be starting.	Cultivating Thinking Terminology
And now that i what is happening with the covid 19 pandemic. If natural selection is occuring then it will be starting.	Background Context
Yes...	Debates
Mpho: I have a question on what Jessy said that if natural selection were to take place we have the people with strong immune system so my question is since we are looking the other species so lets the Giraffes they have long necks and they passed their genes to their offspring so with immune system can a strong immune system be passed to the offspring also?	Use of Terminology Use of Terminology
Anna: So the immune is slightly out of topic but I will explain it for content. The immune system is.....	
Different people have different types of immune system like sometimes when my husband gets food poisoning I don't get it but we are living together.	Explanation Use of Terminology Analogy

Because of that the stronger gene will be passed down to the offspring okay.	
So I'm going to end the discussion now and you have something more to discuss you can do it it with your friends. I normally mention social distancing as a factor.	Discussion Group Work
So I'm gonna briefly say that although social distancing	Social Distancing
So now we can look at the age of people dying so if you look here is the original population that's reproducing, this population is dying which means that shows that very few members of the population are in the reproductive are age actually dying.	Using Terminology
And now the final question that we ask ourselves is there enough of people of the reproductive age are dying and don't have to reproduce because of natural selection?	Probing Questions
So now we are going to look at our lesson today. And remember to take study notes I'll be collecting them at the end of the lesson and continue to ..... So the objective of the lesson today is to describe natural selection. We will then describe one example of natural selection in plants And one example of animals..... describe the advantages of natural selection.	Noting down Use of Terminology Use of descriptions Use of representations
And finally at the end of this lesson we will contrast and compare natural selection and artificial selection. This is a process by which humans use animal breeding to select a particular trait like choosing which individuals from the population will produce offspring .....okay so lets break it down the first thing that you need to know with natural selection is that the environment contributes but in this time humans chooses.....and they do that by breeding specific animals and like breeding specific plants together does that make sense?	Use Of Comparison Explanations

The humans were breeding the animals and were breeding plants. So they selectively develop a particular,,,,, trait...so they pick physical traits Can someone decribe physical traits to me??.....	
Jane: Generally we don't selectively breed humans its animals or plants that selectively breeds. Kanda is that what Hitler was trying to do?I.....well that is a controversial topic Hitler wasn't really trying to selectively breed certain people, he was trying to eliminate certain people from the population. And finally they choose which individuals in the population will produce offsprings. **Anna:** They choose specific individuals. For example, they'll choose the dog brown hair they'll choose a dog with brown hair to reproduce another dog with brown hair. Does that make sense?	Example Questioning Technique
They choose for them to reproduce offspring. Does anyone has a question about the definition. Yes Lunga..... **Lunga:** Yes I have a question, there is this child with three biological parents can you call that artificial selection.	Questioning Technique
How does she has three biological parents? They had artificial insemination. That's a system where you use a surrogate to create a child. So they take the egg from the mother and the sperm from the father and put it to a third person to produce the child and that is not natural selection its that two people cannot make children so they use decide to use surrogacy to have a child.	Use of Analogy Use of Terminology Examples Use of Representation
Anne: So this is an example of artificial selection and we going use dogs as an example.....so in this picture as you see they tried to breed this dog with.....and it produced this dog.	Use of Terminology Diagrams Representation
As you see in this diagram we have a wolf and when it breaks down we have kinds of dogs we have a... We have the....so specific traits are chosen one of the examples is we use a dog for the	Examples Use of Explanations

example for animals and they often choose the relationship towards humans.	
So You know how some dogs wants to come and sit with you in the couch they wanna sleep in the bed with you at night they wanna protect you when someone breaks into your home.	Representation
So if you can take a look at the....this dog is used for herding cattle because they are very good and energetic.....	
as I have said this individuals are bred together then we will look at artificial selection, we have done this in animals and now we will do it with plants so if you look here this is what artificial selection.	Use of explanations Representation
Looked like hundreds of years ago than what we eat today.	Use of pictures
So it was specifically bred until it looked like this one, until they got to this one they bred it so it look this one here.	Picture/Representation
Student: Ma'am are these GMO plants?	Prior knowledge
So today we are not talking about GMO plants and yes GMO plants are similar to this. Genetically modified organisms this is what GMO stands for.	Refocussing the lesson Definitions
It's when they do this in the lab. So they take like one of the example is tomato so they take tomatoes, so the tomatoes we eat today are mixed with apples and fish because they need to take the gene from the apple to make tomato because we love or firm red tomatoes so they take the gene from the tomato and they take the gene from cold water fish so that it doesn't get damaged by fast so that you can grow that on your own.	Explanation
And that is genetically modified.in the lab they take the two and combine them together.	Questioning Technique

Are there any questions on genetically modified organisms?	
	Active participation
Student: Does that make the tomato non vegetarian?	Questioning technique
Anne: Good question give it a think I don't know does it?	Prior knowledge
Student: So Ma'am if I'm allergic to fish and I eat that tomato?	Explanation Terminology Context based examples
Anne: Well, most of the time I have not seen people being allergic to tomato and fish and it's because they put something else in that tomato but it's something else to think about.	
What if that gene came along with it and now people who are allergic to fish become allergic to tomato… But its a debate for another day today we are dealing with artificial selection. So specific traits are chosen.	Use of Debate Artificial Selection
So our example here is this. So they chose the corns, they count probably up to 20 seeds on this little corn here and this one here you cannot count it you don't the time they are so many here. You can see the size increase all the time. they want a greater number and size.	Examples Picture
And what are people doing, they choose it for is to resist the pests. So what they do is they take the seeds from the ones which were the best and they survive the pests.And they take the seeds for the biggest and the best.	Use of Terminology
They artificially select the genes that they want. Ok so advantages they are more desirable traits so can anyone think of an advantage of natural selection?	Questioning Technique Active participation
Student: Yes...Resistance to diseases.	
Anna: Yes exactly resistance to diseases.is there another example of the advantages of artificial selection? Yes Kim.	

Kim: I will say better tasting crops... **Anna:** Yes better tasting crops that's something else to consider ok and more desirable traits. Okay now let's think about some, disadvantages so the disadvantages is there will be less immune to disease. I know we spoken about resistance to pests and will grow crops that are resistant one kind of pests but that can make them susceptible to another kind of pests that hasn't been there like suddenly, we have a dry season that we didn't have in the previous season that can make them susceptible to that than other plants. Do you guys know German Shepards? **Kim:** Yes their hips displaces when they get older and that's because they have been bred over the years to try and make them the right shape. And because of that reason their hips gets displaced when they get older. **Anna:** Yes and And with their short noses they can't breath properly and have lung problems. **Student:** So Ma'am will you say that this is ethical and cause Hereditary problems? So that is a very good question so ill pose it to the class. What do you guys think is it ethical? **(Class)** No. **Anna:** Yes Coco. **Coco**: I think that when the animal reproduces its ethical like with the chicken. Like the population is growing you're gonna need both so you will modify the chicken to produce more so that everyone can have chicken to eat. **Student 1:** But sometimes these chickens they make them so fat they can't walk is that still ethical? **Student 2**: It has a short life span anyway. **Coco**: You see it was brought to die and its ethical to eat them because that was the goal.	Prior knowledge Picture Active Participation Learner name awareness Debates Argumentative discussion

Student 2: They were never bred to live oustide I'm arguing the points. I am not giving an opinion I am arguing both points. **Student 1:** So is it ethical to breed animals until they are disabled?	Use of Questions
Anna: No because we still want husky with blue eyes and we know what happens to a husky with blue eyes?	
They're blind so people go and buy it and they go spend lots of money to get the huskies with blue eyes. So if they don't have blue eyes they kill it because who wants a husky with brown eyes.	Debates
So the ethicalness is something we can debate about for hours.my question is how do they get the animals to breed?	Examples
So with animals there's different ways to do it so cows is a good example so obviously you know the cow gives us the most meat so what they do is they take the semen from the cow and they put them on the females so it reaches the females they don't let them do it themselves and that's how they impregnate the females they don't let them do it themselves.	Use of Terminology Misconception
Student; And what they do with dogs they wait until the dogs are on heat! .	Questioning Technique Use of common words
Anna: Does anyone knows what that means?	
zoe: They are ovulating. Yes, they put the male and the female together when they are on heat.	Use of Terminology
I don't know if you have seen dogs on heat like they look crazy.	
Anna: Exactly they get stuck into it and that is how they selectively breed them. Mpho what is your opinion is it ethical? Is it ethical to do artificial selection? **Mpho:** I think it ethical since population is too high.	

And another thing to consider is why is it ethical in plants and not ethical in animals. So now I'm gonna hand out the worksheets we don't have too much longer in class and this isn't gonna be a homework we gonna do this in class today and in class tomorrow and we are gonna mark it at the end of the lesson tomorrow. You guys can chat and work together with your frends. I will post the memo on whatsapp. What population does multi seection occurs in? **Anna:** You guys are smart I thought this was gonna take you longer. **Anna:** Ok guys we have come to end our lesson now do you guys have any questions? So I wanna go through the process of natural selection i think some people didn't understand it very well . So these are the 3 different factors that help cause natural selection to happen.....and preditation because of this the useful traits can be passed to the offspring and this will cause evolution and once evolution has happened so the process chages again and again with time. So does anyone have a question? Before you go please write your names on your study notes and give them to me.	Use of Worksheets Homework Use of Online tools Whatsapp Recap explanation Linking with other topics So on our previous lesson we talked about the importance of maintaining a Questioning Technique Study Notes

Appendix H: Nomsa's micro-lesson

Mini lesson Observation Transcript	Codes
Nomsa: Remember last week I gave everyone an activity a homework activity. Did everyone do their homework?	HomeWork activities
So we are gonna be marking our activity together i want you to please take out your worksheet but you guys will be telling the answers.	Marking Activity Worksheet
The first activity or the first question in our activity was definitions so the first definition was body fluid.	Definitions Use of terminology
What is body fluid? Remember body fluid is the fluid inside the body. If you cut your skin what's gonna come out?	Recap Questions Questioning Questioning
Students : Blood. Yes we got blood that's the first one. What's the next one?	Use of terms Description
Students: Cytoplasm, yes inside our cells we got a fluid cytoplasm.	Use of Terminology
And the third one? Tissue fluid.	USE OF DEFINITIONS
Nomsa: Good so here is the answer so body fluid is the fluid that is in the body, blood plasma,tissue fluid and cytoplasm inside the cells okay. Everyone happy? Homeostasis. Thats the easy one guys. What is hemostasi? Its a constant environment in a human body. Next word is Thermoregulation you need to break the down the words that you're not so sure about. So Thermoregulation means the regulation of the body temperature. Do you remember which group of animals Thermoregulates? We have ectotherms and endotherms So what is ectotherming animals? Remember to break down in your words. ectotherms are animals that do not use the heat from the inside they depend from external heat. Students: Ther means heat and ecto means outside so they get the heat from the outside.	Recap Questioning Use of definitions Use of Terminology Description

What are the 3 groups of animals that are within the ectotherm animals? **Students :** We have snakes and reptiles. **Nomsa:** What else? The last one its something that lives in the ocean, fish. Remember when we talk about snakes they have something that keeps them warm. Endothermic animals are the opposite. What is endothermic animals? **Student:** They are able to regulate their own temperatures like us. **Nomsa:** Yes so us humans we are endothermic animals. These animals make a constant body temperature irrespective of their body external environment because if its winter or summer our temperature remains constant. Heat produces in the body by cellular respiration. Our next question we have body fluids constantly varies. You need to list the 7 conditions that remains constant for cells to function optimally. Remember these are the things that we have inside our cells. What are the things that we find in our cells? PH, yes PH very good. So if we want to maintain our PH, our water and salt balance....you guys remember this? So this are the 7 things so make sure that you write them down we have our: 1.glucose level 2. our water balance 3. Ion and salt balance 4. Oxygen and carbon dioxide concentration 5. Body temperature 6. PH 7. Vasculity So whats the normal body temperature in the cells of all humans? **Luke** ...37 very well done.	Use of Terminology Use of examples Linking topics Questioning technique Recap Questions Noting down Use of terminology

Remember last week we talk about the temperature of scan for covid?	Contextual knowledge
So we are checking that the temperature is not a way higher than 37 indicating fever which is a symptom for covid.	Use of Questions
Who remembers what an enzyme is?	
So this catalyst helps the temperature to remain optimum so that it works to the best of its ability. Remember the popcorn example?	Recap Question Recap example
Remember if we have popcorn and we put it in the pot on the microwave to make popcorn. And you are giving heat and the popcorn is gonna pop and you can't get popcorn back to what it was before. So what do you think the enzymes is gonna be at 60 degrees? Denaturing. What is denaturing?.	Contextual Knowledge
So exactly what happens to our enzymes. So our enzymes will denature and loose its shape permanently and their ability to function. What do you think will happen at 37 degrees? **Mpho** what do you think will happen? Remember 37 degrees is body temperature. They will be normal.	Engagement
So they'll be normal exactly so they are gonna function optimally and do everything they need to do normally. 07:50-08:06.....so this is exactly what exactly happens to the enzymes. When its cold they don't work they gonna be tampered And when the natural temperature is restored restored they will function at a maximum capacity.	Explanation
Why is the body temperature an important aspect of hemeostaces? Remember this brings us to the previous question of the enzymes,	Linking

So in our body fluid remember the is tissue fluid and that is where we also have enzymes. So enzymes are our biological catalysts. This controls and regulates all body functions that we have. These are located in our body fluid like cytoplasm.	Representation/ Picture Interrogative Questions
So its necessary that the body temperature is kept constant for the optimum functioning of enzymes. We need to keep our temperature constant. So what is the main source of heat in relation to human body? So when is cold what is gonna happen?	Listing
Inside of every cell they are doing something in helping us keep warm. All the cells in our body gives energy you keep us warm so respiration is what helps keep us warm. So remember our cells respire.	Questioning
Okay so every one good? So our last question. List 4 processes of heat....in the human body. Radiation Conduction Evaporation Compression So I'm not gonna go through all of this.	Use of terminology Use of examples Use of Definitions
Remember the example that we used in this picture when the conduction when you are touching something its direct contact. Radiation was through rays and waves and compression..... So next to the third lesson, we are gonna be getting down to the epidermis.	Linking lessons
In this lesson we will explain the function of the epidermis.	explanations
So this topic is very hectic there are many thing to remember and its important that you know all of this for the upcoming test.	Difficulty of a topic
For us to do this we have to do a mind map of this lesson.	Mind map

Each time we begin a new concept i want you to keep adding to your mind map. I want you to keep adding and adding so that in the end of your lesson we gonna put up our mind map and show it to each other. It must be a full mind map so you can use color or can use anything that will help you to study your mind map. So first part is human skin as a thermoregulator. How is our skin structured and how does it function to regulate our body temperature? So our skin forms an outer boundary of our bodies right? So our skin forms a boundary between the inside and outside. We are all kept together with our skin. Our skin plays an important role in regulating our body temperature. So today we are gonna look at the structure and function of each part of our skin and look at how each part plays a role in keeping our temperature the same. First part: structure and function of each part. We have 2 names of the skin. Can everyone look at their skin. The first part of the can you see is our epidermis and the second layer underneath will be our Dermis. If you look at the diagram here the top is our Epidermis and everything underneath it is our Dermis. So you should have something like this so far. Can everyone see? S o the human skin is made of 2 parts, the top part is the epidermis so I'm going to use different colors for the 2 parts. Under this layer is the Dermis so you should have this on your mind map right now. If you want to add any extra definition to help you understand you must just add. The first layer or our epidermis is made of 3 different layers. So our epidermis have no blood vessels or nerves. So if you take a look at this diagram its much more magnified, so this outside layer here is our epidermis. You can see that the blood vessels they stop here they don't go to the epidermis. So the epidermis has those 3 layers i want you to add this in your mind map. So can I move to the next one? Lets take a look at one of the layers. The stratum corneum	Peer Work Use of colour Use of Terminology Use of questions Structure and function Representation Diagram Diagrams Use of colour Mindmap Definitions Diagrams Definitions Example

layer. This is the outermost outside layer so if you are touching your skin like this you are touching the layer of your epidermis. This layer consist of dead and flaky cells. So if you are gonna have dry skin and sctartch it your skin flakes that's normal, this outer cells shed and they are replaced. The next layer is a Granular layer. Granular means granules. This layer consist of the living cells. You don't need to know about the granules and what they do just make sure that you write them down in your mind map. Its the granular layer granules. The next layer we have is the base layer. So when you think about base you think about the bottom so its the bottom layer of the epidermis. It also consist of living cells. So its only the top layer that has dead cells and everything is living. So this cells divide continuously so thy constantly divide. So this is to replace the dead cells. So this is what happens in the base layer they are constantly replacing damaged cells. So now because we have more division of cells, we need to make sure that our cells have oxygen and nutrients. And this comes from our tissue cells and the dermis. So the dermis have cells and blood vessels so that's where our nutrients comes from and supply our base layer. Each cells also contain human melanin, so melanin gives us color of our skin. It also help us to protect us from uv rays against the sun. So we have different skin tones it means that we have different concentration of melanin in our skin. Is there anyone in the class who who's got freckles? **Student:** Yes. **Nomsa:** Have you ever asked yourself why you have freckles or what causes them? You know? So what happens is that melanin is the one that gives us color in our skin?If you have freckles it means that you have more melanin in those areas than in the other parts of the body. So everyone filled their mind map so far? So now lets talk about the third function. All those	Linking knowledge Curricula saliency Mind map Epidermis Description Function Prior knowledge Use of questions Use of terminology Mind maps Function

3 layers helps us to to protect our underlying tissues and also form a waterproof barriers so if you get into water our sin is waterproof. So we have our 3 different types of layers, at the top we have our.....layer underneath we have our granular layer you see this granules? Underneath you find our basic layer. Can we go to the dermis now? Is everyone ready? Ok our dermis is much thicker than the epidermis you can't see it very well in this picture but I will go to the previous one you can see the entire layer at the bottom is dermis and its much thicker than the epidermis. It consist of the connected tissue. Do you guys remember from grade 10? When you learnt about the connected tissues. This connects the dermis tissue and the epidermis and keep it safe. Underneath that we have a layer aliquot tissue. Anyone knows what aliquot tissue is? its a layer of fats and this layer is important because its a .....of heat and actually good in insulating the skin so we will talk about ferroregulation next in terms of our skin structure that helps us to keep warm. We have this layer of fat under our skin or in our dermis to help keep us warm right? So we have this layer of fat under our skin or in our dermis to help keep us warm right? Now lets look on the components of our dermis there are 7 very important parts Blood vessels Lamp vessels Nerves Sensory organs So all 7 of this must be on your mind map. Take a look at this diagram.can you see that our blood vessels at the bottom here and they go all the way up to the epidermis. Remember that it is important that it supply oxygen and the nutrients to the epidermis. you can see that we have some sensory organs here we have our .....muscle connected to the epidermis. We will go through each of this. has everyone written on their mind map?	Picture Pacing Curricular Saliency Prior Knowledge Questioning Linking Function definition Questioning Mindmap Use of terminology Mind map

So the first is our blood vessel. That's the most important thing and the most important function in our blood vessels. Our dermis is very rich in blood vessels. The important thing that you must know about the dermis is the thickness of our blood vessels is controlled by the Hypothalamus so its the part of our brain that controls the thickness of our blood vessels. And this is important for 2 reasons. It causes vaso constriction that's narrowing our blood vessels and the widening of the blood vessels and this is important for Thermoregulation. And the function of the blood vessels is to transport oxygen into the cells and put the waste products away. Like sweating so that you can get rid of salt. Our blood vessels also play an important role to regulate body temperature. You guys ready or the next one? The next one is the lamp vessels we have a large members of little lamp vessels.found in or dermis. And this is important to help us drain excess water from our skin and take it to the bladder. So in this picture, all of this large little vessels and we have all over our body. Anyone has a question about lamp? Next part is nerves are very important and we have 2 types. We have sensory and.....nerves. Sensory nerves have a different function. Sensory nerves send an impulse from the sensory organ and they receiving a message and they sending us to the central nervous system from the brain to the muscles of our blood vessels and our blood vessels needs to constrict and that comes from the impulse to the muscle nerve. What else can happen? We need to let our head stand up because this muscle nerves send a message our as well as our glands. The next thing we gonna talk about is our sensory organ. You guys need to write down all 4 of this sensory organs. The first one is Eyes and the last one Skin is are we all done? Now lets look at the function of any of those before we get there if you have to press on your skin what is the sensation that you gonna feel, now lets press our skin, what are you feeling? You feeling pressure? Each of this sensory organs are responsible for their	Function Example Pacing Questioning Curricula Saliency Sensory Knowledge Function

own sensation. .....is responsible for the heat.....is responsible for the pressure. You have a question? **Student:** What is the difference between touch and pressure? **Nomsa:** So you are just gonna press your skin but there is no pressure but you still know that there is something there. But then pressure is gonna be pushing down your skin. Can you see the difference there? Are you answered? **Student:** Yes **Nomsa:** What is the difference between temperature and heat? When does the feeling capacity interpret pain? So if you can feel temperature you can feel heat, so that's gonna come from and if the heat is too much you are touching a stove and now its causing pain now its gonna be detected by the nerve. So now its not the temperature but pain? So now its gonna be sending an impulse from our nerve to the brain then we will have definite response. Does it answer your question? Yes **Nomsa:** So we are gonna finish with our sensory organs now we will be looking at our hair. I'm sure everyone of us has hair on our arms. So hair is actually an extension of our epidermis on the to layer. So if you look at this diagram, its very simplified. But this top layer is our epidermis. Can you see how the top layer of our epidermis is going down here? You see that? So our hair is our extension of our epidermis. Its over our bodies except soles of our feet and palm of our hands. So now with our hair follicles, the base of each one we have a folding of our dermis this forms the hair color. And this is richly supplied of blood....and that imports our cells . it needs a lot of nutrients. The next thing that we need to know about hair is that they have a follicle length. So this length they open up the follicle. They are important because they secrete an oily substance.it prevents dehydration of our hair	Questioning Student Participation Questioning Diagram Picture Use of colour Diagram

and our skin. If i haven't washed my hair for a while, my hair start to look oily. This oily fatty substance is called.....that protect your hair to shine and doesn't dehydrate. So this is our diagram for our little hair....at the bottom we have....we can see that it opens up into the hair follicle. Can you see there is oil? That's the.....that's coming from our....then our hair grows from our epidermis rapidly and goes up. Has everyone got questions about hair? The last thing we gonna talk about is our what did we say earlier when you cold? We shiver and what else happens? Our hair stands up. And what happens to our skin? We get goose bumps. So this is all the reaction of our .....its the small muscles that connects our epidermis to the bas of the hair. And this is important because when it's cold our cell contracts ill show you our next diagram which pulls our hair follicle then our hair stands up. At the same time our.....cell is contracting we see little bumps in our skin those tiny little bumps comes from our..... muscles. Do you know why your hair stand up? Apart the part to keep us warm. Yes Mpho ..... **Mpho:** they trap heat. **Nomsa:**Actually what they are doing. I want you guys to think us humans as mammals we are all mammals. And we know that some mammals have no hair. Think about cats and dogs, they covered in fur right? So when they are cold the same thing happens. They start to shiver and wrap themselves, whe n the hair stand up it traps air. The air is a very insulator. Like we saying air is an insulator as the hair stands up it traps air to keep us warm. In this diagram we see how this muscles contracts. So here when the wind blows you feeling cold and the muscles contracts. So when it contracts, it pulls the bottom follicle of the hair which makes the whole strand to stand up like this. When you are not cold you relax and if we shiver our hair stands up. The muscle is contacting and pulls the bottom of the hair and it stands up trapping air and help keep us warm Does it make sense everyone? let me see those mind maps well done guys. Lets quickly run *through* all we have done. What's the first layer	Questioning Diagram Prior knowledge Diagram

of our skin? Epidermis. And the first layer of our epidermis? The 3 muscles underneath? The third layer of our skin? What was the function of our base layer? When we are shedding ourselves it replaces the damaged cells, what's next/ we have our dermis right, what was 1 aspect of the dermis? Can you tell me the components of the dermis any component. When you cut your skin what's gonna come out? Blood What are the muscles that we find in our dermis Thank you everyone	Function Questioning

Appendix I: Ronell's lesson plan

Mini-lesson Observation Transcription	
Ronell Good morning everyone, so yesterday we covered or we went through thermo regulation was and the retraction of the skin and today we gonna look at what causes body temperature. We going to start with a bit of a summary does anyone remember what is feedback loop? We did it a while back. I realized that since its morning I'm gonna pretend as if the class is participating and giving the answers that I'm looking for. So this are the questions i brought to the class to try and get to summarize the previous lessons. The type of answer that I'm looking for is that a Feedback loop is a loop that uses a stimuli and then produces feedback to an act of change and its one where the change of the body produces the opposite effect. For example, if the body has too much water then it compensates it by excreting more water or when theres increased temperature or if the body is too warm. They help in cooling the body down. Thermoregulation has a cover which is a way of regulating the body temperature within the body. And again also calms the nervous system to level the body temperature which is 36.9 of the human body and the way in which the body regulates temperature like sweating or when the hair in your skin stands up. And the work of the hypothalamus send feedback to the central nervous system which the body's functions. Can we go into the blood vessels and re,ember the blood vessels or the function of the blood vessels is	Recap Recap Question Acting Summary Definition Examples explanations

to transport blood, oxygen nutrients and waste excretion.	
The types of blood vessels will be Arteries,veins and arterioles . And then the strucure of the blood vessels I understand its been a while since you done that in grade 10 and the layer that guides the vessels are just thin layers of cells. The veins have that thin layer surrounding them.	Curricula Saliency
So now with all that in mind the whole class remembering at where we are and what we done so far.	recap
Lets move on how the body controls the temperature.	
So if the body is too hot the temperature in the body lies beyond the limit. High blood in the blood flows across the hypothalamus and the hypothalamus takes the high blood temperature and it sends signals to the nerves of the body to start reacting in change. And then it sends signals to the sweat glands.	
The sweat glands are under the skin and once the hypothalamus sends signal to them and they increase the activity produce more sweat and the sweat on the skin eveporates and then this evaporation uses the heat energy in the blood vessels to cool the skin down.	Definitions
And now when we go to the main thing of this lesson which is the blood vessels and how they change. So when the hypothalamus sends the signal to the blood vessels, the blood vessels dilate and remember when the pupil its dilating it increases the diameter. This process is called vessel dilation.It is very easy Guys. The easy way to remember is dilation to increase the diameter.	Picture
So as you can see in this picture the blood vessels are in the surface of the skin so here it gets nice and thick when the skin constrict this means theres increased flow blood to the skin when we were too hot.	Example
Those who are like me with those pale skin and we have more blood in the	Background knowledge

surface of the skin to increase the rate in which heat is lost through the skin. So that's what happens when the body is too hot now we move on to too cold. So if the blood in the body reaches low temperature the hypothalamus registers that the blood is too cold. nd then it sends signals to the rest of body So when you are too cold the sweat glands sends the signals to tell the sweat glands not to release sweat because we don't want evaporation cooling us further. The muscles will contract rapidly to cause the shivering and that will cause the metabolism rate to go up which will rise the body temperature and the adrenaline glands will release adrenaline and it will increase the metabolic rate that will increase the body temperature And again we go back to the blood vessels.and this time we that the blood vessels in the skin constrict to increase diameter. And we can see the surface of the skin are thinner and now much further so less heat is lost through viscosity environment and the body stays warm. Bloood vessels are increasing diameter and less heat is lost here. Now i will give the learners an activity where you will create your own feedback loop and the negative feedback loop specifically to show how the body will respond to various changes in temperature. So I'll get the loops for each student individually and then they will swap books for marking. If social distancing allows and if they can't they can mark their own work. So Once they have done that then i will the through the class and answer some questions and just making sure that they are sticking to the task that they are entrusted and then i will give them	Explanations Background Knowledge Awareness of the learners Use of loops Peer Work Reporting Student Identity Pacing

this example it doesn't necessarily have to look like this. You see the body constrict and we have increased temperature. The body is sweating because of dilation. The important thing is that everyones loops looks the same. So I will highlight the points that we are looking for to mark. Which will be to start with the normal body temperature. We then need to have a change decreased or increased body temperature. We need to have atleast two physical effect which are sweating, constriction and dilation things like that will be looked at. Another way we can do the feedback loop is to have low body and then you will have increase temperature. So theres different ways to represent this. And then we will go through questions as they mark their own work, to make sure that they understand. So after that exerscise i will then go to the last topic which will be behaviour of changes . So when you have a hot blood or cold blood. There are temperature senses, if any of this raises the body detects the change in temperature. The hypothalamus informs the brain and stimulate vouluntory change all the changes we looked at so now you can't control when yourhair stick up in your ar or when your blood vessels dilate or constrict in your skin but the voluntory changes happens we are all aware of I. So when I'm feeling cold i wil put on my jacket or I'm feeling hot and I'm gonna take off the jacket. Getting a blanket when yourre cold. Exercising also increase your metabolic rate which will then warm the body up which is why also when you have been exercising your external temperature is very warm and your body will still undergo the phisiological changes to cool your body down because the metabolic rate. Which is why when your're exercising your skin sweats and all the physiological changes we talked about.	Expalnation Background knowledge

I will end the lesson by talking to the learners about other examples they might have about how they keep warm. So thats the structure of our lesson. To explain the.....behind it. I started off the lesson with the summary of the previous topics. And this was done in conversation to get responses from the learners to help them actively engage in the lesson so that they have interest from the begining. I start off low and we work on the theory of the lesson and use the summaries to link it to the current topic. Go over the current topic and present it in slides i used the color for the different responses. So the responses that the body responds hot so i put the color red or when is too cold i used blue. I used different colors to help stimulte the visual and help them separate all the similarities and information. I then used feedback loop exercise because it shows that they now understanding the feedback loop how it works and that they can also apply that to the theory when regulation temperature change. And we were also guided because i have been involving the class that also helps the learners that are struggling and it shows the peer marking as critical thinking and we also have to look at how they need to answer. We marking we get someone's piont of view you might as well undrstand what they are needing and then pose that question to the teacher as the classroom discussion. I then show show any lesson of the behaviorial changes what it is and why its important in the undewrstanding of the general theory. It is not generally created in exams things like that.it also relates prett well to the the knowledge so that they can end the lesson by.....a lot of things they have learnt. and the physiological changes things like sweating and our hair standing up, stuff like our blood vessels dilating, so they bring the lesson to topics that they all relate to. I	Use of color reasoning Reasoning Marking Classroom Discussion Misconceptions Questioning

chose not to have a full consolidation stage i this lesson because .....i felt that the learners were not ready for the exercise like there's a lot of misunderstanding then i have to put that on the table in practical....that's my lesson. Any questions?	Reporting

Appendix J: Nelly's Lesson observation

Mini-Lesson Observation Transcript	
Nelly: Good afternoon grade 12s **Student**s Good afternoon ma'am How you guys doing? **Nelly:** How's your lunch break? **Students** It was ok ma'am **Nelly:** It was just fine neh. So, actually, as I told you last week today we'll be carrying on talking about protein synthesis. Last week we just did a brief intro but today we will look at it in detail. However, as you know, every single lesson should start with a recap, I don't know why I wrote summary but it's the same thing, every lesson needs to start with a recap. So last week we actually learnt a bit more about RNA but we learnt about RNA comparing it with DNA, ok? I just wanna see how much you remember, so this time I'm gonna talk about the differences between DNA and RNA. Kefilwe, may you tell me the differences between DNA and RNA, or at least one difference. **Students:** The DNA is double stranded and RNA is single stranded. **Lindo** Very good, so DNA is double stranded and RNA is single stranded. Yes, **Briana**. **Briana** I wanted to say the same thing. **Nelly** Anything else?	Topic Introduction Brief Introductions Detailed Introduction Recap Introduction Summary Recap introduction Use of Terminology Use of comparisons Prior knowledge Knowledge of differences between terms Structure Description Student Participation Use of Pictures Use of Diagrams

Student Isn't it the Thymine and Cytosine **Nelly:** What about Thymine and Cytosine? Ok so, the nitrogenous bases**, Faith**, can you tell me the differences between DNA and RNA with regards to the nitrogenous bases. **Faith** RNA has Uracil while DNA has Cytosine I think? Nelly: Thembi? **Thembi** Thiamine. **Nelly:** Thank you **Thembi** But ma'am I said Thymine **Nelly:** You said Thymine and Cytosine but you didn't say what about them. But yes, Thymine is there. Ok what else? Thembi? **Thembi** Maam, this all I remember... **Nelly** This is the only thing? I keep on giving you examples For now, until someone else says something **Tiara** So we have deoxyribose sugar in DNA and ribose sugar in RNA **Nelly** Very good, deoxyribose and this side we have ribose sugar. Zack, another one. **Zack** I don't know Lindo Nothing? Alice? **Alice** DNA is in the nucleus where else RNA is in the cytoplasm. Nelly Very good, DNA is in the nucleus where else RNA is in the cytoplasm and nucleus. Ok, anything else? I think just one more, well… let's just say one. Anything else? You remember the example I gave about the ladder?	Examples Use of terminology Interrogative questions Discussions

What about the ladder tells about the structure? Yes **Student** Something about stability maam **Nelly:** Yes, exactly, so DNA is? **Student** More stable ma'am **Nelly:** Let's just say fairly stable. And in that case RNA will be? **Student** Fairly unstable Wow, really? Unstable, very good. Ok so, these are the similarities and differences between DNA and RNA (end of video)... There are three types of RNA? mRNA. Uh-huh. tRNA. Uh- huh rRNA. Ok, so now everyone is confident. And rRNA. Thank you very much. I want us to talk about these three as they are very important for today's lesson. So, Thando, please remind me, what is mRNA and what is its purpose? mRNA, ok what does the m stand for? Thando? Messenger. Messenger, right? So, messenger RNA, what's the purpose of messenger RNA? It sends a message It sends a message Thando. It sends a message, right? It sends a message, ok? And then, Zinet, tRNA? T, what does the t stand for? At least give me that. Ok, are you shy? Transfer. Yes, transfer RNA. What is the purpose of transfer RNA? It transfers. Yes (inaudible) it transfers. Maam, doesn't it transport? Yes, yes, it transports, transfers. So as I gave you… Is it the same thing? Does the t stand for transfer or transport? T stands for transfer, but remember my example I was like think about tRNA as a truck that	

transports amino acids. But t stands for transfer, ok? And lastly rRNA. Oh ok. Ribosomal RNA. Ribosomal RNA, and what does that do? It ribosomes RNA. Wow, please elaborate, what do you mean it ribosomes? What does ribosome mean? (Inaudible) Yes Ayisha So mRNA takes the opposite of whatever strand is in the DNA, tRNA will take the opposite of that again and rRNA takes it back (end of video)... Like last we wrote our vocab test, however, today we will not write a test because I feel like everyone did very well in the last vocab test, even though nobody got a hundred percent, I thought one person that, but no body got a hundred percent, most of you got like, ninety percent if that's what I should call it, so everyone did a very good job, so, yeah, good job. So, rather today we going to play a game as a vocab test substitution, ok? Ok then, protein synthesis, now, what is protein synthesis, we spoke about this briefly, Fortunate, what is protein synthesis? It is the making up of protein (it is when) it's the build up of protein. Yes, very good. So protein synthesis is the process where proteins are synthesized, as I said many times in life science just break down the words especially if you're not sure because by just breaking down words you can understand them, ok? So, as I gave this picture last week, here we have DNA saying it wants protein. So it's giving an instruction, ok? So then from that instruction mRNA, which is the tiny, skinny guy there (end of the video)… So actually in your textbook there's another mistake, in the textbook that we are using there's another mistake, it says, I think it says is copied as an mRNA strand but I said please don't use the word copied, ok? Hence I mean to say created as the mRNA strand, ok? Sorry maam, why is copying not appropriate?	

Because we don't make a copy of, from DNA to RNA it's not a copy of but they are complementary bases so for example, let's say our DNA strand consists of ACGTTA, let's say this is DNA, ok? Now, copy means to make an exact copy, meaning if this is the case our mRNA should be ACGTTA, you know what I mean? So it's not a copy, we are making complementary strand, which in this case, let's check the memory, what does the A complement? T T, and C? G GCAAT, no no no, ok we'll fix that… but now don't forget this is mRNA, is there Thymine in mRNA? No. So where there's T what do we replace it with? U Exactly, so let me just erase that. So it's? U So is this a copy? No It's not a copy, that's why we don't say make a copy of. Ok with that said from then onwards the mRNA strand leaves the nucleus through the nuclear core. Thandeka, what is the nuclear core? It's the opening of the nucleus.. Yah, it's like an opening, these little holes over there, right? And attaches itself to the ribosome. Refilwe, why does it attach to the ribosome? Why? Why does the mRNA attach itself to the ribosome? Julius? Why? Why? Is it to get ready for protein synthesis? Exactly, because the ribosome is the place where protein synthesis occurs, it's the location, ok? That's why it has to go there. Ok then, let's check your understanding, Side, what is the first step in transcription? In transcription? Maam, can you remind me which one is transcription. Transcription is the first stage whereby DNA is transcribed to RNA, mRNA. So the first step of it will be the unwinding?	

Yes, very good, and then Ayisha, what follows there after? It unzips. Very good. Sobeya, what happens there after? No, maam, the answer Ayisha gave is incorrect. Why is it incorrect? The hydrogen bonds have to break first before it unzips. Very good, I was actually hoping that she was gonna say it but very good, thank so much for pointing that out, very good, and then what happens? Refilwe. After? After the hydrogens bonds are broken, DNA is unzipped, then what? And then there is creation of the mRNA? The mRNA is created that is complementary to the DNA. Very good, next is translation (end of the video)... Transcription, it happens, ah here we are, in the nucleus there is a DNA strand, mRNA strand, there's form and we have a code on there which is basically a triplet of nitrogenous bases, ok? Then this side we have, in the cytoplasm is the anticodon, tRNA codon, ribosome, and this is another mistake in this textbook. Can you call it a protein when it's like this? No. No, right? It must fald before it becomes a protein. So what's the problem with this? It's a polypeptide chain. So please don't say it's a protein it's a protein when it's still a chain that has not folded yet. So the textbook that we have has a lot of mistakes. Ok so now I'm giving you two minutes in your groups try to label as many from A to K. Two minutes. Maam, (inaudible) Pardon. (Inaudible) The two minutes has already started, I hope you taking (inaudible)(end of video)... I want you to use the numbers and the figures to guide you in writing your essay so one two three, now use that as your guidance. Now eveybody stand up… stand up. We going to	

play a game sherades, ok? So as I said this is the stuff you should look for the vocab test that you supposed to write today, ok? So, Ayisha you can go towards Thandeka's sorry Fortunate's team. You can come this side, stand here, Thandeka, you can go that side, Thando, this side. Oh, there are many people this side. Yes, there are many people. Just one person and Julius is this side. Ok, so basically we just gonna I… I'm running out of time, we just gonna play a few rounds, ok? So in your team I'm giving you 30 weconds to decide two people you can trust that you think can give you definitions very well and two, can say things very quickly. Discuss. (Discussion). Ok so which one is group one? Thandeka's group. Ok so Thandeka's group is group one. Ok great, so we have group and group to, we gonna see how many words you guys get right, who's the representative here? Ok, Ayisha can go first. You can just stand here so that there's as many people seeing this as possible. This Sherades, I don't if you guys have ever played this game before but basically you just show the word and you just hold it cause you can't hold it up here, if you can hold it up here it's fine, just show the word then if the person describes, after the description clue if you yourself who's holding the phone gets it right then you go down, that's for correct and then up for pass, if you feel like this is too difficult then pass, that way you can get more points, ok? Please let me describe and someone else go answer. Thandeka you can come. Who's gonna answer, me? Ok let me go. Ok, can you see? Is everyone seeing? It didn't record. I don't think it's recording (end of video)... Ok, just begin, and start. Ok, where is the rRNA and stuff? Cytoplasm? Down. The thing that helps protein synthesis occur but like a catalyst?	

Ribosome? That breaks down hydrogen bonds. Codons? No no no, it breaks the hydrogen bonds. Enzymes. Down. Wow. You know you can pass, right? I'm waiting for them. Ok ok, you the stuff that you get from your parents, you inherit from your parents? Genetics? A short, short… Genes. I'll take it. Ok so, you're male and we are females, we have different what in our bodies? We have testosterone and we have oestrogen and all those things. Hormones? Yeah. The one that's in rRNA and not in DNA. Uracil? Yes. And that's almost almost, ok now time is up. Ok very good, you guys did well. Let's see your points. Ok who's going to be from this side, from this side? Oh Julius is in this team, I don't know why. I'm in that team? Yeah. Julius we've already won. Are you sure it's winning? Julius is in that team, there is five points. Group two bathong, group two. Julius is in that team, you guys are fine, you're fine. (inaudible). I gave you time to discuss this, here, just hold it straight and we are starting, just hold it straight, you can come a bit closer if you want to. Single cell organisms. (Answer inaudible) Yeah. Pass. Ok, say a base. You can go a bit back. Can you go back a bit. A base? Pass. Cell division process but you don't get four cells, the other one.	

Meiosis. No, you don't get the… the other one, there are two, the other one, meiosis and? Mitosis. Ok, so instead of DNA? RNA. Yah. A triplet of bases. A triplet of nitrogenous bases. A codon. Yes. You said the answer so that's a pass. Ok you keep saying pass, you not supposed to go up. No, she did pass. She did this but it still wrote pass. No no, she was supposed to go up and then (inaudible) No, she got it correct and she did this but it still wrote pass. I think it's because she goes up first before she goes down, that's probably why. Do you remember which one she got right, please don't cheat. She got mitochondria right. Mitosis. Ok, next team quickly, next team. There are only two. I'm sorry, we are changing. Again? Yeah, we still have some time so we can… (discussion). Ah no give someone else a chance. Fortunate (discussion). Ok guys, keep quiet then we are starting, Fortunate hold. And start. Ok so the one that pairs with C, what pairs with C? Thymine? No. Oh, it's Guinine. Yes, so, down,down. So the first part that we did on the board, what's that calle? Transcription. Perfect. The bases, what are they called? Nucleotides. Good shot. It's not that but I knew she would get it. Albinism is an example of? What? Albinism is an example of?	

Remember when I said teenage mutant, wow, nevermind. Ah pass. Go up. (discussion) Ok so, we have the three bases, what's the… we have the three bases, right? So that gives you, you said the word just now. Nucleotides. No no no. What complements the codon? What complements the codon? Yes. Anticodon. Yes. Up, down, down (end of video)...	

Semi-structured Interviews

Appendix K: Nomsa's interview

Nelly *Number 1* I would like to believe that learning took place because when giving learners a chance to speak, as a teacher I get to see if we have lost each other or not. I will rephrase my explanation if need be and I will see the learner's depth of understanding and confusion, so I think interaction helps. *Number 2* With the teaching strategies, please refer to the lesson plan. I think I explain them quite clearer there. I believe these teaching strategies are conducive for teaching and learning in a traditional classroom context because my lesson was just simple, I was using the whiteboard and the markers. There was nothing that needed electricity or internet connection, there were not a lot of complications. I think even in a real class situation, it could have went well. *Number 3* Firstly, I knew that working alone could have taken them the whole lesson so that is why I opted for working in pairs. Secondly, working in pairs is part of cooperated learning, which according to an article by Wong, it also is regarded as one of the ways learners learn faster, efficiently, and with greater retention. Of course, it depends on what the learners prefer. Thirdly, I wanted them to help each other because some	

learners understand things better when they are taught by their peers. And lastly, I opted for pairs because in larger groups some learners may end up not doing anything, so it is just to help them help each other and to avoid chaos like larger groups and to also save because working individually could have taken time. So, it worked for many things, I think I achieved different goals in just that pair work. *Number 4* I don't know if I'm understanding the question well, but the way I understand it I will just answer. I think Schush teaching skill, because I was able to teach a whole lesson without PowerPoint slides to remind me what to say next. So, I know I can survive just with a chalk and green board classroom and my class was in order. I think I interacted well with the learners. *Number 5* The level of preparedness, on a scale of one to five, I would say four because I last did homeostasis in first year. It was not my major in my last years of varsity. I had to give myself more time to do proper research and see how I can relate this topic to COVID-19 because that was part of the plan also. And to see if there have been any changes, you know you need to keep up with the content, even though school textbooks are updated late. But I think as teachers we need to keep up with the	

content. So, I had to read some articles because the last time I did this was first year, so I had to read a lot of articles to see what has changed and what hasn't changed. But, by the time I got to class, I think I was well prepared. *Number 6* In a traditional classroom, yes, I would like my learners to know that a test does not have to be about giving grades, but a test is also part of learning. And this tries to help them to be less anxious when facing graded tests. I would have started like this; I would not change it. I think I liked how I did it to start with the test. *Number 7* I think it was just good, but I have to improve on my pace. I think I was too fast because I was trying to cover up the time. I also think on a real class situation, that game could have taken the whole period because those people already knew the stuff, but it took them more time. Or it could have been because they had also forgotten some of the stuff. But I think there is a lot to improve with the pace. *Number 8* The structure of the micro teaching really impacted the planning and how to conduct the lesson. Well the class size was very small and that is not the reality of many South African schools. With such a small class size, its really easy to move around the	

desk and assist learners as much as I could unlike in a bigger class. And its easier to see learners who are lost. Its easier to interact with learners in a smaller class. I had more time for each pair and its easier for me to look around the class and see who is not focusing. The time was fine because it was the normal time that school periods have. It was mostly the class size that impacted because I don't think I could have had more time to move around the class and to assist all the pairs if it was a big class. *Number 9* The very primary thing I had to consider in this micro teaching is that I'm not teaching real learners, I'm teaching student teachers and most, if not all of them already knew what I was talking about. They would probably give me answers more quickly relative to high school learners. So, making the lesson shorter than it could have been in a real class situation, that is why I decided to incorporate a very comprehensive game which was a surprise test to make the lesson more interesting. That surprise test was a form of a formative assessment. I also had to look up misconceptions related to homeostasis to make sure that I do not perpetuate them in my lesson. *Number 10* While I was engaging with the learners, some of them were actually not doing the activity. It could have been because they	

knew that they were not real learners or because they had forgotten the topic. So, I had to give them hints, which I think I could have done in a real class situation, to be able to finish the activity. I also had to correct some misconceptions and or alternative explanations. And some got encouraged to finish when I gave them the hints, after all it was not a real test. It was a time for me to interact with them for them to ask questions. I think engaging with them was really to encourage them to complete the activity and see what they were not understanding and to also see the people who were not doing the work. *Number 11* I would have definitely cut out some content that I covered in the lesson to make it shorter so that I don't rush through that because I really believe that I rushed through my lesson. Also, the activity could have been done in bigger groups because pairs do not actually work when you are in a large class. Also, to save on the printing of the activity cards because there were a lot of cards and when working in pairs in a bigger group it meant more cards and as a teacher it meant more work on my side. *Number 12* About twenty minutes of the lesson was the revision activity/surprise test. Not everyone completed it, it could have been because the learners were not focused on the previous	

lesson. So, I had guide some of them through the activity. Most of them were confusing the blood glucose level negative feedback so I had to quickly summarize that before the day's lesson. I think I went through the osmoregulation and the source level negative feedback very fast, I was trying to keep up with the time which I think made me sound not so clear, I don't know though. I would have probably done a summary of this lesson in the next lesson to make sure that the learners had understood me and were on the same page because I really think I went through that whole think really fast. I knew the lesson could be longer because of the game, so that is why I even printed notes for the class and to fill the notes here and there as the lesson went on. Although I gave them notes, I still drew the nephron on the board so that learners pay more attention to what I was saying rather than completely looking down on the notes. *Number 13* What I found difficult when preparing a lesson was that you know sometimes you could think you want to start the lesson with an icebreaker question, which in a real class situation will get the learners to really think about it and it could be an interesting discussion. But then you would think that okay these people will give me a straight answer, there is no trial and error. They just	

know, so they are just going to give one simple clear answer which means the lesson could be faster and less interesting because there wouldn't be those wrong answers which you could build on and try to correct. So, when planning the lesson, I tried to put more content so that the lesson is not very short, straight, and simple. For example, I could ask what they know about osmoregulation and those people will tell me straight what they know about osmoregulation. But with grade twelves, they must remember maybe grade eleven work, say wrong answers, and stuff like that. So, I think it was really difficult to plan for the lesson because it is like teaching people who already know the thing. *Number 14* The surprise test was a test yes but not for marks. I just wanted to see if the learners understood the previous lesson before moving on to the day's lesson. As I was going around the class, I could pick up some misconceptions as the learners were completing the test and I had to correct that with the learners. I also set surprise tests to keep learners on their toes so that they study every time when they get home and to take the responsibility for their own learning. Also know that a test is not meant to punish or just to grade them, its part of learning and to see where they went wrong and a chance to answer questions before I move on and to	

help me as a teacher to see how far the learners understood the content. *Number 15* I must say that I was quite nervous at the beginning of the lessons because in my mind it was like my colleagues could just storm in anytime to correct me. But I believe that disturbed my flow because its like you are teaching but then you are teaching people who know, and I felt like they could just correct me. I think that now instead of just teaching what I know and what I planned, I was focused more on what if I made a mistake. Even when one of the colleagues raised their hand to ask a question, I was very hesitant to take the hand because I thought it was a hand to correct me. In short, its very difficult to teach people whom, some of them are even more specialized than myself in the topic. As the lesson went on, I was just comfortable and I just taught the topic even though I just had those moments of having a conversation in my head like what am I saying, what am I saying. I think it really went well. *Number 16* With the misconceptions, I think its that there is a direct relationship between salt consumption and thirst. Some learners think believe that when you eat more salt, you become more thirsty which not exactly true. Eating salty food does not necessarily	

increase a person's sense of thirst. I did not want to go more into details in that not to confuse them. I think that was the misconception I had to correct on the lesson. *Number 17* Those people already knew what I was teaching so I think the lesson was not quite informative or interesting for them as it could have been with grade twelves. They didn't have a lot of questions to ask, I was the one who had to generate most questions, even in my planning I had to do proper research because I knew some of them would ask questions even though they already knew the answer. So, it was quite a daunting experience because some could have asked questions that a grade twelve learner would not have thought about. It was intimidating, I must say. *Number 18* With pairs there was order in the pairs, the learners showed maturity and even though they did not know each other they worked well, I did not have to shout for them to settle down. In a real class situation, working in pairs or groups is a chance for disorder just like when pairs are friends it might be a chance for the learners to discuss other news not related to the lesson and this wastes time. I could have ended up separating friends. In a traditional context, I could have considered if the learners are	

comfortable working with each other because in my school years I was not comfortable working with a male partner. I had to consider those different thoughts. But in our situation, the microteaching, the learners showed maturity, they worked well together, there was no chaos. In high school, you have to consider different things like are they fine working in pairs, should I swap them, and stuff like that and also to make sure that they are not doing their own things or talking their own private stuff. *Number 19* Microteaching is not enough especially for us PGCE students, I think I learnt a lot more in the three weeks-based school teaching compared to the microteaching. Microteaching just teaches us lesson planning and how to make sure that your lesson plan is fit for that forty minutes and just to have that confidence. But it does not give us the feel of a real class situation because you have to remember that those people are just matured, you would not have to deal with the disruptions in class. They will just listen to whatever you are saying, the questions that they ask are proper questions and even when they answer you, they give you proper answers. Even if you are not making any sense, sometimes you are explaining something and lets say it would not make sense to a grade twelve learner but because they already know what	

you want you want to say before you even say it, they will just understand and they will just get you. Maybe I am a confusing teacher, who knows. I will know when I have to teach grade twelves then I will know that I should not explain it like this, I should explain it like that. But with them it just makes sense because they already know what you want to say. I do not think that is enough. Just an overall, from my interactions with my friends who were in different groups, with microteaching you can be in a good group which would just ask you simple questions, be good to you and interact with you in a way that you do not get in trouble with your tutor. Some people got really hard groups, lets say someone has a masters in a topic that you are teaching and they ask questions which are way higher than grade twelves and you are just going to be more nervous. As I was saying, I last did homeostasis in first year, it was not my major in my other years so somebody could have just asked me a question that they did in physiology which is not even grade twelve content. So, there are various things which we need to consider there with microteaching. Yes, I really do not think it is enough because when I went to the three-weeks based school learning, that is when I had to deal with learners with different attitudes and I needed to correct them.	

Appendix L : Ronell's Interview

Ronnel *Good day Ronnel how are you?* I am good thank you. Thank you so much for making time for this interview. No problem, thank you so much for the message I had completely forgotten so I was not home and ready but just I had forgotten that it was a scheduled interview. I am so sorry. ***Interviewer:*** You know, I just realized now, to say, oh my God I should have reminded you in the morning. Its no problem, it has just been one of those crazy days. It is none of your fault at all. ***Interviewer****:* I just want to know what your thoughts about the lesson were and whatsoever, so I guess we will just get right on it. ***Ronnel:*** Cool. ***Interviewer****:* All right, so firstly I just want to find out what was in mind when you were planning the lesson like what did you consider? ***Ronnel:*** So, before the lesson, I had, because it was my second lesson of the two, I had obviously already scheduled to correspond with the previous lesson which I had linked to COVID which was part of the whole thing so I had my lesson subject really kind of chosen. And then when it came to my delivery, a large portion of it came from my critiques that I had gotten	

from the previous lesson. So, I, that led to me trying to you know, introduce the colour aspects as well as the diagrams that showed the comparison which were issues that were brought up in my previous critique and I tried to build on that. And other than those two things, it was mostly just me trying to look at the topic and trying to kind of find a way to best explain that. ***Interviewer:*** I just wanted to find out, Ronell, because I'm not sure it I think the lesson plan I got was for another lesson. ***Ronell:*** The lesson plan you got is the correct one. There were sections where I skipped over sections where I might open discussions, which obviously those would be enhanced and especially a large portion of the lesson and a large portion of my general teaching style is to try and engage and promote discussion. So that would be slightly different, but the overall structure of the lesson I would imagine would be the same obviously it would be very dependent on the class, because I would try and adapt it to the class I was teaching. ***Interviewer:*** So, did you kind of somehow feel like you teaching you a micro-lesson affected how you planned? ***Ronell:*** No, when I planned the lesson, I planned it in the mindset as if I were teaching an actual class. I did not see the point in catering it for the audience because	

it was about learning to teach a proper class so I would rather plan for that. Actually the microteaching helped me a lot from the other students being that they contribute their suggestions to my lesson or just the lessons themselves, then I would not have gotten otherwise. ***Interviewer:*** Thank you so much like that was a very honest response, you know.	

Appendix M: Nelly's Interview

Interview transcript	Codes
Nelly *Number 1* When I was planning the lesson plan, my main goal was to make a way for learners to really know the steps that are taken, the steps for protein synthesis that was my main goal. I feel like because I am the type of teacher who always uses myself as a reference. When I was in high school, I did not even understand why we were learning about protein synthesis and I actually did not understand it, really. When I got to varsity, when I did my Bachelor of Science that is when I truly understood because I came to learn about the different proteins that are produced and why they are made. So back in high school, it was just like, what, like, I hear what you think about proteins but what do they do. So yeah, my goal was just, I just wanted to learn is to like know the steps and just know the flow, after this, this happens, after this, that happens as part of that specific lesson. *Number 2* I felt like the lesson went okay, with regards to my goal, as I said, my goal was not to explain that beyond what the textbook was saying at that moment. Because I felt that referencing me again, back in high school, I did not really understand it, but I just knew	

the information. I did not understand how it was implied or how it could be, you know how it worked in my body, so only when I got to varsity, I got to understand. So, I think it went well in the sense that for the duration of the lesson, learners were able to answer my questions with regards to the information that they had learned. And my goal was not about the implementation how its implemented, how protein synthesis actually occurs. It was just, do you know after this step what happens? You know after this, okay it is transcription after transcription it is translation. What happens in transcription? What happens in translation? So, with regards to that specific goal, I think it went well since that was that my main goal. I forgot to mention something. So. for this lesson. What I did was that I also gave the learners, sorry I don't remember if it was classwork or homework, but basically after learning or going through protein synthesis to process from transcription to translation and everything in between, I expected them to write an essay explaining the process of protein synthesis. So, I think one that was my main skill even in the previous as I said, these were actually two, was one lesson divided to two lessons. Even in the previous one, I had said that for the next lesson, which is this one, I would want learners to know how to write an essay. So basically, I	

gave them a certain figure, which is on the PowerPoints, and I asked them to basically explain how protein synthesis works and so forth, so I feel like the main skill I wanted to teach was essay writing but like scientific essay, not English essay. Yeah, that was the main skill is there any other skill? That was the main one. I feel like probably there were other skills that I was not conscious of. When I was planning, that was the main thing. I wanted them to learn how to write a scientific essay because every exam I think once you start from grade 10, every exam has the last question where they ask you to write an essay about something. *Number 3* Okay, to what extent would I say the lesson went well? I am trained to analyse things with numbers. So, I think, since this was just microteaching and I could not actually take the homework that I had prepared for them, the essay that is, I cannot really tell how well. But with regards to the class communication, I am the type of teacher when I teach in the classroom, I do not want to speak alone. So, as I teach certain things, I randomly ask questions and choose different learners and so forth. So, with regards to how the learners, acting learners at that time, were interacting, I could really see their understanding was there. But at the same time you know since this was like so artificial, this was not an actual classroom	

with actual learners, it had adults who knew the work because we studied for it, I feel like I cannot take much credit. But if I were to be in an actual classroom, I would have wanted to receive those essays that they had written and mark them and see truly their understanding truly their skills of writing, and so forth and to also see maybe way they did not understand very well. But like, it is very difficult for me to say it went super super well and just to toot my own horn, but I would have really liked to see how they had written the work to understand if it went as successful as I wanted it to go. *Number 4* Traditional classroom context, definitely I would have started the lesson in the same way. I cannot emphasize the importance of a recap. It's really beyond me because when I look back from my high school days, there were lessons whereby we had recapped and I could really easily connect the information from yesterday's information with that of todays, and those that did not, I don't even remember half of the things that we learned in that particular subject. So, I would definitely. Recap is not even something that you need special tools for, you know, you just reminding the learners and you don't even have to be speaking, you as a teacher, for the recap the whole time you can ask questions. What did we learn yesterday? Do you remember what this is? What is this?	

And when you ask questions then they are forced to think and remember, and when you actually make the effort to think and your brain thinks oh this is important information and sticks right. So, I would have made the exact same decision, even in a traditional classroom. *Number 5* So, for the duration of the lesson, I asked the students questions. I really feel like that is very important, because we all learn differently and I feel like teachers are so deep into this whole lecture system that they don't understand the importance for learners to also partake. For example, I am that one person, I don't know, it's a very weird thing but sometimes I realize things when I say them out loud, so I tried to also create that classroom environment, and it is good for many things. So first it is good for discipline. When you have a class whereby you control the conversation. I tell you the truth, it is very rare that learners will just go and start making a noise. As soon as you turn around and write on the board, they start going crazy and talk about their own things, it is so rare. Because now they are all interested in this conversation, even if they are not, they know that I would randomly pick them to answer something so they force themselves to partake in this conversation and really pay attention. And many times, I heard that learners actually	

complained that in class they feel like it is unfair that the teacher is speaking the whole time, and things like that, it happens a lot. So, I don't want to have a classroom that is, you know, teacher based. So I want to involve my learners in everything that I do and I'm the type of teacher that even if I were to do experiments, you know, demonstrations, I would definitely demonstrate but I also want to have demonstrations whereby they can play around with what I've created. And this being different from experiment, because I made it, I demonstrated it and then they just see how it works, you know, so I really want them to partake in every way possible. And also, this covers of different learning styles. Not everyone is always going to be listening. Some people really just do want to talk, and when they are given that opportunity, that platform, I feel like the chances of them remembering what we spoke about are higher. So yeah, I prefer that system over anything else, and it goes back to my high school days my life sciences teacher. She did the exact same thing she would like make us talk about things and she would ask us the most weird questions, she will make us come up with like abbreviations to remember the work. So, she made our classroom very learner based, and I really liked that, so most of the	

things that I do in life in my life sciences class, I learned from her. *Number 6* So, I do not think it is very easy for a teacher to say I was not prepared at all. I do not think it is. With me I cannot say I was not prepared because, I mean, I have learned for three years I have been hearing proteins during my undergrad degree, this is not even including in high school. So I feel like I really know the process and I know it even deeper than any high school learner or someone in matric could because I majored in, you know, so I was very very prepared and it's actually a topic that I really do enjoy teaching and learning about. I enjoy that hence I did it in varsity. So, how was I prepared? I was like very much prepared, and in the sense that it was not just, I am going to walk in and teach the old way. It was, I sat down and actually thought about, you know charades, instead of vocab tests, let's do this rather and it was not just this play game like, I was just bored, but it was like, let's play a game because I want to find a way for learners to learn without them being like put on the spot, you know, because vocab tests can really make a learner feel dumb. Yeah, it really happens even though you studied. I know with me, it happens a lot because I have a terrible memory, so even at some point I would eat brain food and stuff. So, even though I	

would study I would try to write down the definition exactly the way I studied instead of my understanding, and I just wanted that to change. It should not be the textbook definition, you know, because that is what usually teachers and people expect in a test. I wanted, through the charades game just to really have them truly understand. Regardless of how it is written in the textbook, just truly truly understand. And that's why I think I really did think about it, I really sat down, I thought how can I do this? How can I do that? And when I saw that analogy, I was like this is a perfect analogy, you know, you can compare protein synthesis to the production of or the serving of food in a restaurant. And I tried to also think about okay, can a learner easily misunderstand this analogy for something else and I really thought out of anything else I could think of this was like the most perfect analogy. So yeah, I really think I was very very prepared, because I was being creative, I feel like when I'm really prepared for something is when I start creating my own methods or my own ways to do something so the mere fact that I did, I was definitely well prepared. *Number 7* So now we are looking at the questions that you said were stimulated by the video I sent. So why did I say it is important to start with a recap? I do not know if I mentioned it	

before, I have a bad memory of myself, and when someone is lecturing to me, I do not really pay attention the first time. However, if something is repeatedly said just like drilling, I have a higher chance of remembering and as I said, as a teacher I really always put myself as a reference because I was never like the smart student, neither was I the not smart one, I was just always average. So I feel like I fell on both and I use myself as an example because I feel like I can understand those who do actually very much struggle, and those who sometimes, you know, who many times succeed. So the reason why I said we need to recap is because it is very easy as a learner, imagine you are a learner and in a day, how many classes do you go to, maybe, three plus three, six, maybe 10 classes a day, and life sciences is probably one out of the 10, depending on the school obviously if the school is one hour each lesson is a bit different but government schools goes up probably 35 minutes each lesson. So obviously, you just have so much work, by the end of the day you have heard so much that your brain has even forgotten some of the things you know did not even make the effort to remember them so that's why I feel it is important to start with a recap. And a recap is also a way to show continuation. It does not seem like we ended and now we open a new chapter, when you recap you are	

showing that there is a flow. And if you understood this from yesterday, then you can easily understand today's work, and it is also to help catch up those who were physically not there and mentally not there, so those learners who are just sitting and they were thinking about, you know TV or cartoons or whatever, or even problems cause learners sometimes face problems that teachers cannot even help with. So, just to bring them back just to also create that continuation. That is why I had a recap. That is why I believe it is important as well. *Number 8* Would I use the same strategy in a traditional classroom? I would, like I am trying to find a reason why I would not, but I would. At the end of the day my lesson plans were not based on the resources, because I feel like that mindset is also very dangerous when people limit themselves to the resources that they have, they cannot think creatively, they cannot really find different ways of teaching different things. So when I came up with the lesson plan I always made sure that even if, like, it is not based on my resources but it is based on my best ability to help learners understand the work, and that was the main thing that was the important thing. If I did not have a resource, I would always find something to, you know replace it with. So, definitely I would have definitely done that, going back	

with my mindset, I don't look at my resources I look at my learners and I can have my learners understand the work and how they think. And, yeah, that is why I did it that way. *Number 9* Okay, so firstly I used PowerPoint for my presentation. I felt like PowerPoint was good because if maybe learners were just bored by what I was saying or explaining, they could just look at the PowerPoint and just easily understand I made it very easy to understand also, it was very simple and not really full of information. I felt like it just had important main points and I also made it like very colourful and lively just to draw learners attention to it because I know, again I always use myself as a reference, in class I am that one learner that gets very easily bored if everything is just dull, and, you know, not bright, so I easilly get bored and I get distracted, I start thinking about food and stuff. So that was my purpose of making it like that. Secondly, I saw this picture online, of the DNA double strand calling out the different RNA strands that they are going to make protein for certain table. So, I really like that because that picture, explained basically what protein synthesis is using the analogy of a restaurant so like the DNA strand is like the head chef, and then the RNA strands were just cooks that helped. So, I really like that I used that	

as well. It just explained overall what protein synthesis is. What else did I use? So, before the lesson, because this lesson when teaching it I divided into two, there was protein synthesis one and two, one where I just introduced and defined a lot of things like what is DNA? What is tRNA? What is RNA? Difference between DNA and RNA? Things like that. And I also showed a video explaining proteins synthesis, because in the previous lesson to this one, I had just introduced protein synthesis saying DNA and RNA are used in the production of proteins. And then I ended with a video. So, the video I feel like it was just a build-up when you connected to this lesson. What else did I use? So, I believe, in, bringing like tests and things like that as a reminder, or as just something that pushes learners to study and to memorize and to understand the work that they receive. So, usually, I feel like I am the type of teacher that would say every single week you are writing a vocab test or something like that. So, what I did since natural science has a whole lot of definition and has its' own language, I would usually say there is a vocab test, however in this lesson I put a game of charades. So instead of just even getting nervous sitting down writing words and did I write it correctly but I understand it like this but now I cannot really explain it, you know, except for giving learners that	

pressure. What I did was we played at the end, I planned that learners would play charades, so that they can also hear how their classmates define certain words. So for example, if I cannot find a way to explain what protein synthesis is during charades, a classmate could be trying to explain to someone else, that thing that that produces protein or something like that oh protein synthesis. Yeah. Okay, but hopefully they will not use things like that thing in the exam. *Number 10* In the lesson, I allowed learners to engage with me as we were talking about the difference between RNA and DNA. I am a little confused as to which lesson I sent you because there were two. I don't know if I sent you the first one or the second one, because the first one, it was when we're learning about DNA and RNA, but then the second one in the recap, we spoke about differences between DNA and RNA. So yeah, I am just going to act like I sent you both. So, the reason why I allowed learners to tell me the differences, was because before that activity, either been before as in the previous day or before during the revision, we defined DNA and RNA strand. So that part is very easy because if you understand what the DNA strand is and you can describe to me very clearly. And you also understand on the RNA strand is and	

you can describe it very clearly, then it should be very easy for you to state the differences so I did not feel like I had to put any input in that part, because I felt like that was the very moment where I could see the understanding, and where I could see if they really knew the work, did they really fully understand what a DNA strand is or what an RNA strand was strength was. So, yeah, that was the main reason I just I just felt like it was perfect for them to partake because it is a build-up also. It is not like I was teaching a different thing. So, that is why I did not feel the need to say anything. So, going back to also giving them an opportunity to talk. I always try to talk when I have to in a classroom. And when I do not have to, I give them an opportunity. *Number 11* So firstly, I did explain why use the PowerPoint, it is more attention drawing, I guess. What else did I say, I used the PowerPoint. I used the picture as a summary, its' purpose served as a summary that analogy. So, I really like using analogies because sometimes when you say something it is not easy to understand but when you compare it to something similar, it is easier to understand. So, I used that picture as an analogy because sometimes it is just easier to understand when you relate it to something you understand. So people are or everyone has experienced or seen	

someone being served, or how somebody is served in the restaurant or how just the restaurant works, if you have never experienced that, you have seen movies or something right, so that's why I use that analogy specifically, just so that they have a clearer sense and they can truly understand why protein synthesis has occurred. And then there was the video but the video was in the previous lesson, I don't think I should explain that for this lesson. So, I will not. And then there was the game charades, I explained in the previous answer, I wanted them to also hear how their classmates describe or explain certain words, instead of putting forth a vocab test. So, maybe I did not really know how to express or explain what this word is however if I hear what a classmate of mine said I'm like oh, actually that is not very much, easy way to say it and usually it is very easy to remember what other people say like in games and things like that, compared to just a lecture. So that is why, and you said would I use these strategies in the traditional class? So, obviously a traditional class does not have like computer probably not even electricity, I don't know, maybe. But like, no projection. So, the PowerPoint will definitely be out of the picture. But I would instead of, because my PowerPoint presentation also included certain figures that I would have drawn. So, if all I have is	

a chalkboard and then I will just try to draw it actually going back to my experience in high school when we were learning about protein synthesis my teacher actually drew a big cell on the board and just showed the process step by step and I think that was awesome, so I probably do the same thing. And the nice thing is that she used different colours. So, it is not just the green Blackboard and the white chalk, she used different chalks, which means basically she used my PowerPoint colourful presentation, and in a more traditional way, she used the chalk and stuff. So yeah, I think those. Sorry I forgot your question, but yeah, those are the strategies I used and that is how I would use them. And yeah, in a traditional class the charades game, I think, Can I use the charades game in a traditional class? Remember I said initially that I would usually use a vocab test, so I think the vocab test is a more traditional way, but just to make it a bit more modern, or a bit more exciting, I came up with it from a game perspective. And I would pay attention to how learners are describing certain things and if they do not describe in a certain way, or a way that I wanted them to, then I would correct them, if not immediately after. So there are definitely even more ways to have games in a traditional class, games whereby learners can write things on paper, things like that so I would definitely think of more	

methods but definitely the more traditional way is just writing a test, vocab test. *Number 12* By the way, this is just a disclaimer, I am not saying that biodiversity is more difficult. I am just saying I am less interested in it, it is like, you know how in pure maths there was probability. I really hated that session because I did not understand why I have to calculate the probability of something happening, you know, because I mean whatever it is just a probability, it does not even mean it will go with the probability you expect, Anyway, yeah I really do not know this is back to question eight, I do not know what I found difficult. *Number 13* Question six was real learning occurring because I was interacting with my learners? I think firstly, it is important to note that my interaction with the learners is not just for their pleasure or their enjoyment of the lesson, but when I interact a certain way I want them to enjoy the lesson, however I am also taking certain information, and seeing where learners understand where they do not understand and how I can, in the moment I am seeing if a learner does not understand this, change it. How can I rephrase it so that they understand the perfect way so I would say it is quite unfortunate that I cannot say all my learners were learning. You know, I cannot really	

proudly say all my learners were learning. However, I feel a majority of the learners could have said they took something out. Not looking at the lessons that we had to present during that time because of the COVID-19 we were not in an actual class. During my practical's and currently where I am working, I actually do teach learners, and it is just so amazing how when we interact, maybe one learner makes like a very small mistake and then becomes shy and the whole classroom laughs and then they help him and they correct him or her, and things like that. And you can really see because I also have this habit whereby if someone got something wrong in the class, and they fixed it, when I meet up with them randomly during lunch time I will asked him the question. Hey, what is this again? And then he or she obviously in that moment will be nervous and think for like two seconds and will not be able to answer me. So, though, I feel like it just increased the chances of the majority of the learners that are being ignored. Would okay let me put this properly, whose learning styles are being ignored generally in a lecture type of classroom, usually the learners that really pay attention very well are those who love audio or those who prefer listening. However, there are those who also like talking. And in my classroom, I feel like I ensure that those who like talking and those	

who prefer listening are covered more, so I cannot say 100% learning was happening because you never know, some of these learners they just look at you and they are not doing anything that the listening, however, they are just thinking about some random thing. So I cannot fully confidently say yes but I feel like I if I am interacting with them and if I see the evidence of what I am seeing in their books, and if I can randomly meet up with them on a random day random time and ask them a question, and even though they struggle a bit to answer it eventually everything we speak about, they will remember it. *Number 14* What did I find as difficult when preparing for the lesson? I feel like I could have found more problems if I was teaching a subject that I did not really truly enjoy like for example, I am more of like the microbiology type of teacher, you know, but if you give me all diversity and no offence to people that like that part of life science but then part is just, I'm just so not interested in it, so I feel like the most difficult part would have been like to push myself to actually be creative. But what did I find as difficult in this one? You said in my planning, right? I do not know. I do not remember. I really wish I had received these questions like soon after I did the planning and the presentation because I do not	

remember. And I am pretty sure there must have been something that just challenged me a bit, you know, there always is. I do not remember. I actually really enjoyed preparing for this lesson and also it is difficult for me to say what I found difficult because I had to choose the subject and the lesson, and what I was going to teach so I just chose immediately what I wanted to talk about. So, it is very difficult for me to think about what difficult thing, I had found. I feel like however if maybe I was given diversity biodiversity, it would have been a different story. *Number 15* Okay, question number eight I think, about the vocab tests. Okay so now I know which lesson we are talking about; this is lesson two of the protein synthesis. Okay, so in that lesson, I explained that they did well in the test. Yes, they did. And I was not going to give them another one. Yes. So, my plan is, you know, rewarding but in a way that everyone receives the reward, you know, so, maybe this is just me, an average learner speaking. One minute I can seem like a very smart student and the next minute I can seem like not a smart student. Sometimes learners have really like learning boundaries that even us teachers really cannot break. And the system that we live in or the educational system is in, is that you only get a reward when you are the best. And I just	

don't like that because I feel like you should be rewarded when you do your best, you know, because you can never compare another person to me they probably had a different foundation where they had an advantage compared to me and so forth. So, in, us not doing the vocab test, the reward was it was now a fun game, you know, and everyone was being rewarded. At the same time. Because this is something that everyone could enjoy. So, yeah, this thing of top 10 and so forth, like, I'm very happy for students, sometimes even me, that get top 10 and get golden key, and so forth. However, I really just don't like it I don't like it at all, so I prefer that everyone is rewarded when they do their best, so I had imagined and created the scenario that my learner's maybe got their highest average, since all these vocab tests took place. So since now they got the highest you know what let us change things up a bit and let us make it a bit fun. That means, now I am also showing them as a classroom that I trust them, that they will make their own efforts to actually study certain words that they do not understand and they do not have to be pushed by these tests to understand. So yeah, that was the point of that reward. And the word was the charades game, just to make a team. *Number 16*	

So, I just want to make sure I understand this question properly. You are saying, in the lesson my peer students were the learners, right? How did it impact the lesson and how did it impact the planning? Sorry, just to make sure you understand how did them acting as the learners impact my planning and learning. I think that is what you are trying to say. But then let me answer to my best ability you can correct me whenever. So, how did it impact my lesson? I really personally honestly did not like the fact that my peers were the ones who were acting as learners I did not like it at all. Because, I mean they know the work, and I feel like they were obliged to just go with the lesson and participate because it was also for their marks, it is not the same. It is really not the same at all. I really would have preferred to have it in an actual classroom whereby everything that I had planned, I could see it going the way I had planned it, you know, just see the success the build-up and so forth. It was more boring, because they are my peers, they know to keep quiet, they just keep quiet, you know, they do not disrupt, if they disrupt you can see it is just artificial, they are acting. It was really more boring because I really love in my actual class were when they disrupt, my learners are really just so funny. When they disrupt, they would say something funny that I would	

even love, you know, and when they disrupt, they never really or hardly disrupt to be disrespectful. They always disrupt because maybe they have been shocked because I said a word that they do not understand and they act like what the hell is that and then, you know, those cute moments that make teaching fun I guess I really wanted that. So, the lesson. The mere fact that my peers were there acting as learners, it was pretty boring, from my point of view and yeah it just felt like I was doing it for marks, it did not feel like the real thing, like it was fun, or anything like that. And how did it impact my planning? It did not impact my panning at all because when I was planning, I was really acting like I was going to teach an actual classroom at Soweto or wherever. So, my planning was not impacted by the fact that they were there at all so I would have definitely use the exact same strategies as I did with them in an actual classroom so that did not impact my learning my planning at all. *Number 17* So sorry that was question 10, I think this is question eleven. So, when planning to circle back to question ten, I really did not find anything difficult with regards to the information that I should give now it is hitting me. Since I have a degree in science, and I studied these things like throughout. I know from like a deeper perspective	

compared to the textbook and the textbook really looks at like the basics. Like when you learn about photosynthesis in the textbook, you really do not even truly understand which proteins are needed for what whereby in varsity, I knew that this protein was needed for this so photosynthesis had to occur, so that this person was released when it was released went back to the location it was needed. So, I think initially, like when I was first introduced to lesson planning. I always found it like very difficult to say how much information should I add to the lesson and that was sorted because we have the CAPS document which by the way is very helpful in my defence, some people find it limiting. It is really helpful for someone like me who has a degree and you want to specialize on something because you know what not to touch on and I think when teaching, this is my difficulty, when teaching and the learner is like but I do not understand, why must protein synthesis happen? And you say because we need proteins. But what do we need proteins for? And then you have to give an example, let us say you cut yourself wit something and then now you are losing blood you are losing this right, so your body has to create certain proteins find a way to ensure that that place is fine, you know you just come up with like, I think that is just the difficult part, the part whereby I have to,	

when they ask questions beyond the textbook, and I have to know how to explain because if I were to explain this then I confuse them a bit more and I will say something that will trigger questions from other learners. But obviously in that artificial classroom that is not something I will experience because everyone is just so obedient and or just trying to act like a typical class which was difficult, I guess. So the difficulty would have been in an actual classroom if I was asked questions and now I would have to think how can I explain this in a simpler way or where can I stop or what information can I omit when I am explaining certain information. *Number 18* Yes, definitely, there are some misconceptions. So, like I know there is the rRNA that RNA confuses a lot of learners. And with regards to, because we know that rRNA is a building block for ribosome right. So it confuses other learners in the sense of how it is placed and, but obviously this is coming from my imagination, not from the classroom as I said it's very difficult because they were not actual learners but I know that when I was planning rRNA can create a lot of misconceptions with regards to how it is actually formed. What else can cause a misconception? Yeah, there is also like this misconception of DNA. I think at some	

point I heard that learners used to think that DNA leaves the nucleus. And maybe it meets mRNA and that mRNA is produced outside the nucleus. Yeah, I think that was a misconception. And what else. I do not remember if it is in this lesson. No, no, I do not remember if in this lesson I have to explain, or if I did explain that. When I mRNA is produced the DNA strand closes again so, that can be another misconception learners may think that the DNA, once those bonds break between the nitrogenous bases, then the DNA is open now and forevermore. So that could be a misconception. What else, let me think. How the protein is formed of folds can also be a misconception like how does it always fold? How does it fold? And, yeah, that is one of those questions I would not want to be asked, because there is, I know like from a biochemistry, like explanation whereby it is just a bit too much because even biochemists are like they do not know how but it is the simplest rate and forms very quickly, and they calculated the possibilities of how it could have formed and how is it that it is formed this way, you know, that's just another admin. So, if there is also the folding that is another one. There was also a misunderstanding about the ribosome like which one moves during translation, is it the ribosome, or is it the mRNA strand. That is another misconception. So, there can be	

many misconceptions and that is why, when teaching I really liked incorporating videos, I know for this specific reason I did not. But the previous one I did, I really just because in the previous one, they explained protein synthesis as a process and then we went to it in detail in this lesson. So I really like using videos because I feel like if learners really see that I'm explaining the same thing as what you should be explaining obviously finding most relevant video, then they can understand that okay that means it does not happen like this, or maybe because it happens maybe I do not explain a very crucial point of a learner and the learner is always thinking but what about this and then I show them a video and then their question is answered. So, I really prefer doing it like that. Videos are very important. So, there are many misconceptions is very easy for misconceptions to appear. *Number 19* Last question, what would I change if I were to teach it again? It is so difficult for me to answer this question because I did not teach it in an actual classroom. I would have really wanted that raw learner and those learners who react when confused, their faces react. Because most of my classmates, my peers, they were like, just looking at me. There was no interest. And many of them were worried about their lessons so you could see some of them like fidgeting, going	

through what they are going to teach so even though okay, there were those few that actually paid attention and looked kind of interested, it is not the same. So, I feel like if I was in a typical school environment, I would know what I would want to change, but it is very difficult to know from that specifically because it does not feel real. I would have wanted that actual classroom experience for it to feel real. I still feel like I did not teach it and I will not lie, even right now, I want to teach it, I want to teach this topic the way I had planned it. To see, well, what could I change? What could I improve on what went wrong? What should I use in all, if not all in majority or many of my other classes? So, it is very difficult for me to answer this question, it is really difficult with that classroom. You know, it is so difficult, like I am really trying to think. But would I have changed? Yeah, because anyway, again my learning or sorry my teaching methods do not depend on me, it is not about me and how comfortable or uncomfortable I am, you know, it depends on the learners. Sometimes maybe the strategy does not work on them, then I have to come up with a new one. So, it is not about what makes me comfortable. So that is why it is very difficult for me to see what I can change it only depends on them. So yeah.	

Appendix O

Anna's Interview

Interview transcript	codes
Anna *Number 1* When I was planning for this lesson, I considered the prior knowledge the learners needed to have, I also considered my prior knowledge as well as the knowledge that I had on the content. The topic was an overview of the brain for grade 11 learners, it might have been grade 12, it was a while ago. But I considered what sort of knowledge the learners also needed to have by the end of the lesson, so the objectives of the lesson. And then how to link that information to what the learners already knew and how to make it applicable to them. I had a video where I sort of engaged the class and by applying that video learners were able to see why we were learning such a topic. So, I try link it to the learner's life experience as well as their prior knowledge. *Number 2* The lesson started by watching a TikTok video and this was an online lesson, so it was recorded, we did not have actual learners in the class. But I have taught online, so I just pretended I was teaching learners anyway. We started watching a TikTok which is the one where the baseball comes flying at the camera and then the	

person drops his coffee and I then spoke about the reactions. So our reception and the way in which we see things coming towards us and then we react, so then I linked that reaction to the brain and the parts of the brain that are responsible for certain actions. So, then I followed on breaking down each part of the brain with their responsibilities. From there once we had gone through all the parts that the learners are required to know, then I took them to the ICT integration that I had found, it is called the Zygote Body Viewer, basically a 3-D view of the body and you can break it down to different levels so you can look at the muscles or you can look at the nerves or bones. I was obviously looking at the nerves and the nervous system and then I could zoom into the parts of the brain and you can see then the parts of the brain in 3-D which is really cool. So, then we went through that and if I were in class with the learners then I would allow them to look themselves with a little bit more work or a little bit more time rather. And then finally to wrap up the lesson or check the understanding of the learners then I got them to create a table where they matched parts to function in the brain, so the certain part of the brain and they had to link to the function. So that was then the end of the lesson, it was a short lesson because we were only allocated 20 minutes.	

Number 3 Teaching strategies that I employed were mainly lecture presenting as the teacher and then the students listened. I did use as I spoke then I wrote at the same time and that added then to the visual learners and I got the learners to write the information down at the same time. So, then those kinaesthetic learners could then write down and take in some of the information. Obviously its not exactly what you want for kinaesthetic learners, but it is something additional and then the learners also get notes. But these strategies are also written on the lesson plan which I will send through. I would say a lecture and If the learners had time to use the ICT tool then they could obviously spend some time experimenting, so it would be a little bit of experimental teaching as well. *Number 4* If I was teaching in a traditional classroom, I would have loved to have learners have their phones with them, and hopefully connected to Wi Fi or data or something and even if they had PCs that would have also worked well. So, then they could have used the ICT tool themselves, individually or in pairs, and then work through it as we discussed the certain part of the brain. So say we're talking about the cortex, then I could say to the learners go and find the cortex on the 3d model. So that would have	

been really nice if it was a traditional classroom. Obviously if the school is under resourced, it's a little more difficult than it would have been the case of rather projecting it, rather not projecting it but having it on my computer on my laptop and then that could sort of show groups of the class at certain times and they could come up in groups in and look at the 3d model. I think it also makes a difference how you write, so I had a little pin that writes, I write on my computer so I can draw as if I'm writing on a board but on the computer. So, I used that in the video but if I was in a traditional classroom, then I would be writing on the board. So, that would not have changed in that way but as I said, and the use of the 3d model could have been really individualized if each learner had they earn a cell phone or laptop in the classroom. I felt really prepared for this lesson, I made sure that I knew a lot about what I was teaching so I liked to find extra information. I did study human physiology so teaching the human brain, I had the content and knowledge there. I also did some extra research matching the knowledge that I have with what the learners needed to know from the CAPS document. And in terms of using ICT tools, I also really felt confident in that because I have taught online this past year so I am really used to teaching online and using those sort of technologies which	

makes it a comfortable experience for me. I think the main thing that made me feel really prepared was that I made sure that I knew what I was talking about, I really like to spend a lot of time reading and researching behind the content of this lesson or of any lesson for that matter. *Number 6* This microlesson skills that that I used would have included ICT skills. So, recording the ICT 3-D model as well as being able to write and talk at the same time, that is quite a difficult skill but it is something that you can build over time so I would have used that skill. Not of multitasking but of being able to break down the information as you talk, so although you are saying more, you do not write as much as you say. The skill of breaking down the information, its all very well knowing all about the brain but if you cannot break it down and explain it to learners, the information is not going to get across. So, the breaking down of information skill is very important, I think I used that quite a lot. Time management as well, so while you are in the lesson, you cannot just rush through and be done in ten minutes or not get through half the work. So, time management skills are very important and as are class management. Obviously in this lesson, because it was recorded and online I didn't have any class	

management but I did try and integrated if it was happening, so that skill probably was not employed as much as it would have been employed in a traditional classroom. *Number 7* I would say that the lesson went really well. There are few things that I did record more than once. I do tend to say words repeatedly even though I probably do not need to repeat them so I could practice reducing how much I blab on maybe. If we talk about microteaching, I will just put a keynote in here because the microteaching, although I do not have a video of that, I felt that went really well. I felt the same level of preparedness, I felt that my skills were good, my content knowledge was good. I am still working on engagement tools so engaging the class in the lesson and linking their prior knowledge, sort of using questions like have you ever experienced this or have you wondered why this happens. Those sort of questions that draw in the learners and draw in their curiosity. I think I still need to work on those skills, those interesting linking skills, I do not know what to call them now, but the ones that draw the learner's curiosity. I think I definitely need to work on that. But I think content knowledge, having studied human physiology, I think that really helps in teaching life sciences at least the human body part.	

Nthabi *Number 1* When I was planning the lesson plan, my main goal was to make a way for learners to really know the steps that are taken, the steps for protein synthesis that was my main goal. I feel like because I am the type of teacher who always uses myself as a reference. When I was in high school, I did not even understand why we were learning about protein synthesis and I actually did not understand it, really. When I got to varsity, when I did my Bachelor of Science that is when I truly understood because I came to learn about the different proteins that are produced and why they are made. So back in high school, it was just like, what, like, I hear what you think about proteins but what do they do. So yeah, my goal was just, I just wanted to learn is to like know the steps and just know the flow, after this, this happens, after this, that happens as part of that specific lesson. *Number 2* I felt like the lesson went okay, with regards to my goal, as I said, my goal was not to explain that beyond what the textbook was saying at that moment. Because I felt that referencing me again, back in high school, I	

did not really understand it, but I just knew the information. I did not understand how it was implied or how it could be, you know how it worked in my body, so only when I got to varsity, I got to understand. So, I think it went well in the sense that for the duration of the lesson, learners were able to answer my questions with regards to the information that they had learned. And my goal was not about the implementation how its implemented, how protein synthesis actually occurs. It was just, do you know after this step what happens? You know after this, okay it is transcription after transcription it is translation. What happens in transcription? What happens in translation? So, with regards to that specific goal, I think it went well since that was that my main goal. I forgot to mention something. So. for this lesson. What I did was that I also gave the learners, sorry I don't remember if it was classwork or homework, but basically after learning or going through protein synthesis to process from transcription to translation and everything in between, I expected them to write an essay explaining the process of protein synthesis. So, I think one that was my main skill even in the previous as I said, these were actually two, was one lesson divided to two lessons. Even in the previous one, I had said that for the next lesson, which is this one, I would want learners to	

know how to write an essay. So basically, I gave them a certain figure, which is on the PowerPoints, and I asked them to basically explain how protein synthesis works and so forth, so I feel like the main skill I wanted to teach was essay writing but like scientific essay, not English essay. Yeah, that was the main skill is there any other skill? That was the main one. I feel like probably there were other skills that I was not conscious of. When I was planning, that was the main thing. I wanted them to learn how to write a scientific essay because every exam I think once you start from grade 10, every exam has the last question where they ask you to write an essay about something. *Number 3* Okay, to what extent would I say the lesson went well? I am trained to analyse things with numbers. So, I think, since this was just microteaching and I could not actually take the homework that I had prepared for them, the essay that is, I cannot really tell how well. But with regards to the class communication, I am the type of teacher when I teach in the classroom, I do not want to speak alone. So, as I teach certain things, I randomly ask questions and choose different learners and so forth. So, with regards to how the learners, acting learners at that time, were interacting, I could really see their understanding was there. But at the same time you know since this was like so	

artificial, this was not an actual classroom with actual learners, it had adults who knew the work because we studied for it, I feel like I cannot take much credit. But if I were to be in an actual classroom, I would have wanted to receive those essays that they had written and mark them and see truly their understanding truly their skills of writing, and so forth and to also see maybe way they did not understand very well. But like, it is very difficult for me to say it went super super well and just to toot my own horn, but I would have really liked to see how they had written the work to understand if it went as successful as I wanted it to go. *Number 4* Traditional classroom context, definitely I would have started the lesson in the same way. I cannot emphasize the importance of a recap. It's really beyond me because when I look back from my high school days, there were lessons whereby we had recapped and I could really easily connect the information from yesterday's information with that of todays, and those that did not, I don't even remember half of the things that we learned in that particular subject. So, I would definitely. Recap is not even something that you need special tools for, you know, you just reminding the learners and you don't even have to be speaking, you as a teacher, for the recap the whole time you can ask questions. What did we learn yesterday? Do	

you remember what this is? What is this? And when you ask questions then they are forced to think and remember, and when you actually make the effort to think and your brain thinks oh this is important information and sticks right. So, I would have made the exact same decision, even in a traditional classroom. *Number 5* So, for the duration of the lesson, I asked the students questions. I really feel like that is very important, because we all learn differently and I feel like teachers are so deep into this whole lecture system that they don't understand the importance for learners to also partake. For example, I am that one person, I don't know, it's a very weird thing but sometimes I realize things when I say them out loud, so I tried to also create that classroom environment, and it is good for many things. So first it is good for discipline. When you have a class whereby you control the conversation. I tell you the truth, it is very rare that learners will just go and start making a noise. As soon as you turn around and write on the board, they start going crazy and talk about their own things, it is so rare. Because now they are all interested in this conversation, even if they are not, they know that I would randomly pick them to answer something so they force themselves to partake in this conversation and really pay attention. And	

many times, I heard that learners actually complained that in class they feel like it is unfair that the teacher is speaking the whole time, and things like that, it happens a lot. So, I don't want to have a classroom that is, you know, teacher based. So I want to involve my learners in everything that I do and I'm the type of teacher that even if I were to do experiments, you know, demonstrations, I would definitely demonstrate but I also want to have demonstrations whereby they can play around with what I've created. And this being different from experiment, because I made it, I demonstrated it and then they just see how it works, you know, so I really want them to partake in every way possible. And also, this covers of different learning styles. Not everyone is always going to be listening. Some people really just do want to talk, and when they are given that opportunity, that platform, I feel like the chances of them remembering what we spoke about are higher. So yeah, I prefer that system over anything else, and it goes back to my high school days my life sciences teacher. She did the exact same thing she would like make us talk about things and she would ask us the most weird questions, she will make us come up with like abbreviations to remember the work. So, she made our classroom very learner based, and I really liked that, so most of the	

things that I do in life in my life sciences class, I learned from her. *Number 6* So, I do not think it is very easy for a teacher to say I was not prepared at all. I do not think it is. With me I cannot say I was not prepared because, I mean, I have learned for three years I have been hearing proteins during my undergrad degree, this is not even including in high school. So I feel like I really know the process and I know it even deeper than any high school learner or someone in matric could because I majored in, you know, so I was very very prepared and it's actually a topic that I really do enjoy teaching and learning about. I enjoy that hence I did it in varsity. So, how was I prepared? I was like very much prepared, and in the sense that it was not just, I am going to walk in and teach the old way. It was, I sat down and actually thought about, you know charades, instead of vocab tests, let's do this rather and it was not just this play game like, I was just bored, but it was like, let's play a game because I want to find a way for learners to learn without them being like put on the spot, you know, because vocab tests can really make a learner feel dumb. Yeah, it really happens even though you studied. I know with me, it happens a lot because I have a terrible memory, so even at some point I would eat brain food and stuff. So, even though I	

would study I would try to write down the definition exactly the way I studied instead of my understanding, and I just wanted that to change. It should not be the textbook definition, you know, because that is what usually teachers and people expect in a test. I wanted, through the charades game just to really have them truly understand. Regardless of how it is written in the textbook, just truly truly understand. And that's why I think I really did think about it, I really sat down, I thought how can I do this? How can I do that? And when I saw that analogy, I was like this is a perfect analogy, you know, you can compare protein synthesis to the production of or the serving of food in a restaurant. And I tried to also think about okay, can a learner easily misunderstand this analogy for something else and I really thought out of anything else I could think of this was like the most perfect analogy. So yeah, I really think I was very very prepared, because I was being creative, I feel like when I'm really prepared for something is when I start creating my own methods or my own ways to do something so the mere fact that I did, I was definitely well prepared. *Number 7* So now we are looking at the questions that you said were stimulated by the video I sent. So why did I say it is important to start with a recap? I do not know if I mentioned it	

before, I have a bad memory of myself, and when someone is lecturing to me, I do not really pay attention the first time. However, if something is repeatedly said just like drilling, I have a higher chance of remembering and as I said, as a teacher I really always put myself as a reference because I was never like the smart student, neither was I the not smart one, I was just always average. So I feel like I fell on both and I use myself as an example because I feel like I can understand those who do actually very much struggle, and those who sometimes, you know, who many times succeed. So the reason why I said we need to recap is because it is very easy as a learner, imagine you are a learner and in a day, how many classes do you go to, maybe, three plus three, six, maybe 10 classes a day, and life sciences is probably one out of the 10, depending on the school obviously if the school is one hour each lesson is a bit different but government schools goes up probably 35 minutes each lesson. So obviously, you just have so much work, by the end of the day you have heard so much that your brain has even forgotten some of the things you know did not even make the effort to remember them so that's why I feel it is important to start with a recap. And a recap is also a way to show continuation. It does not seem like we ended and now we open a new chapter, when you recap you are	

showing that there is a flow. And if you understood this from yesterday, then you can easily understand today's work, and it is also to help catch up those who were physically not there and mentally not there, so those learners who are just sitting and they were thinking about, you know TV or cartoons or whatever, or even problems cause learners sometimes face problems that teachers cannot even help with. So, just to bring them back just to also create that continuation. That is why I had a recap. That is why I believe it is important as well. *Number 8* Would I use the same strategy in a traditional classroom? I would, like I am trying to find a reason why I would not, but I would. At the end of the day my lesson plans were not based on the resources, because I feel like that mindset is also very dangerous when people limit themselves to the resources that they have, they cannot think creatively, they cannot really find different ways of teaching different things. So when I came up with the lesson plan I always made sure that even if, like, it is not based on my resources but it is based on my best ability to help learners understand the work, and that was the main thing that was the important thing. If I did not have a resource, I would always find something to, you know replace it with. So, definitely I would have definitely done that, going back	

with my mindset, I don't look at my resources I look at my learners and I can have my learners understand the work and how they think. And, yeah, that is why I did it that way. *Number 9* Okay, so firstly I used PowerPoint for my presentation. I felt like PowerPoint was good because if maybe learners were just bored by what I was saying or explaining, they could just look at the PowerPoint and just easily understand I made it very easy to understand also, it was very simple and not really full of information. I felt like it just had important main points and I also made it like very colourful and lively just to draw learners attention to it because I know, again I always use myself as a reference, in class I am that one learner that gets very easily bored if everything is just dull, and, you know, not bright, so I easilly get bored and I get distracted, I start thinking about food and stuff. So that was my purpose of making it like that. Secondly, I saw this picture online, of the DNA double strand calling out the different RNA strands that they are going to make protein for certain table. So, I really like that because that picture, explained basically what protein synthesis is using the analogy of a restaurant so like the DNA strand is like the head chef, and then the RNA strands were just cooks that helped. So, I really like that I used that	

as well. It just explained overall what protein synthesis is. What else did I use? So, before the lesson, because this lesson when teaching it I divided into two, there was protein synthesis one and two, one where I just introduced and defined a lot of things like what is DNA? What is tRNA? What is RNA? Difference between DNA and RNA? Things like that. And I also showed a video explaining proteins synthesis, because in the previous lesson to this one, I had just introduced protein synthesis saying DNA and RNA are used in the production of proteins. And then I ended with a video. So, the video I feel like it was just a build-up when you connected to this lesson. What else did I use? So, I believe, in, bringing like tests and things like that as a reminder, or as just something that pushes learners to study and to memorize and to understand the work that they receive. So, usually, I feel like I am the type of teacher that would say every single week you are writing a vocab test or something like that. So, what I did since natural science has a whole lot of definition and has its' own language, I would usually say there is a vocab test, however in this lesson I put a game of charades. So instead of just even getting nervous sitting down writing words and did I write it correctly but I understand it like this but now I cannot really explain it, you know, except for giving learners that	

pressure. What I did was we played at the end, I planned that learners would play charades, so that they can also hear how their classmates define certain words. So for example, if I cannot find a way to explain what protein synthesis is during charades, a classmate could be trying to explain to someone else, that thing that that produces protein or something like that oh protein synthesis. Yeah. Okay, but hopefully they will not use things like that thing in the exam. *Number 10* In the lesson, I allowed learners to engage with me as we were talking about the difference between RNA and DNA. I am a little confused as to which lesson I sent you because there were two. I don't know if I sent you the first one or the second one, because the first one, it was when we're learning about DNA and RNA, but then the second one in the recap, we spoke about differences between DNA and RNA. So yeah, I am just going to act like I sent you both. So, the reason why I allowed learners to tell me the differences, was because before that activity, either been before as in the previous day or before during the revision, we defined DNA and RNA strand. So that part is very easy because if you understand what the DNA strand is and you can describe to me very clearly. And you also understand on the RNA strand is and	

you can describe it very clearly, then it should be very easy for you to state the differences so I did not feel like I had to put any input in that part, because I felt like that was the very moment where I could see the understanding, and where I could see if they really knew the work, did they really fully understand what a DNA strand is or what an RNA strand was strength was. So, yeah, that was the main reason I just I just felt like it was perfect for them to partake because it is a build-up also. It is not like I was teaching a different thing. So, that is why I did not feel the need to say anything. So, going back to also giving them an opportunity to talk. I always try to talk when I have to in a classroom. And when I do not have to, I give them an opportunity. *Number 11* So firstly, I did explain why use the PowerPoint, it is more attention drawing, I guess. What else did I say, I used the PowerPoint. I used the picture as a summary, its' purpose served as a summary that analogy. So, I really like using analogies because sometimes when you say something it is not easy to understand but when you compare it to something similar, it is easier to understand. So, I used that picture as an analogy because sometimes it is just easier to understand when you relate it to something you understand. So people are or everyone has experienced or seen	

someone being served, or how somebody is served in the restaurant or how just the restaurant works, if you have never experienced that, you have seen movies or something right, so that's why I use that analogy specifically, just so that they have a clearer sense and they can truly understand why protein synthesis has occurred. And then there was the video but the video was in the previous lesson, I don't think I should explain that for this lesson. So, I will not. And then there was the game charades, I explained in the previous answer, I wanted them to also hear how their classmates describe or explain certain words, instead of putting forth a vocab test. So, maybe I did not really know how to express or explain what this word is however if I hear what a classmate of mine said I'm like oh, actually that is not very much, easy way to say it and usually it is very easy to remember what other people say like in games and things like that, compared to just a lecture. So that is why, and you said would I use these strategies in the traditional class? So, obviously a traditional class does not have like computer probably not even electricity, I don't know, maybe. But like, no projection. So, the PowerPoint will definitely be out of the picture. But I would instead of, because my PowerPoint presentation also included certain figures that I would have drawn. So, if all I have is	

a chalkboard and then I will just try to draw it actually going back to my experience in high school when we were learning about protein synthesis my teacher actually drew a big cell on the board and just showed the process step by step and I think that was awesome, so I probably do the same thing. And the nice thing is that she used different colours. So, it is not just the green Blackboard and the white chalk, she used different chalks, which means basically she used my PowerPoint colourful presentation, and in a more traditional way, she used the chalk and stuff. So yeah, I think those. Sorry I forgot your question, but yeah, those are the strategies I used and that is how I would use them. And yeah, in a traditional class the charades game, I think, Can I use the charades game in a traditional class? Remember I said initially that I would usually use a vocab test, so I think the vocab test is a more traditional way, but just to make it a bit more modern, or a bit more exciting, I came up with it from a game perspective. And I would pay attention to how learners are describing certain things and if they do not describe in a certain way, or a way that I wanted them to, then I would correct them, if not immediately after. So there are definitely even more ways to have games in a traditional class, games whereby learners can write things on paper, things like that so I would definitely think of more	

methods but definitely the more traditional way is just writing a test, vocab test. *Number 12* By the way, this is just a disclaimer, I am not saying that biodiversity is more difficult. I am just saying I am less interested in it, it is like, you know how in pure maths there was probability. I really hated that session because I did not understand why I have to calculate the probability of something happening, you know, because I mean whatever it is just a probability, it does not even mean it will go with the probability you expect, Anyway, yeah I really do not know this is back to question eight, I do not know what I found difficult. *Number 13* Question six was real learning occurring because I was interacting with my learners? I think firstly, it is important to note that my interaction with the learners is not just for their pleasure or their enjoyment of the lesson, but when I interact a certain way I want them to enjoy the lesson, however I am also taking certain information, and seeing where learners understand where they do not understand and how I can, in the moment I am seeing if a learner does not understand this, change it. How can I rephrase it so that they understand the perfect way so I would say it is quite unfortunate that I cannot say all my learners were learning. You know, I cannot really	

proudly say all my learners were learning. However, I feel a majority of the learners could have said they took something out. Not looking at the lessons that we had to present during that time because of the COVID-19 we were not in an actual class. During my practical's and currently where I am working, I actually do teach learners, and it is just so amazing how when we interact, maybe one learner makes like a very small mistake and then becomes shy and the whole classroom laughs and then they help him and they correct him or her, and things like that. And you can really see because I also have this habit whereby if someone got something wrong in the class, and they fixed it, when I meet up with them randomly during lunch time I will asked him the question. Hey, what is this again? And then he or she obviously in that moment will be nervous and think for like two seconds and will not be able to answer me. So, though, I feel like it just increased the chances of the majority of the learners that are being ignored. Would okay let me put this properly, whose learning styles are being ignored generally in a lecture type of classroom, usually the learners that really pay attention very well are those who love audio or those who prefer listening. However, there are those who also like talking. And in my classroom, I feel like I ensure that those who like talking and those	

who prefer listening are covered more, so I cannot say 100% learning was happening because you never know, some of these learners they just look at you and they are not doing anything that the listening, however, they are just thinking about some random thing. So I cannot fully confidently say yes but I feel like I if I am interacting with them and if I see the evidence of what I am seeing in their books, and if I can randomly meet up with them on a random day random time and ask them a question, and even though they struggle a bit to answer it eventually everything we speak about, they will remember it. *Number 14* What did I find as difficult when preparing for the lesson? I feel like I could have found more problems if I was teaching a subject that I did not really truly enjoy like for example, I am more of like the microbiology type of teacher, you know, but if you give me all diversity and no offence to people that like that part of life science but then part is just, I'm just so not interested in it, so I feel like the most difficult part would have been like to push myself to actually be creative. But what did I find as difficult in this one? You said in my planning, right? I do not know. I do not remember. I really wish I had received these questions like soon after I did the planning and the presentation because I do not	

remember. And I am pretty sure there must have been something that just challenged me a bit, you know, there always is. I do not remember. I actually really enjoyed preparing for this lesson and also it is difficult for me to say what I found difficult because I had to choose the subject and the lesson, and what I was going to teach so I just chose immediately what I wanted to talk about. So, it is very difficult for me to think about what difficult thing, I had found. I feel like however if maybe I was given diversity biodiversity, it would have been a different story. *Number 15* Okay, question number eight I think, about the vocab tests. Okay so now I know which lesson we are talking about; this is lesson two of the protein synthesis. Okay, so in that lesson, I explained that they did well in the test. Yes, they did. And I was not going to give them another one. Yes. So, my plan is, you know, rewarding but in a way that everyone receives the reward, you know, so, maybe this is just me, an average learner speaking. One minute I can seem like a very smart student and the next minute I can seem like not a smart student. Sometimes learners have really like learning boundaries that even us teachers really cannot break. And the system that we live in or the educational system is in, is that you only get a reward when you are the best. And I just	

don't like that because I feel like you should be rewarded when you do your best, you know, because you can never compare another person to me they probably had a different foundation where they had an advantage compared to me and so forth. So, in, us not doing the vocab test, the reward was it was now a fun game, you know, and everyone was being rewarded. At the same time. Because this is something that everyone could enjoy. So, yeah, this thing of top 10 and so forth, like, I'm very happy for students, sometimes even me, that get top 10 and get golden key, and so forth. However, I really just don't like it I don't like it at all, so I prefer that everyone is rewarded when they do their best, so I had imagined and created the scenario that my learner's maybe got their highest average, since all these vocab tests took place. So since now they got the highest you know what let us change things up a bit and let us make it a bit fun. That means, now I am also showing them as a classroom that I trust them, that they will make their own efforts to actually study certain words that they do not understand and they do not have to be pushed by these tests to understand. So yeah, that was the point of that reward. And the word was the charades game, just to make a team. *Number 16*	

So, I just want to make sure I understand this question properly. You are saying, in the lesson my peer students were the learners, right? How did it impact the lesson and how did it impact the planning? Sorry, just to make sure you understand how did them acting as the learners impact my planning and learning. I think that is what you are trying to say. But then let me answer to my best ability you can correct me whenever. So, how did it impact my lesson? I really personally honestly did not like the fact that my peers were the ones who were acting as learners I did not like it at all. Because, I mean they know the work, and I feel like they were obliged to just go with the lesson and participate because it was also for their marks, it is not the same. It is really not the same at all. I really would have preferred to have it in an actual classroom whereby everything that I had planned, I could see it going the way I had planned it, you know, just see the success the build-up and so forth. It was more boring, because they are my peers, they know to keep quiet, they just keep quiet, you know, they do not disrupt, if they disrupt you can see it is just artificial, they are acting. It was really more boring because I really love in my actual class were when they disrupt, my learners are really just so funny. When they disrupt, they would say something funny that I would	

even love, you know, and when they disrupt, they never really or hardly disrupt to be disrespectful. They always disrupt because maybe they have been shocked because I said a word that they do not understand and they act like what the hell is that and then, you know, those cute moments that make teaching fun I guess I really wanted that. So, the lesson. The mere fact that my peers were there acting as learners, it was pretty boring, from my point of view and yeah it just felt like I was doing it for marks, it did not feel like the real thing, like it was fun, or anything like that. And how did it impact my planning? It did not impact my panning at all because when I was planning, I was really acting like I was going to teach an actual classroom at Soweto or wherever. So, my planning was not impacted by the fact that they were there at all so I would have definitely use the exact same strategies as I did with them in an actual classroom so that did not impact my learning my planning at all. *Number 17* So sorry that was question 10, I think this is question eleven. So, when planning to circle back to question ten, I really did not find anything difficult with regards to the information that I should give now it is hitting me. Since I have a degree in science, and I studied these things like throughout. I know from like a deeper perspective	

compared to the textbook and the textbook really looks at like the basics. Like when you learn about photosynthesis in the textbook, you really do not even truly understand which proteins are needed for what whereby in varsity, I knew that this protein was needed for this so photosynthesis had to occur, so that this person was released when it was released went back to the location it was needed. So, I think initially, like when I was first introduced to lesson planning. I always found it like very difficult to say how much information should I add to the lesson and that was sorted because we have the CAPS document which by the way is very helpful in my defence, some people find it limiting. It is really helpful for someone like me who has a degree and you want to specialize on something because you know what not to touch on and I think when teaching, this is my difficulty, when teaching and the learner is like but I do not understand, why must protein synthesis happen? And you say because we need proteins. But what do we need proteins for? And then you have to give an example, let us say you cut yourself wit something and then now you are losing blood you are losing this right, so your body has to create certain proteins find a way to ensure that that place is fine, you know you just come up with like, I think that is just the difficult part, the part whereby I have to,	

when they ask questions beyond the textbook, and I have to know how to explain because if I were to explain this then I confuse them a bit more and I will say something that will trigger questions from other learners. But obviously in that artificial classroom that is not something I will experience because everyone is just so obedient and or just trying to act like a typical class which was difficult, I guess. So the difficulty would have been in an actual classroom if I was asked questions and now I would have to think how can I explain this in a simpler way or where can I stop or what information can I omit when I am explaining certain information. *Number 18* Yes, definitely, there are some misconceptions. So, like I know there is the rRNA that RNA confuses a lot of learners. And with regards to, because we know that rRNA is a building block for ribosome right. So it confuses other learners in the sense of how it is placed and, but obviously this is coming from my imagination, not from the classroom as I said it's very difficult because they were not actual learners but I know that when I was planning rRNA can create a lot of misconceptions with regards to how it is actually formed. What else can cause a misconception? Yeah, there is also like this misconception of DNA. I think at some	

point I heard that learners used to think that DNA leaves the nucleus. And maybe it meets mRNA and that mRNA is produced outside the nucleus. Yeah, I think that was a misconception. And what else. I do not remember if it is in this lesson. No, no, I do not remember if in this lesson I have to explain, or if I did explain that. When I mRNA is produced the DNA strand closes again so, that can be another misconception learners may think that the DNA, once those bonds break between the nitrogenous bases, then the DNA is open now and forevermore. So that could be a misconception. What else, let me think. How the protein is formed of folds can also be a misconception like how does it always fold? How does it fold? And, yeah, that is one of those questions I would not want to be asked, because there is, I know like from a biochemistry, like explanation whereby it is just a bit too much because even biochemists are like they do not know how but it is the simplest rate and forms very quickly, and they calculated the possibilities of how it could have formed and how is it that it is formed this way, you know, that's just another admin. So, if there is also the folding that is another one. There was also a misunderstanding about the ribosome like which one moves during translation, is it the ribosome, or is it the mRNA strand. That is another misconception. So, there can be	

many misconceptions and that is why, when teaching I really liked incorporating videos, I know for this specific reason I did not. But the previous one I did, I really just because in the previous one, they explained protein synthesis as a process and then we went to it in detail in this lesson. So I really like using videos because I feel like if learners really see that I'm explaining the same thing as what you should be explaining obviously finding most relevant video, then they can understand that okay that means it does not happen like this, or maybe because it happens maybe I do not explain a very crucial point of a learner and the learner is always thinking but what about this and then I show them a video and then their question is answered. So, I really prefer doing it like that. Videos are very important. So, there are many misconceptions is very easy for misconceptions to appear. *Number 19* Last question, what would I change if I were to teach it again? It is so difficult for me to answer this question because I did not teach it in an actual classroom. I would have really wanted that raw learner and those learners who react when confused, their faces react. Because most of my classmates, my peers, they were like, just looking at me. There was no interest. And many of them were worried about their lessons so you could see some of them like fidgeting, going	

through what they are going to teach so even though okay, there were those few that actually paid attention and looked kind of interested, it is not the same. So, I feel like if I was in a typical school environment, I would know what I would want to change, but it is very difficult to know from that specifically because it does not feel real. I would have wanted that actual classroom experience for it to feel real. I still feel like I did not teach it and I will not lie, even right now, I want to teach it, I want to teach this topic the way I had planned it. To see, well, what could I change? What could I improve on what went wrong? What should I use in all, if not all in majority or many of my other classes? So, it is very difficult for me to answer this question, it is really difficult with that classroom. You know, it is so difficult, like I am really trying to think. But would I have changed? Yeah, because anyway, again my learning or sorry my teaching methods do not depend on me, it is not about me and how comfortable or uncomfortable I am, you know, it depends on the learners. Sometimes maybe the strategy does not work on them, then I have to come up with a new one. So, it is not about what makes me comfortable. So that is why it is very difficult for me to see what I can change it only depends on them. So yeah.	