TEACHERS' PERCEPTIONS OF INQUIRY BASED LEARNING IN TEACHING GRADE 12 LIFE SCIENCES: A CASE STUDY

by

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DECLARATION

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Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality-checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

25th May 2023

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SIGNATURE DATE

ABSTRACT

Inquiry-Based Learning (IBL) is considered a preferable teaching approach to the traditional teacher-centred method. This study aimed to understand teachers' perceptions of IBL, its effectiveness, benefits, and the challenges impeding its effective implementation. Adopting a constructivist viewpoint, qualitative research methods were used, including interviews with Grade 12 Life Sciences teachers and learners, classroom observations, and document reviews in South African schools.

The findings showed that teachers understood IBL as an effective learner-centred approach to teaching and learning and desired more training in the approach. IBL was found to be effective in facilitating Grade 12 Life Sciences topics, helping teachers develop pedagogical skills and fostering positive attitudes. Learners responded positively to IBL, actively participating and gaining scientific knowledge and skills. The flexibility of IBL allowed for the integration of remedial actions to overcome implementation challenges.

The study revealed the need to provide support for teachers to become effective facilitators, allocate necessary resources, and promote IBL to improve learners' enrolment, retention, and examinations' results. The research contributes to knowledge and identifies opportunities for further studies.

KEY TERMS

Teachers' perceptions; Inquiry-based learning; Effectiveness and ineffectiveness; Implementation; Life Sciences; Grade 12 Life Sciences learners; Learner-centred; Teacher-centred; Scientific inquiry; Science process skills; Inquiry cycle; Differentiated types of inquiry.

LIST OF ABBREVIATIONS AND ACRONYMS

CAPS	Curriculum and Assessment Policy Statement
CEDU	College of Education
CPDF	Classroom Practice Diagnostic Framework
DoBE	Department of Basic Education
DoE	Department of Education
DSF	Division of Student Funding
ERC	Ethics Review Committee
FET	Further Education and Training
G12LS	Grade 12 Life Sciences
G12LSLs	Grade 12 Life Sciences Learners
G12LSTs	Grade 12 Life Sciences Teachers
IBL	Inquiry-Based Learning
ICT	Information and Communication Technology
NQF	National Qualifications Framework
NRC	National Research Council
NS	Natural Science
PK	Pedagogical Knowledge
PTA	Parents-Teachers-Association
SCK	Subject Content Knowledge
SEBD	Social Emotional and Behavioral Difficulties
SGB	School Governing Body
SPS	Science Process Skills
STEM	Science, Technology, Engineering and Mathematics
UNCTAD	United Nations Conference on Trade and Development
Unisa	University of South Africa
ZPD	Zone of Proximal Development

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CHAPTER 1: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

An Inquiry-Based Learning (IBL) approach involves all related activities done repeatedly in a challenging but supportive learning environment to continually empower, engage, and develop learners' scientific and critical thinking skills, initiatives, critical judgment, and creativity to improve learning and the acquisition of knowledge, such that learners develop the culture of a lifelong learner (Lawson, 2010).

The teacher's understanding of IBL, attitudes towards the approach, and the teaching and learning environment, remain some of the major factors to be examined to identify reasons for the effectiveness and ineffectiveness of the IBL approach. Essential to explore teachers' perceptions and attitudes towards the IBL approach to teaching and learning of Grade 12 Life Sciences (G12LS), and also, how ineffective implementation of the IBL approach influences the academic performance, enrolment, and retention rates and dropout among Life Sciences and other science learners (Weybright et al., 2017; Murray, 2014; Hartnack, 2017).

1.2 BACKGROUND OF THE RESEARCH STUDY

Implementation of IBL practices in the classroom to ensure the impartation of scientific knowledge will not be achievable if the Life Sciences teacher takes total control of teaching and learning. Weimer (2013) questioned the idea of teachers whose overwhelming teacher-centred activities of delivering the subject content, leading the discussions, previewing, and reviewing the materials, offering examples, asking, and answering most of the questions, deprive learners of the real opportunity to participate and learn meaningfully during the teaching and learning process.

It could be deduced from Weimer's statement, that her support for the IBL approach in attaining the main objectives of the learner-centred approach is non-negotiable. Ahmed (2013) emphasises that the role of the teacher should be more of a facilitator and a guide rather than that of an instructor. The emphasis on a facilitator is a learner-centred approach, and the indication of an instructor is teacher-centred. Ahmed (2013) also argued that the learner-centred method helps learners be more autonomous, increases learner participation and encourages them to construct their own learning experiences. To meaningfully impart scientific knowledge during the teaching and learning process, learners should be allowed to participate actively by engaging them with more learning activities during the learning process. It is therefore inevitable that there should be a deviation from traditional teaching methods to achieve the gains of the teaching and learning of G12LS's topics.

In the South African context, the curriculum defined 'Life Sciences' as the scientific study of living things from molecular level to their interactions with one another and their environments [Department of Basic Education (DoBE), 2011]. According to the Curriculum and Assessment Policy Statement (CAPS), Life Sciences is a subject that is taught to learners in Grades 10, 11, and 12, and because of its natural phenomena, science apparatuses are needed to effectively facilitate the teaching and learning of the subject. The Life Sciences teacher as a facilitator is expected to provide the learners with relevant resources or materials that will actively engage them in the inquiry of real questions, and stimulating and enhancing learning. Making the learning of science interesting is one of the critical aspects of Life Sciences teachers' responsibilities. The CAPS document emphasises a systematic approach to scientific inquiry. The systematic approach includes formulating hypotheses and carrying out of investigations and experiments as objectively as possible to test the hypotheses (DoBE, 2011, p. 8). However, this involves the active participation of learners in teaching and learning.

1.3 PROBLEM STATEMENT

The DoBE estimated dropout rates of between 42 – 56 percent of children from grades R – 12 (Matric College, 2022). The United Nations International Children's Education Fund (UNICEF) affirms that the South African annual dropout rate increased from an approximate of 250,000 to 750,000 children due to the COVID-19 pandemic. This is a worrying 200 percent increase compared to the 250,000 dropout rate of 2019 (Matric College, 2022). Four out of one hundred learners enrolled in Grade one to Grade 12, attained four-year degree qualification, and two completed their education with lesser qualifications (Dyomfana, 2022). Most persons aged 20 years were not in education, 46.3 percent of learners who were years old, and three out of 10 learners aged 18 years, dropped out of school (Department of Statistics South Africa, 2021).

Murray (2014) emphasises the “poor performance of learners entering South Africa’s higher education system” leading to a poor percentage of learners who graduate within the minimum required time for the degree enrolled. According to Hartnack (2017), the push-out factors are influences within the school responsible for dropout. Some teaching and learning approaches among others are some of the push-out factors, Grade 12 Life Sciences learners (G12LSLs) are also affected by these problems (Ahmed, 2013; Duckworth, 2009). Minimising or eliminating this dropout becomes necessary. One of the main causes of this problem is the uninteresting teacher-centred approach. There is a need for a learner-centred approach to increase learners’ participation in the learning process and thereby motivate them to increase their interest to becoming lifelong learners (Trna, Trnova, & Sibor, 2012).

The methods used by teachers in the teaching and learning processes of Life Sciences could either make or mar the overall objectives set before the learners. The South African school curriculum does not prescribe the exact instructional strategies or methodologies, instead, it gives the teachers the flexibility to explore and take advantage of their local circumstances, including the availability of resources (DoBE, 2011). The CAPS document advocates the teaching of Life Sciences to be organised according to four knowledge strands, with the knowledge strands being interdependently covered for a period of three years in the Further Education and Training (FET) phase. These knowledge strands are:

1. Life at the Molecular, Cellular and Tissue Level,
2. Life Processes in Plants and Animals,
3. Environmental Studies, and
4. Diversity, Change and Continuity.

The curriculum emphasises the importance for Life Sciences’ teachers to help learners recognise the links between related topics as it will enable them to construct scientific knowledge and have an in-depth understanding of nature and the interconnectedness of the natural world.

Sonmark et al (2017) emphasise the clear connection between the teachers' pedagogical knowledge (PK) and the learners' overall learning success. The lack of subject content knowledge (SCK) and pedagogical knowledge, poor creative teaching skills of the Life Sciences teacher may be the underlying factors impeding the meaningful learning of Life Sciences. In addition, the unavailability and inaccessibility of learning resources or facilities relevant to effective teaching and learning of Life Sciences further aggravate IBL implementation (Olfos, Goldrine, & Estrella, 2014; Onwu & Stoffels, 2005; Anderson, 2002). Consequently, it may be near impossible for learners to identify the links among the knowledge strands and to understand the natural world with the abovementioned challenges in place.

The classroom atmosphere should prepare the mind of the Life Sciences' learners, to be filled with curiosity to explore the natural world. Čeretková, Melušová, and Šunderlík (2013) argue that the classroom atmosphere is the key feature in the efficient implementation of IBL, it should be viewed as a shared sense of ownership and purpose where every activity, including mistake, is unarguably part of the learning process. Making the teaching and learning of Life Sciences fun and exciting is another aspect that must not be ignored by teachers. Once learners lose interest in learning, the dropout rate will certainly increase. However, research indicates that teachers form individual perceptions of inquiry and use them as referents for science teaching (Mokiwa, 2014), and calls for further research on teachers' perceptions of IBL in various teaching contexts. Perceptions are taken here as teachers' views and ideas of the processes and products of science knowledge and how learners acquire them. Therefore, in response to this call, the study explores teachers' perceptions of IBL approach to teaching and learning of G12LS.

1.4 THE RESEARCH AIM AND OBJECTIVES

The aim of this research study is to gain an understanding of teachers' perceptions towards the use of the IBL approach to teaching and learning of G12LS and to examine reasons for IBL's successful implementation and the factors responsible for its non-implementation. The following research objectives were identified:

1. Establish Grade 12 Life Sciences' teachers' (G12LSTs') understanding of IBL,
2. Understand the significance of the IBL approach to G12LSLs' participation in the teaching and learning process, and
3. Ascertain the reasons for IBL's implementation and non-implementation in teaching the G12LS.

1.5 THE RESEARCH QUESTIONS

The research study was guided by the main research question and the sub-research questions that emanated from the research aim and objectives:

1.5.1 Main research question

What is the Grade 12 Life Sciences teachers' understanding of the IBL approach in attaining the objectives of teaching and learning of Grade 12 Life Sciences?

1.5.2 Sub-research questions

i. How do G12LSTs perceive the IBL approach to teaching Life Sciences topics?
ii. How does the implementation of IBL impact on G12LSLs' academic achievement? and
iii. Why is IBL implementable or impracticable in teaching the Grade 12 Life Sciences topics?

1.6 SIGNIFICANCE OF THE STUDY

The information that will be obtained from this research findings will be significant in providing support for not only Life Sciences teachers, but also other science subjects' teachers to become effective facilitators rather than instructors. Furthermore, improve teaching and learning of science subjects and facilitate the execution of scientific tasks. It could be anticipated that IBL should help to minimise or eliminate dropout among science learners by creating an enabling environment that will stimulate scientific curiosity in learners and motivate them to learn.

Effective implementation of the IBL approach to teaching and learning is envisaged to impart scientific skills and knowledge to learners. It is imperative to increase learners' classroom interaction and participation to learn meaningfully. In addition, it is intended to encourage learners to become critical thinkers and researchers who learn by means of sourcing and discovering relevant information, and generating ideas to solve scientific problems through alternative ways.

The importance of moving away from teacher-centred instruction to a more learner-centred approach to teaching and learning Life Sciences cannot be overemphasised (Weimer, 2013). It is very important to look for a lasting solution to the increasing rate of dropout among science learners. Furthermore, to increase science learners' yearly enrolment and steadily improve the pass rate of science subjects. Increasing the number of science courses graduates who are also competent and employable is one of the major underlying reasons for this work.

The research findings and recommendations are intended to contribute meaningfully to the already existing wealth of knowledge from the works of other researchers and to serve as relevant sources of information for further research. Improving science education through an IBL-oriented science curriculum is very crucial for the development of science and technology.

1.7 CONCEPTUAL FRAMEWORK

A conceptual framework in research is that which is related to some abstract idea(s) or theory, it is generally used by philosophers, researchers, and thinkers to develop new concepts or to reinterpret existing ones (Kothari, 2004). The researcher's decision to adopt a conceptual framework in providing support for the study was to explore the different participants' constructive views and their understanding of the IBL phenomenon. Science process skills, types of inquiry tasks, phases of inquiry, and epistemic development are some of the underlying ideas intended to drive the main concept of the research work. However, the research would be based on the constructivism theory of generating knowledge and learning, this approach is believed to help students build knowledge and acquire scientific skills continuously. The constructivist design focuses on the perspectives, feelings, and beliefs of the participants (McMillan & Schumacher, 2014). The use of insightful interview questions will assist in gathering the desired and authentic data from the participants as it relates to their experiences of IBL.

1.8 DEFINITIONS OF KEY TERMS AND CONCEPTS

The following are the definitions of key terms within the context of the study:

- **Teachers' perceptions:** Teachers' perceptions within the context of this research study refer to teachers' views and ideas of the processes and products of science knowledge and how learners acquire them (Mokiwa, 2014). In addition, it includes teachers' attitudes towards the use of the IBL approach in ensuring the transfer of scientific knowledge to their learners.
- **Inquiry-based learning:** This is a learner-centred teaching approach that reflects the constructivist philosophy of teaching where learners constantly construct new knowledge using prior scientific knowledge and taking responsibility for their learning experiences. Hofer, Abels, and Lembens (2018) consider IBL activities to be essential elements of science education, these learners' activities form IBL classroom inquiry – critical thinking, logical or scientific reasoning, investigating, experimenting among others, to develop scientific knowledge. The researcher considered IBL as the main area of focus in the study, examining areas of IBL features or characteristics as the driving force to achieving the main objectives of the research work.
- **Effectiveness and ineffectiveness:** According to the Macmillan Dictionary (2020), effectiveness is "the degree to which something works well and produces the result that was intended". Effectiveness implies the degree to which the objectives of using IBL approach were achieved, the extent to which the characteristics of IBL were integrated to teaching and learning of G12LS.

The level to which IBL implementation yields expected results. Ineffectiveness in this context implies the extent to which certain factors impede the effectiveness of the IBL approach.

- **Implementation:** According to Merriam-Webster Dictionary (2020), “implementation is the process of making something active or effective, an act or instance of implementing something”. Implementation in this research implies making the IBL approach to the teaching of G12LS active or effective.
- **Life Sciences:** According to DoBE (2011), “Life Sciences is the study of life at various levels of organization…” it is one of the science instructional offerings within the FET phase, it is taught to Grades 10, 11, and 12 learners in South Africa. Life Sciences as an instructional offering provides learners with adequate knowledge and skills necessary to further their studies in the university education in any of a variety of sub-disciplines like Biochemistry, Biotechnology, Botany, Microbiology, Genetics, and Zoology among others.
- **Grade 12 Life Sciences learners:** Are learners in the highest level or grade at secondary school in the FET phase in South Africa who chose Life Sciences as one of their subjects. Learners in Grade 12 need to pass their matriculation examination which is rated by the National Qualification Framework (NQF) as NQF level 4, the matriculation qualification is an entry requirement to university education (DoBE, 2011).
- **Learner-centred:** Teaching style in which learners play active roles in the teaching and learning process. Guido (2017) describes learner-centred as the teaching method that prioritices learners’ active participation in science inquiry activities, allowing learners to construct their own learning experiences. Learners become more autonomous in the learner-centred approach to teaching and learning.
- **Teacher-centred:** Teaching style in which teachers play active roles in the teaching and learning process. Ahmed (2013) asserts that teacher-centred approach deprives learners of control over their own learning, it has been replaced by the learner-centred approach in recent times. Duckworth (2009)

argues that a teacher-centred approach will deny learners the opportunity to develop scientific and critical thinking skills, acquisition of scientific knowledge will be impeded. Unlike the learner-centred approach which is time-consuming, the teacher-centred approach is highly time-efficient (Hotchkiss & Fleron, 2014; Coe, Aloisi, Higgins, & Major, 2014; Ramnarain & Hlatswayo, 2018).

- **Scientific inquiry:** Brunsell (2010), the fundamental importance of teaching science is through scientific inquiry, learners' understanding of Life Sciences requires the use of scientific evidence to create logical explanations of natural phenomena which is basic to scientific inquiry. The study of Life Sciences cannot be done in isolation, this study viewed scientific inquiry as a vital aspect in ensuring meaningful teaching and learning of Life Sciences. Inquiry, scientific inquiry, and IBL convey similar or the same concepts in this research and can be used interchangeably.
- **Science process skills:** Science Process Skills (SPS) facilitate learning of sciences by emphasising the importance of the learning process, this is evidenced in learners' active participation, motivation, creativity, and the development of positive attitude towards taking responsibility for their learning experiences (Dogan & Kunt, 2016; Kurniawan, Maison, Darmaji, Indrawati, & Astalini, 2019). SPS by implication enables a friendly learning process that encourages learners to regularly reflect on their learning or inquiry activities and in turn increase their capacity to retain acquired scientific skills and knowledge.
- **Inquiry cycle:** These are the different phases in the scientific process that guide learners through stages of introduction, exploration, designing the investigation, conducting the investigation, conclusion, presentation, or communication, and deepening or broadening, to form an inquiry cycle through their connections (Van Uum, Verhoeff, & Peeters, 2016). It is imperative to arrange the phases of the inquiry cycle from the viewpoint of the learners as they are required to make connections as they progress through phases of the

inquiry cycle to accomplish a scientific task and formulate new questions or problems for further inquiry.

- **Differentiated types of inquiry:** These are the different types or levels of inquiry tasks used by teachers to effectively implement the IBL approach to teaching and learning, they include demonstrated, structured, guided, coupled, and self-directed or open inquiry types or levels (Llewellyn, 2011). This is important for this research study because it shows how learners become more autonomous in the learning process as they successively move from less advance inquiry tasks to more advance tasks or levels.

1.9 THE OUTLINE OF THE STUDY

Chapter 1: Introduction and Background of the Study

This chapter gave the general orientation of the research study, problem statement, aim and objectives, and the research questions. Moreover, the significance of the study, the conceptual framework, the outline of the study, and the definitions of key terms and concepts within the context of the research study were included.

Chapter 2: Literature Review

In chapter two, the researcher conducted an extensive review of the literature on issues pertaining to teachers' understanding and perceptions of IBL. The study examined the benefits of IBL to the teachers and their learners, its effectiveness, and the reasons for its ineffectiveness. In addition, it discussed the conceptual framework of the research study.

Chapter 3: Research Methodology

In this chapter, the researcher gave details of the research design and methods used for gathering and analysing data to achieve the set objectives of the research study, it focused on the appropriate participants as the rich sources of information using a case study through a qualitative approach.

Chapter 4: Data Presentation, Analysis and Findings

Chapter four covered the analysis of interviews with teachers and learners, classroom lesson observations, and other data retrieved from the selected schools. It presented the thematic report derived from the interview transcripts supported by findings from the lesson observations and document reviewed.

Chapter 5: Summary, Conclusions and Recommendations

This chapter gave the findings, conclusions, and limitations based on the analysis and presentation in the preceding chapter. It also included recommendations from the study and it identified opportunities for further research studies according to the research findings.

1.10 CHAPTER SUMMARY

This chapter introduced the research topic and gave the background of the research study. It further explained the problem statement and outlined the aim and objectives of the research and the research questions.

In Chapter Two, the researcher conducted an extensive literature review covering aspects of the focus of the research study.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The overview of the research study was provided in chapter one, it explained what the study aimed to achieve. In this chapter, a report is provided of an extensive literature review conducted by the researcher in the aspects relating to the teachers' perceptions towards the IBL approach, and the effectiveness and ineffectiveness of IBL in teaching G12LS.

The theoretical literature reviewed included among others, the traditional teacher-centred approach compared with the IBL approach, types of inquiry in IBL tasks, the attitudes of teachers and learners towards the IBL approach, its effectiveness, and factors responsible for its ineffectiveness. It concluded by providing the conceptual framework that guided this study.

THE TEACHING OF LIFE SCIENCES: HISTORICAL PERSPECTIVE

The apartheid education system separated South Africans into different racial groups through its' racial policies (Moore, 2015). Moore further described how poor funding of some aspects of education in the country led to poor educational standards. Unavailability of educational resources and or facilities, and poor teachers' training impacted negatively on the teaching and learning of Life Sciences and other science subjects, especially for the country's marginalised racial groups (Khumalo, 2022). Certain racial groups were restricted from enrolling in specific disciplines which included science courses (Wills, 2011). The Reservation of the Separate Amenities Act of 1953 and the Bantu Education Act of 1953 made it impossible for the majority of the population to have access to some basic amenities which included quality education (Parow, 1953). The establishment of separate Universities for Black learners in 1959 was to strengthen the 1953 Acts (Bot, 1985). Under such a discriminatory system, science education could not inclusively progress.

From this historical period onwards, the IBL approach to teaching Life Sciences was negatively influenced due to the apartheid system of education. Marginalising the largest racial group through poor funding leads to a lack of educational resources and facilities, a lack of teachers' training, and restriction from enrolling in certain courses including Life sciences. Consequently, it has significantly contributed to the challenges that are still encountered today in science education.

The complexity of the apartheid education system, and its consequences, resulted in the slow progress made by South African learners in science education. However, this has changed since the transition from the system of apartheid education to the education system resulting from the 1994 first democratic election. All learners irrespective of age, gender, and/or race now have equal opportunities and access to quality education depending on their financial capability and/or the level of government's provisioning of educational amenities (Vally & Motala, 2022).

2.2 TEACHERS' PERCEPTIONS

Teachers' perceptions can be defined as teachers' reflections or understanding of a subject matter (Twahirwa, Ntivuguruzwa, Twizeyimana, & Nyirahagenimana, 2022). According to Elhanahy and Forawi (2019), teachers' perceptions can be described as teachers' understanding of the nature of a subject matter, where incorrect understanding can impede implementation. They further assert that the perceptions of teachers help to reveal aspects where teachers have needs and require support or professional training in order to achieve set objectives. However, this study adopts these definitions and describes teachers' perceptions as teachers' views, ideas, and understanding of a concept being discussed.

The effect of teachers' perceptions of IBL is very critical to achieving the objectives of teaching and learning science subjects (Abhinandan, 2020). Mukandayisenga, Opanga, and Nsengimana (2021) found that teachers perceive the integration of an IBL approach to teaching and learning science subjects as very effective and that it contributes significantly to learners' motivation to actively participate in learning and their learning success.

IBL is perceived by teachers as an ideal teaching and learning approach to improve science education, as it is effective for the acquisition of scientific skills, although it requires regular professional training for effective implementation (Twahirwa et al., 2022). Some teachers viewed school system as one of the factors that impede implementation of IBL, although they assert that IBL enable transfer of scientific knowledge through learners' active engagement in the teaching and learning process (Gholam, 2019). Successful implementation of IBL is highly dependent on teachers' positive attitudes towards the approach, beliefs about science and their educational background (Ramnarain & Hlatswayo, 2018; Gholam, 2019).

Teachers are expected to have the mindset of entrusting the learners with the responsibilities for their own learning experience (Gholam, 2019). Ramnarain and Hlatswayo (2018) found that Physical Sciences teachers from rural district in South Africa showed positive attitudes towards the use of IBL approach during teaching and learning. They further acknowledge its benefits in helping learners understand abstract scientific concepts. Despite the challenges encountered by the science teachers, they were still of the view that IBL approach contributed to learners' acquisition of scientific skills and that it further made the learners less reliance on the teachers and it enable meaningful learning irrespective of learners' cognitive capabilities (Sereynivorth, 2022).

2.3 THE TEACHING OF LIFE SCIENCES ACCORDING TO CAPS

The CAPS document emphasised the need for learners to study and learn Life Sciences to develop their scientific skills and to broaden their knowledge in areas such as:

- Understanding of biological concepts, science processes and theoretical knowledge,
- Becoming a critical thinker on scientific issues,
- Being scientifically informed on stem cell research, biotechnology, and other related aspects of science, and how the breakthrough helps to solve various human problems,

- Understanding the causes of deterioration of the environment through human activities and natural occurrences, and how the damage can be avoided or minimised,
- Attaining a considerable level of academic excellence to be able to make scientific judgments on what is scientifically correct and incorrect,
- Using their scientific knowledge to contribute meaningfully to the growth of South Africa in science and technology, and
- Having a deep understanding of the history of science in South Africa and to drawing up a clear direction for further scientific development (DoBE, 2011, p. 8-9).

It gave three broad subject-specific aims in Life Sciences. These subject-specific aims enable connections among the major cognitive levels as it is related to the reasons for studying Life Sciences. These are:

- Specific Aim 1, which relates to knowing the subject content (‘theory’),
- Specific Aim 2, which relates to doing science or practical work and investigations, and
- Specific Aim 3, which relates to understanding the applications of Life Sciences in everyday life, as well as understanding the history of scientific discoveries and the relationship between indigenous knowledge and science (DoBE, 2011, p. 13).

The CAPS document further states that it is a study of life at various levels of organisation, and it comprises sub-disciplines, or specialisations such as Biochemistry, Biotechnology, Microbiology, Genetics, Zoology, Botany, Entomology, Physiology (plant and animal), Anatomy (plant and animal), Morphology (plant and animal), Taxonomy (plant and animal), Environmental Studies, and Socio-biology (animal behaviour) (DoBE, 2011).

2.4 TEACHERS’ PERCEPTIONS AND THE IBL APPROACH

Teachers’ views, ideas, and understanding of IBL is very crucial to achieving the objectives of using a learner-centred approach to teaching and learning in science education. Ali (2014) views the learners engaged in IBL activities as being scientists who take scientific decisions and engage in scientific ways of learning. Implementation of IBL activities in the classroom requires the teacher’s positive attitude towards the approach. Teachers' perceptions of IBL are characterised by how the teachers structure the classroom environment, conduct informal and formal assessments, engage the learners, conduct their role in an IBL classroom, the role of the learners, and phases of the inquiry cycle (Mokiwa, 2014). These components will be discussed further in this chapter. The Life Sciences as a practical subject should be taught to learners in more practical ways (Sshana & Abulibdeh, 2020).

According to Coffman (2009), IBL is an approach that helps to engage learners in the learning process to enable them to gain a deeper understanding of the material being taught or investigated. It implements a constructivist approach so that learners interact with the content by constantly asking questions to enable the acquisition of scientific knowledge.

The IBL approach creates a learner-centred classroom environment designed to engage learners in hands-on activities and enables learners to investigate scientifically, thereby discovering solutions independently. Learners are guided using the materials or resources provided by the teacher but devise their own procedures for how to solve problems (Könings et al., 2021). They frequently ask themselves questions that help them formulate their own problems to investigate, which in turn leads them to the discovery of new concepts or even better alternatives on how to solve scientific problems.

The greater the learners' involvement in teaching and learning processes the greater the opportunity to learn. IBL is envisaged to help G12LSLs not only grasp scientific concepts and principles, but also take responsibility for their actions, and be self-directed during the learning process. Learners become better at science learning, gain confidence, and build their self-concepts when they are actively involved. IBL is expected to provide opportunities for learners' active involvement, leading to greater insights and to the development of their scientific skills.

The IBL approach helps to strengthen the learners' critical thinking skills as they rely on activities such as exploration, discussions, researching, investigating, and analysing of a particular subject. The IBL approach is flexible enough to accommodate all learners, irrespective of their different learning styles or how they prefer to learn. Rogers (1980) argues that learners are "… open to experience, new ways of seeing, new ways of being, new ideas and concepts" when using IBL. Learners may not reach their full potential were they not allowed through the IBL approach to experience and see new ways of generating ideas and concepts for solving scientific problems.

The quality and adequate SCK and the PK of the teacher play a significant role in determining the overall success of integrating the IBL approach into teaching and learning. This could also be linked to the learners' improvement and achievement in the learning of Life Sciences. However, effective teaching may not be realised without improving the quality of teachers' education and professional development. Guerriero (2017) argues that,

> *"…as professionals, teachers are expected to process and evaluate new knowledge relevant for their core professional practice and to regularly update their profession's knowledge base".*

The teaching profession is without a doubt a knowledge-rich profession. To meet the dynamic nature and the various demands of teaching, teachers are faced with the tasks of becoming learners themselves to draw from the available wealth of knowledge and to constantly remain relevant in the teaching profession. The learners are always at the receiving end. If a teacher is not equipped with relevant and adequate knowledge of the subject, the learners suffer.

Integration of the IBL approach in the teaching and learning of Life Sciences comes with a huge cost. Teaching and learning of science cannot be done in isolation. The G12LST may have relevant and adequate SCK and PK of science and yet fail to impart scientific knowledge to his or her learners if the school does not make provision for a well-equipped science laboratory and other science learning facilities or materials. Learners in under-resourced schools are already disadvantaged even before the start of teaching and learning, as the lack of relevant resources greatly inhibits the meaningful teaching and learning of Life Sciences (Onwu & Stoffels, 2005).

IBL cannot be separated from hands-on field activities and science excursions. Learners' perceptions of the natural or physical world they live in can increase their yearning for scientific knowledge. The search for such scientific knowledge is not only to be found within the four walls of the classroom. Coffman (2009) argues that learners can work collaboratively with teachers and other learners, as well as with experts around the world, to solve workable and at times complex problems. The inquiry-oriented activity links teachers, learners, and resources together so they can identify key questions from data collected around the world. The key idea is to work collaboratively using the internet to discuss and share documents and or information, utilising the science laboratory to engage in group tasks, and availing other resources with individuals within and outside of the classroom (Ragoonaden & Bordeleau, 2000).

It is not enough for schools to be adequately equipped with necessary science learning materials and facilities such as laboratories, the library, computers with internet facilities, etc., there should also be teacher-learner support to ensure that learners are able to perform scientific inquiry and make meaningful connections between what was taught in the classroom or laboratory and the natural world outside the classroom or laboratory.

In a rapidly changing world where most underdeveloped countries are left behind, increased knowledge of science and technology may be the solution such countries need to keep abreast of the dynamic nature of the world's development (World Social Report, 2020). The world's leading economies have from time to time reviewed their innovative policies to take advantage of the available opportunities in science, technology, and innovation as key aspects to developmental growth [United Nations Conference on Trade and Development (UNCTAD), 2021].

Da Motta and Albuquerque (2004) argue that there is unreliable data on research and development in less developed countries, unlike the leading economies of the world which possess well-organised data and a proper recording system in science and technology. The government's innovative policies geared towards improving school science and technology education might be the panacea for economic growth and advancement. A more IBL-oriented science curriculum will go a long way to achieving this objective. Science, technology, and innovation have been identified by UNCTAD (2021) as one of the aspects of interest to achieve sustainable development goals.

2.5 COMPARATIVE PERSPECTIVES – TRADITIONAL TEACHER-CENTRED AND IBL APPROACHES

Ramnarain and Hlatswayo (2018) assert that the introduction of an IBL approach is indicative of a paradigm shift from a traditional teacher-centred to a learner-centred approach to teaching and learning. They further argue that the increase in IBL research in recent times is a clear indication that the IBL approach has become the preferred modern method of teaching and learning.

Guido (2017) defines IBL as a learning and teaching method that prioritises learners' questions, ideas, and analyses. He also defined IBL from learner and teacher perspectives; from the learner's viewpoint, IBL focuses on investigating an open question or problem. Guido argues that an IBL approach should be evidence-based reasoning and creative problem-solving to reach a conclusion in which the learner is expected to defend or make a presentation on the findings.

He describes IBL from the teacher's point of view as a pedagogic approach used in moving or guiding learners beyond general curiosity into the realms of critical thinking and understanding. Learners must be encouraged to ask questions and be supported through the investigation process, understanding when to begin and how to structure an inquiry activity.

Hotchkiss and Fleron (2014) define IBL as classroom practices that include the following:

- The focus is problem solving either within or outside the classroom,
- Learner-centred activities dominate the majority of class time,
- Subject matter or task is designed to enable continuous learning with each inquiry-finding leading to another round of investigations,
- The teacher acts as the facilitator or a coach whose role in the teaching and learning process is decentralised,

- Learners play an active role in interacting, working collaboratively and taking responsibility for their learning experiences. Their activities have a direct impact on the amount of class time spent on learning, and
- Learners' use of reflection and active communication either in verbal or written form enables the development of new modes of thought, new learning strategies, and new conceptual patterns.

Mallari (2020) states that IBL provides the greatest promise in facilitating learning activities towards achieving the goal of science teaching for the 21st century. Unlike the traditional teacher-centred approach which emphasises direct instruction, IBL is particularly used to develop learners' scientific literacy.

The traditional teaching style, also known as teacher-centred instruction, is described by Ahmed (2013) as a teaching and learning approach in which learners become passive participants, who receive teachers' knowledge and wisdom. Decisions about curriculum, topics or subject matter, classroom activities, and the form of assessments are exclusively made by the teacher. Learners cannot take responsibility for their learning experiences.

Resilient Educator (2020) states that in the teacher-centred approach, learners work alone, which discourages collaboration during the learning process, and learners exclusively listen and put all their focus on the teacher. Learners' communication skills may become stunted due to lack of collaboration which may lead to boredom and an uninteresting learning process as they cannot express themselves, ask questions, and take responsibility for their learning experiences.

A teacher-centred approach supports the teacher in taking over the work or learning activities that legitimately belong to the learners. When this happens, further learning outside of the classroom becomes near impossible (Duckworth, 2009). A teacher-centred approach prioritises teaching (how teachers transmit Knowledge) over learning (how learners develop critical and problem-solving skills), it is vice-versa in the IBL approach.

Teacher-centred learning is theoretically derived from a direct instruction philosophy of teaching and learning (Eltanahy & Forawi, 2019). In a teacher-centred approach, learners are told by the teacher the concept or skill to be learnt and are expected to follow instructional activities designed to make them learn in a predetermined way (Direct Instruction Teaching Method: Definition, Examples & Strategies, 2015). Direct instruction or predetermined ways of teaching and learning encourages rote-learning and thereby discourages learners from developing scientific skills.

Siahaan, Suryani, Kaniawati, Suhendi, and Samsudin (2017) argue that some teachers used a teacher-centred approach because of time constrains so as to cover the syllabus, as the science curriculum did not make sufficient time to effectively implement an IBL approach which demands more time for practicals, demonstrations, and science inquiries. These teachers are more concerned about the objective of completing the syllabus or curriculum rather than achieving the objective of empowering learners through meaningful teaching and learning.

In whichever kind of activity or subject matter the teacher decides to use, an IBL approach allows learners to develop unique strategies for solving open questions (Guido, 2017). A teacher-centred approach will not be effective in dealing with open questions.

Duran and Dökme (2016) compare traditional teacher-centred teaching with inquiry-based teaching in table 2.1 below:

Table 2.1: Tabular Comparison between Teacher-Centred and IBL Approaches

Comparison of Traditional Teacher-Centred Teaching with Inquiry-Based Teaching		
	Traditional Teacher-Centred Teaching	**Inquiry-Based Teaching**
Teacher	Provide information, present principles, concepts, and generalisations.	Guide, counsellor, and allows for divergent thinking.
Learner	Passive receiver of information.	Solves problems by following scientific stages.
Area of interest	Related to teaching of phenomena, skills, and concepts. Focuses on what to teach.	Related to selection of the method suitable for solving the problem. Focuses on what and how to teach.

Learning environment	Class, teacher and standard classroom tools, fixed class hour.	Learning is a creative process that is independent of any specific person, time, and place.
Method-Technique	Lecturing, reciting, repeating, and dictating.	Problem solving, project based, experimental.
Communication	Competition-based communication.	Cooperation-based communication.
Creativity	Performance of activities expected from children as modelled by the teacher is important.	Children have opportunities to try original ways of accomplishing behaviours and skills expected of them.
Expectation-motivation	All children are expected to be successful in the subject studied. Perfection is promoted.	Children’s attempts to solve problems through their own ways are supported. Every type of effort is supported.
Purpose	Something must be learnt as it must be learnt.	Learners learn by solving problems. The purpose of learning is understanding.
Measurement-evaluation	One-dimensional, product-oriented evaluation through standard tests.	Multi-dimensional, process-oriented evaluation through performance tests, portfolio etc.

The above teaching methods comparison in Table 2.1 by Duran and Dökme (2016) may be further explained as follows:

- **Inquiry-based teaching:** Focus is mainly on the learners’ development of their problem-solving skills, critical thinking skills, creative thinking skills, and SPS. It enables learners’ active participation by allowing them to engage their minds in searching for various alternative ways of solving the problem posed by the teacher. Learners rely on prior scientific knowledge to construct new knowledge. The teacher states the purpose and encourages the learners to do critical thinking through designing and planning scientific investigations, interacting as a group, gathering data, organising and communicating their findings to other groups or to the entire class, and evaluating their results.
- **Traditional teacher-centred teaching:** The teacher acted as an instructor and expected all learners to respond in a specific way. This teaching method placed value on stated standards. Such teaching is about getting the results (product-oriented), unlike an IBL teaching method which emphasises the science process. Traditional teacher-centred teaching and learning encourages rote-learning

leading to memorisation in which learners may not be able to build on prior scientific knowledge. Under such circumstances, the development of learners' problem-solving skills, critical thinking skills, creative thinking skills, and their ability to engage in SPS will be near impossible. Learners working in such a learning environment would not be able to cope with the dynamic nature of the scientific world.

IBL is viewed by many educationists and researchers as the preferred teaching approach to the traditional teacher-centred approach. Otukile-Mongwaketse (2018) liken the traditional teacher-centred approach to the authoritarian style of teaching.

2.6 IBL AND SCIENCE PROCESS SKILLS

SPS refers to the learners' cognitive activity of creating meaning and structure from new learning experiences; these skills are learning strategies that are used in the process of understanding a new situation (Vicente, 2013). The development of learners' SPS is one of the aspects that cannot be ignored when considering the effectiveness of the IBL method of teaching and learning. IBL classroom integration requires and or enables the gaining of scientific skills and knowledge through the regular use of SPS.

SPS activities promote learners' creativity, motivation, and attitude to acquire scientific skills (Kurniawan et al., 2019). It increases learners' motivation and improves their attitude towards the IBL approach. Learners solve scientific problems independently after developing a substantial degree of SPS. SPS are reproducible for self-sufficiency (Siahaan et al., 2017).

SPS help learners independently develop skills in understanding scientific concepts or ideas (Siahaan et al., 2017). The IBL approach does not only facilitate the transferring of scientific knowledge, but it also helps learners to regularly develop their SPS as they continually engage in the scientific inquiry process.

Learners may not be able to learn Life Sciences meaningfully if they are not equipped with the necessary science process skills, in the same way a learner may not be able to surf the internet or operate a computer system if he or she has never had access to an internet facility, computer or electronic device. The IBL approach in relation to SPS shall be examined in this study for the purpose of understanding how its concepts may positively influence learners' Life Sciences learning during the inquiry process.

An IBL approach to Life Sciences teaching and learning involves the development of a variety of process skills that are useful in everyday life, in the community, school, and workplace. Learners gain these skills because the IBL approach enables an environment that supports creativity, where learners take responsibility for their learning experiences which in turn builds their confidence. During scientific inquiry, learners develop the ability to think objectively and critically, and to use a variety of forms of reasoning while they use process skills to investigate, reflect, synthesise, and communicate their findings or results (DoBE, 2011).

The SPS forms the foundation for the scientific method; they are observation, communication, classification, measurement, inference, and prediction (Michael, 1990). There are other integrated SPSs which include: identifying and forming a problem, formulating hypotheses, interpreting data, identifying, and controlling variables, and experimenting, and include the teacher's ability to choose relevant resources applicable to SPS (Karamustafaoğlu, 2011; Adha & Jayanti, 2022). For this study, SPS has been identified as one of the most relevant components because of its embeddedness within the IBL approach.

Life sciences, being one of the natural science (NS) subjects, and because of its phenomenal nature, requires G12LSTs to conduct Life Sciences tasks/exercises or inquiry activities in a way that will develop and improve learners' SPS.

According to DoBE (2011), one of the purposes of the Life Sciences learning area is to encourage the development of learners' SPS through scientific inquiry. This cognitive activity enables learners to construct or develop new concepts from prior knowledge or experiences (Vicente, 2013). IBL cannot be separated from SPS as they both involve science inquiry activities such as formulating and posing questions or problems, making observations, comparing and measuring data, recording information, sorting and classifying, interpreting data, making predictions or inferring, hypothesising, controlling variables and experimenting, planning scientific investigations, conducting investigations, communicating Life Sciences information, and drawing conclusions (DoBE, 2011). G12LSTs stand the chance of benefiting from the proper implementation of an IBL teaching approach and SPS, as this will create a warm relationship with learners and increase their cooperation and class participation leading to greater positive results.

2.7 PHASES OF AN INQUIRY CYCLE FOR IBL

Eltanahy and Forawi (2019) state that inquiry is to seek information to solve a question or problem. According to Llewellyn (2011), the inquiry is polymorphous, having many definitions and interpretations, while science inquiry can exist as minds-on by using the internet, research literature, and other resources for the investigation of a phenomenon, it can also exist as a combination of minds-on and hands-on activities.

Science inquiry is to seek information to solve a scientific question or problem posed by the teacher, learners, or the textbook, using a scientific procedure or investigation through activities like exploration, and experiments (Eltanahy & Forawi, 2019). Science inquiry relies on learners' SPS such as observation, communication, classification, measurement, inference, prediction, etc. Learners will be able to conduct proper science inquiries only if they have developed their SPS because science inquiry requires learners' critical and logical thinking in the learning process.

Brunsell (2010) argues that it is imperative to teach science subjects through science inquiry, but some science teachers rarely use the IBL approach as they are still struggling to develop a holistic understanding of what science as inquiry means, and how it should look practically in the classroom. The importance of training G12LSTs on the use of an IBL approach and science inquiry both theoretically and practically cannot be overemphasised, considering the positive influence it has on the success of G12LSLs.

According to the National Research Council NRC (1996) in National Science Education Standards, science as inquiry includes learners doing the act of investigating, knowing about the process of scientific inquiries, and the teacher using inquiry as an instructional approach to teaching.

Bybee et al. (2006) describe phases of the inquiry cycle in the 5E model, which includes five phases in the learning cycle of scientific inquiry engagement, exploration, explanation, elaboration, and evaluation. Van Uum et al. (2016), however, gave seven phases of the inquiry cycle, in which the descriptions of some phases are similar in meanings when compared with the 5E model.

For a lifelong learner, scientific inquiry should be viewed as a continuous process throughout a lifetime. Prior scientific knowledge or skills should always serve as the basis for acquiring and building greater scientific knowledge. Examining the phases of an inquiry cycle will help to understand how learners continuously construct new and more complex scientific knowledge when faced with new and more challenging scientific tasks. Van Uum et al. (2016) describe the phases of an inquiry cycle as:

2.7.1 Phase 1 Introduction: In the introductory phase, problems or exciting research questions are introduced to the learners to inspire them to search for solutions or information leading to the cause of a phenomenon. In the process of scientific inquiry learners' epistemic understanding increases, leading to increased interest and the curiosity to learn more due to the authenticity of the research practice. The introductory phase helps the learners to view themselves as young and new scientists who are about to embark on a scientific project (Van Uum et al., 2016). At this phase of inquiry, Bybee et al. (2006) stress the need for teachers to meaningfully engage their learners to draw from prior scientific knowledge and make necessary connections with the current task to be investigated. The teacher's supervision and guidance in this phase will help the learners construct new scientific concepts or ideas.

2.7.2 Phase 2 Exploration: The success of the exploration phase is dependent on how learners make meaningful connections between prior knowledge and the phenomenon in question. The research problem should prompt a positive response from the learners by motivating them to ask several questions by engaging with and relying on their prior knowledge to make connections and gather relevant information leading to the accomplishment of the research project. The exploration phase precedes the formulation of research questions, research plans, and provisioning of all necessary tools or facilities to facilitate the research project (Van Uum et al., 2016).

2.7.3 Phase 3 Designing the investigation: In this phase, research questions are formulated, and research design and methodology are planned. Learners are enlightened on the procedures on how, when, and what to investigate in the research process using research questions as the guide towards achieving their objectives. The designing phase precedes the actual research investigation. Teachers are expected to address the procedure necessary in formulating research questions to give learners a clear direction on what is expected of them. Learners can work collaboratively in the gathering of relevant research data (Van Uum et al., 2016).

2.7.4 Phase 4 Conducting the investigation: This is the stage at which the main data collection for the research purpose takes place. It is important to follow a well-planned procedure during data collection, note-taking, voice-recording, documents, etc. Data should be itemised and tagged with a date, place, and time of the collection to enable processing and analysing of the data collected. Teachers are expected to guide and address learners when they are faced with problems that could impede the progress of their research activities. Teachers may also ask follow-up questions that will create the opportunity to learn while the process progresses. In this phase the well-planned research questions always precede the direction of the investigation. Learners engage in the discovery of data, while the teacher observes and guides them towards success (Van Uum et al., 2016). It is the phase in which learners explore, test out, gain understanding and scientific knowledge even from mistakes made; teachers' guidance here helps to improve learners' scientific skills through further probing questioning (Bybee et al., 2006; Rodriguez & Harron, 2019).

2.7.5 Phase 5 Conclusion: The organisation of the data collection is done at this phase. Learners analyse data collected during the investigation by making connections between the data collected with the planned research questions and try to determine if there is consistency between them. They also examine the level of the disparity between their opinions and the reality. Learners therefore categorise their findings into various themes as they relate to the research questions and thereby draw up their conclusion. Preparation for the presentation of the research findings is made at this phase. The conclusion phase precedes the presentation or communication of the results (Van Uum et al., 2016).

2.7.6 Phase 6 Presentation or communication: Research results are communicated, and ideas shared by learners during the presentation phase, and the levels of success achieved during the actual investigation of the research are revealed during learners' sharing of ideas and presentation. The presentation and communication phase gives the teachers the opportunity to evaluate and assess the learners and to make necessary recommendations on their research outcomes. The outcomes of the research may lead to further research projects (Van Uum et al., 2016).

2.7.7 Phase 7 Deepening or broadening: The overall success of the entire inquiry process is examined at this phase. This phase enables teachers and learners to collectively reflect on the whole exercise to ascertain their understanding of connections made between prior knowledge and new concepts, deliberation on difficult and or unanswered questions which might lead to the next cycle of inquiry of the project. Discussion may be held in groups for the purpose of broadening learners' knowledge or they may be engaged by teachers in an informal assessment manner to elucidate areas that are unclear to the learners. In this phase, another research project can be facilitated. Learners will be prepared to build on knowledge or concepts acquired from the just concluded research project (Van Uum et al., 2016).

Brunsell (2010) emphasises the use of evidence and explanation during learners' engagement in science inquiry activities. His emphasis implies that science inquiry may not be effective without learners' presenting evidence and explanations for their science inquiry findings or results. He gave five features of science inquiry as:

- Learner's engagement in scientific oriented questions or problems,
- Learner's prioritising the provision of evidence in their response to questions or problems,
- Learner's scientific explanations as derived from evidence collected during inquiry,
- Learners connect explanations to scientific knowledge, and
- Learners present findings and justify explanations.

The National Research Council (1996) suggests the need for a more inquiry-based learning environment, where learners can improve their scientific skills and understanding of science theoretically and practically. The learning environment should not be limited to classrooms, it should include science laboratories, libraries, science excursions or exhibitions.

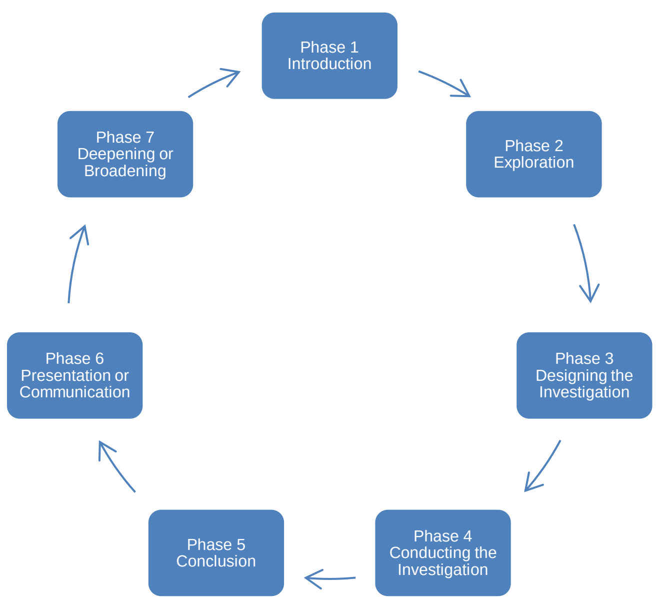

Figure 2.1: Diagrammatical Description of Phases of an Inquiry Cycle for IBL (Van Uum et al., 2016).

IBL practice undoubtedly should be a continuous process. As described above by Van Uum et al. (2016), there should be connection between achieved cognitive levels or prior knowledge of learners and the higher successive cognitive levels. This by implication will allow learners to develop and broaden their knowledge of science and continuously construct new and greater scientific knowledge.

2.8 TYPES OF INQUIRY IN IBL TASKS

To resuscitate learners' declining interest in studying science, teachers need to be creative in the way teaching methods and lessons or topics are presented and introduced to the learners. Kartika and Rani (2017) argue that IBL also known as the learner-centred method helps to foster learners' independence and creativity. The teacher's IBL task and choice of inquiry type should motivate learners to participate actively in teaching and learning.

Demonstrated, structured, guided, coupled and self-directed or open inquiries of IBL tasks are some of the inquiry types used by teachers to facilitate the process of inquiry teaching and learning of science. Llewellyn (2011) grouped the inquiry types into four major categories namely: demonstrated Inquiry, structured inquiry, teacher-initiated inquiry (guided and coupled Inquiries) and learner-initiated inquiry (self-directed or open inquiry) based on the source of questions being investigated and responsibility assigned to the teacher, learner, or both.

Eltanahy and Forawi (2019) further explain and compare Llewellyn's (2011) four major categories of inquiry in tabular differentiated types as seen in the table below:

Table 2.2: Eltanahy and Forawi Differentiated Types of Inquiry

			Teacher Initiated Inquiry		**Learner Initiated Inquiry**
The Area of Inquiry	**Demonstrated Inquiry**	**Structured Inquiry**	**Guided Inquiry**	**Coupled Inquiry**	**Self-Directed Inquiry or Open Inquiry**
1. Posing a Question	Teacher	Teacher	Teacher	Learners select from a predetermined bank of questions	Learner

2. Planning Procedures	Teacher	Teacher	Learner	Learner	Learner
3. Analysing Results	Teacher	Learner	Learner	Learner	Learner
4. Drawing Conclusion	Teacher	Learner	Learner	Learner	Learner

2.8.1 Demonstrated inquiry in IBL tasks

Demonstrated is the least advanced inquiry type, the teacher poses the question, plans the inquiry procedures by providing necessary materials, conducts the inquiry by the investigation and gathering of data, analyses the results, makes findings, and draws conclusions about the science inquiry (Eltanahy & Forawi, 2019). The teacher conducts the science inquiry while the learners watch and listen throughout the teaching and learning process. In this inquiry task, the teacher at this level conducted all the activities required alone with the purpose of showing learners how to conduct science inquiry before moving to a more advanced inquiry type or task in where learners can participate.

2.8.2 Structured inquiry in IBL tasks

In structured inquiry, the teacher gives the learner the questions, materials, and structure to perform the investigation, and the learner analyses and comes up with the results of the investigation and draws a conclusion (Juntunen & Aksela, 2013; Eltanahy & Forawi, 2019). The structure could be a hands-on activity, where learners are expected to use the materials provided by the teacher to observe and collect necessary data that will be helpful in conducting their investigation, and coming up with the outcome after the scientific inquiry process.

2.8.3 Guided inquiry in IBL tasks

In guided inquiry, the learner gets the questions and the material from the teacher, but the structure and the results of the inquiry process are both open to investigation (Juntunen & Aksela, 2013). According to Eltanahy and Forawi (2019), guided inquiry is the first teacher-initiated inquiry where learners become more responsible than the teacher in the inquiry activities.

The guided inquiry process encourages learners to conduct the investigation, allowing them to view themselves as scientists by designing their own procedures and generating own concepts for solving problems (Michigan Sea Grant, 2020). Learners are motivated and increase their interest in science once allowed to participate in IBL activities that make them view themselves as learner-scientists. Michigan Sea Grant (2020) highlights the steps in a guided inquiry as follows:

- In an anti-clockwise manner learners are engaged, and an inquiry question is written,
- Inquiry-Based question is written either by the teacher or a learner,
- Development of the word list that will lead to the search for relevant information on the research question is done by teachers and/or learners,
- Graphic charts are used by learners to make connections between the concepts and the word list that is developed,
- Learners generate workable hypotheses that are relevant to the inquiry question,
- The teacher encourages the learners to search for relevant information on some recommended websites on the internet to validate their hypotheses,
- Learners process data collected and prepared the findings, and
- In conclusion, the learners analyse the findings and make presentations.

Most importantly, guided inquiry is designed to promote learning through learner investigation, it enables the development of critical thinking and SPS in learners, and it helps learners to view themselves as learner-scientists, because the guided inquiry process puts the emphasis on scientist in learner-scientist (Michigan Sea Grant, 2020).

2.8.4 Coupled inquiry in IBL tasks

Coupled inquiry allows the learners greater autonomy in carrying out the inquiry activities than the guided inquiry permitted. This is because the question is not posed by the teacher. Neither did the teacher participate in any aspect of the inquiry process. The learners select from a predetermined bank of questions, plan the inquiry procedures, analyse the results, and draw conclusions (Eltanahy & Forawi, 2019). It is the inquiry type that assists learners to become more autonomous in the learning process and to completely take responsibility for their learning experiences.

2.8.5 Self-directed or open inquiry in IBL tasks

In open inquiry, the teacher only gives support to the learner with the materials if needed in the investigation (Juntunen & Aksela, 2013). Open inquiry also known as self-directed inquiry enables the learners to explore widely and to engage in scientific problem-solving using a wide range of SPS (Llewellyn, 2011). Although it is like a guided inquiry process, learners formulate their own problems or questions which provide the opportunity to investigate further.

Teachers can use different inquiry types for different learners depending on their cognitive capability. This ensures that learners with low cognitive capability are guided until they can conduct self-directed or open inquiry activities (Discovering Science through Inquiry, 2009). It allows learners irrespective of their cognitive capabilities to develop scientific skills according to their learning abilities. The National Research Council (1996) encourages science teachers to integrate inquiry science tasks into their daily teaching to improve learners' problem-solving skills.

Although finding a solution to a problem posed or a question asked by the teacher, learners or textbooks, is the learners' responsibility, nonetheless the teacher is expected to facilitate teaching and learning by ensuring a very supportive and conducive learning environment. Learners engaging in scientific inquiry are actively involved in IBL class activities that help them seek various alternative solutions to the subject matter or question posed.

2.9 IBL AND SUBJECT CONTENT KNOWLEDGE OF THE LIFE SCIENCES TEACHER

Teachers' SCK is the body of knowledge and its interrelated components that is expected to be taught to learners (Ball, Thames, & Phelps, 2008). SCK of G12LSTs includes the mastery of not only the subject content (textbook) but also the content of the science curriculum, subject syllabus, work schedule, subject lesson plan and time allocation for each topic etc.

A teacher's knowledge of subject matter is an essential aspect for effective teaching and learning. Teachers with poor knowledge of Life Sciences cannot empower learners to acquire scientific knowledge in an IBL approach even if all necessary resources are made available to them. The importance of having a deep SCK not only ensures that the teacher facilitates professionally, but it also gives the teacher confidence to engage his or her learners through the process of active learning. Effective impartation of scientific knowledge in IBL approach requires teacher's in-depth knowledge of the subject's content and thinking processes, to unravel and solve scientific problems. G12LSTs need adequate subject content knowledge to effectively exercise their PK during scientific inquiry.

Alabdulkareem (2016), posits that teachers' SCK is importantly indicative of their competence to deliver the subject content; this important attribute to effective teaching is however not self-sufficient. This is because the meaning of some scientific concepts is mostly hidden and requires more than SCK to interpret for learners' comprehension. Learners are expected to acquire scientific concepts or ideas to solve scientific problems in the process of conducting science inquiry. G12LSTs lacking in-depth SCK may not be able to effectively supervise and facilitate the science inquiry process.

The teacher's SCK is crucial to improving Life Sciences teaching and learning. The teacher's in-depth SCK is closely linked to learners' achievement. Teachers' insufficient or lack of SCK of the subject matter will certainly result in learners' underachievement as a teacher cannot give what he or she does not have. In other words, learners' learning success is partly dependent on teachers' in-depth knowledge of the subject content.

2.10 IBL AND PEDAGOGICAL KNOWLEDGE OF THE LIFE SCIENCES TEACHER

Olfos, Goldrine, and Estrella (2014) argue that SCK and PK may be convincingly related, however, teachers' ability to creatively develop, select, present, and explain tasks, and facilitate productive classroom discussions, makes PK distinctive from SCK. It takes a Life Sciences teacher with good PK to understand and interpret learners' responses and preconceptions of scientific concepts. A skilled teacher recognises the experienced 0f learners and applies corrective measures to bring learners back on track. The PK attributes will help teachers implement the IBL approach.

Teachers' PK enables them to impart scientific knowledge, ideas, or concepts to learners through effective and relevant analogies, illustrations, and demonstrations that make subject content easily comprehensible for learners (Shulman, 1986). Impartation of scientific knowledge during an IBL approach will be almost impossible without demonstration by teachers of learners' involvement in investigation, practical work etc. The theoretical teaching should be complemented with practical aspects of the inquiry process due to the nature of Life Sciences. Integration of practical aspects to teaching will not be effective for teachers using a teacher-centred approach, due to learners' lack of active participation.

PK is the connection between SCK and the practice of teaching (Ball et al., 2008). The practice of teaching was rightly described by Shulman (1986) as relevant analogies, illustrations, and demonstrations to make subject content easily comprehensible. They are the PK skills the Life Sciences teacher needs to facilitate an IBL approach to teaching and learning. To effectively implement the IBL approach to teaching of Life Sciences, teachers need to develop strong SCK and PK, as they are inextricably linked and important for the G12LSTs to impart knowledge to learners.

PK is topic specific knowledge for teaching a particular subject, it is having certain traits or skills that are neither taught nor could they be integrated into the school curriculum

(Ball et al., 2008; Shulman, 1986). These distinguishable and significant traits made some educationists to argue that teaching is more of a calling than a profession. These attributes make a G12LST unique and outstanding.

Szydlo (2014) states that his classroom teaching is standard with a twist of something different, all classroom or lesson activities are relevant to the syllabus and are done enthusiastically to gain the learners' attention. The objective is to make learners enjoy science and appreciate it. Szydlo knew that once learners enjoy doing science, they will appreciate it and participate actively. The PK or teaching practice skills is part of what attracts and stirs up the learners' interest to learn. The IBL approach requires learners to participate actively in the teaching and learning, this can only be achieved if learners develop an interest in and enjoy doing science inquiry.

In responding to the question "what makes great teaching?" Coe et al. (2014) assert that it is the type of learning activities learners are engaged in that determines what makes teaching great and improves learners' progress. They further suggested and described six components to be considered in order of priority for effective teaching. On their list, PK comes first, other components mentioned such as quality of instruction, classroom climate, classroom management, teachers' beliefs and professional behaviours cannot be separated from the IBL approach because they mostly form part of IBL characteristics.

It takes good PK to not only understand the materials being taught but also to be able to understand how learners think of the content and to evaluate learners' method and approach to learning and the misconceptions they brought to the subject matter (Coe et al., 2014). It will be near impossible for teachers to become aware of learners' weaknesses and the misconceptions that they bring into the classroom without an IBL approach to teaching and learning, as teacher-centred teaching and learning allowed very little or no opportunity for learners to express themselves in the learning process. In the same vein, Olfos et al. (2014) aptly note that the teachers' PK is an important indicator of learners' learning success.

The teacher's level of competence in Life Sciences is an important influence on learners' behaviour and learning, and plays a role in pedagogical progress and learner learning. What PK is and how teachers perceive their own pedagogy must be considered a separate component of PK. Teachers may find it challenging to illustrate concepts to their learners to enable understanding if they themselves have poor PK.

Teachers who possess SCK without PK cannot be effective in their teaching, because having only one is as ineffective as having none (Shulman, 1986). It requires teachers' SCK and PK to clear the misconceptions learners bring into the classroom, and to enhance and encourage effective learning.

To improve the teaching of science subjects, effort must be made to improve teachers' pedagogic knowledge by regularly using an IBL approach to teaching and learning (Lyngved, Pepin, & Sikko, 2012).

The effectiveness of an IBL approach to Life Sciences teaching and learning will be impeded for teachers who possess only SCK; they must also have a strong PK. The art of teaching Life Sciences should attract and arouse learners' interest to learn effectively, the lack of PK explains why some high-performing learners or graduates cannot effectively teach or impart scientific knowledge to learners despite their vast knowledge of the subject content matter.

2.11 LIFE SCIENCES AND IBL CLASSROOM ENVIRONMENT

An ideal classroom environment is one which is devoid of all types of distraction that impedes effective learning, and is a favourable and learning-resourced environment which encourages learners to actively participate in learning activities that enable knowledge acquisition.

Lyngved et al. (2012) indicated that an IBL approach is imperative to achieving learning objectives, it offers quality education and helps to create an effective classroom environment which enables collaboration and shared ownership.

The science laboratory, library, science exhibition or excursion, and hands-on science activities etc. should be included in the Life Sciences classroom environment. Unlike a teacher-centred approach in which learners' participation is limited to listening to the teacher and taking down notes, an IBL approach encourages learners to actively participate in the learning process by extending their science inquiry activities beyond the four walls of the classroom.

The classroom environment is one of the major factors determining the effectiveness of an IBL approach to teaching and learning, with learners constructively responding to teaching and learning once they view the learning environment as positive and supportive (Young, 2014). A conducive and learner-centred classroom is capable of motivating learners to learn meaningfully.

The classroom climate should be designed to constantly demand more engagement but also must recognise the learners' self-worth (Coe et al., 2014). The learners should feel like young scientists when they enter the IBL classroom environment, as this will motivate them to participate actively in the learning process. The IBL approach could be time consuming for teachers, with Coe et al. (2014) suggesting that teachers should make efficient use of lesson time by properly coordinating learning resources, classroom environment and learners learning activities to ensure meaningful progress within a specified timeframe.

The IBL classroom is a learner-centred classroom environment designed by the teacher to engage learners in hands-on activities to enable them to investigate and discover solutions on their own. Learners are guided using relevant materials which form part of the classroom environment provided by the teacher, but originate their own procedures on how to solve the Life Sciences problems. They frequently ask themselves questions which help them to formulate their own problems to investigate, which in turn leads them to the discovery of new concepts or even better alternatives on how to solve problems.

The Life Sciences teacher is expected to create a classroom environment efficient in implementing the IBL approach; it should be an environment where learners are allowed learning autonomy to explore and develop scientific skills, and innovate new ideas or concepts. It is an environment where they are supported not only by the teacher's knowledge but also by the IBL enabling resources provided by the teacher or school. Learners have a sense of belonging and are able to take responsibility for their learning experiences or successes (Čeretková et al., 2013).

The IBL classroom teacher is a constructivist, he or she encourages and guides the learners to frequently assess how the classroom activities help them to gain knowledge and understanding (Coe et al., 2014). Due to its learner-centred nature, learners in the IBL classroom become active or expert learners through regular questioning of themselves and the strategies adopted in trying to get solutions. The IBL classroom encourages learners to use active techniques i.e., hands-on experiments, etc. to acquire new scientific knowledge on which they can reflect and discuss new alternatives for a better understanding of learning from previous knowledge gathered (Young, 2014). The teacher uses his or her informed knowledge of the learners' pre-existing conceptions in guiding activity and ensuring that learners can build on their prior scientific knowledge.

Teachers' beliefs about IBL and how lessons should be designed and taught may significantly influence how they create an IBL classroom environment (Čeretková et al., 2013). G12LSTs are expected to create a classroom environment that will facilitate an effective IBL approach. When teachers view themselves as facilitators, creating a classroom environment where IBL characteristics can be integrated into teaching and learning, becomes an essential requirement. Training for teachers on effective IBL classroom processes becomes inevitable, especially for teachers with negative attitudes or beliefs towards an IBL approach.

2.12 TRADITIONAL TEACHER-CENTRED TO IBL CLASSROOM ENVIRONMENT

Murray (2013) describes how teachers can turn a traditional teacher-centred classroom setting into an inquiry-based classroom environment, using one or more of the following points simultaneously:

Plan classroom activities: A prior engagement of learners, especially a day before a lesson period is essential for classroom time-management. Teachers should have learners preview the lesson and the relevant resources needed for the classroom activities (Murray, 2013). This will enable learners to have enough time to spend on the inquiry process. IBL being a process-oriented approach could be time-consuming without achieving lesson objectives, if not carefully planned by the teacher. Teaching and learning should commence outside of the physical classroom before and after the actual specified lesson period in the physical classroom.

Avoid answering questions: Teachers who ask and answer most of the questions in an IBL classroom setting will deprive learners of the opportunity to express themselves (Weimer, 2013). The objectives of the IBL approach become unattainable under such circumstances, as the teacher may not be able to identify aspects of the lesson where learners are experiencing difficulties and require a facilitator's guidance. A classroom environment that allows learners to discover the answers by offering them relevant resources will help them develop their SPS and critical thinking skills (Murray, 2013). Learners' motivation increases as they successively achieve learning objectives, but this will not be possible if they are not allowed to ask and answer most of the questions with the teacher's expert guidance. An IBL classroom environment should be structured by the teacher to support learners' understanding of the scientific methodology, concepts, and inquiry processes etc. until they become more autonomous in the learning process.

Be attentive: The teacher is expected to prioritise the learners learning needs and learning objectives when taking decisions or planning an IBL lesson. This includes how the classroom discussion and activities should be structured, and how these needs and objectives can be met. This requires thoughtfulness from the teacher (Mackenzie, 2016). Listening to learners when they speak will enable the teacher to identify not only their challenges but also to provide relevant resources to help them overcome those challenges. Observing the learners' responses when answers are provided for questions raised during discussion will help the teacher overcome the temptation of presuming or guessing the questions learners are going to ask or how they understand the answers provided (Murray, 2013). Spending more time to understand their real questions and ensuring that they truly understand the answers and scientific concepts, is worth the extra time spent in the learning process, as this will better equip them to confront more challenging scientific problems or tasks.

Encourage questions: The IBL classroom enables learners to ask questions, develop critical thinking skills and to find alternative ways of solving scientific problems. Teachers show a positive attitude when they encourage learners to ask and answer questions, as this inspires effective learning (Yoshinobu, 2017; Bogler, 2018). Encouraging learners to ask questions aids meaningful learning, however, as classroom discussion of questions and answers becomes multidirectional, lesson objectives may not be achieved if not properly managed by the teacher (Murray, 2013). The teacher should be able to guide and return the discussion back on track with the aim of gaining relevant scientific concepts necessary in transferring knowledge to subsequent lessons. Other unanswered questions raised by learners can be used by the teacher to engage the learners after classroom activities in the form of research work or projects; it will prepare them for future classroom activities or lessons. This engagement will enable the teacher and learners to cover their syllabus effectively.

Prioritise inquiry process and avoid lecturing: Murray (2013) emphasised the importance of how learners reach conclusions. The teacher-centred approach may deprive learners of the insight into how they reach conclusions due to their' passive participation (Weimer, 2013). An IBL classroom is an enabling learning environment where learners are actively engaged in the inquiry process to develop their SPS and critical thinking skills. A Teacher-centred classroom is product-oriented and promotes lecturing over the inquiry process, which limits learners' roles to passive listening, taking notes and observing the instructor, with emphasis on the end-product, unlike in the IBL classroom which prioritises the learning process.

Flexible classroom activities: IBL lesson plans and activities are highly flexible and thus could require a longer period of time to complete a lesson activity as it encourages alternative ways of solving a problem and encourages learners to critically conjure their own inquiries (Bogler, 2018). As the lesson plan or activity changes, due to learners' inquiries, the teacher is expected to guide them, so they do not lose track of the main learning objectives. Some skills such as creative problem-solving and critical thinking are very difficult to teach, but learners can develop such skills during the inquiry process (Murray, 2013). Repeated lesson activities may not always be the same in an IBL classroom, even if the learning objectives remain the same. Bogler (2018) argues that a teacher in an IBL classroom may become overwhelmed when trying to implement an inflexible lesson plan. Adjusting the lesson plan or activity becomes inevitable as the inquiry process influences a need for a change to ensure that learning objectives are achieved. Learners may no longer ask questions if the teacher gives the impression that asking questions will waste time and learning objectives may not be achieved under such circumstances. Teachers must realise that being flexible will not slow down learning but rather provide an opportunity for scientific concepts to be acquired from questions asked, and as such the lesson should be planned proactively (Yoshinobu, 2017).

Encourage research and use of technology: The use of technology in an IBL classroom enables learners to conduct effective research and share ideas on the subject matter (Murray, 2013). To create an IBL classroom, in which learners can be engaged in meaningful inquiry activity, the teacher and school must ensure the provision of computer systems with internet facilities to enable learners to source relevant resources for their inquiry tasks. The classroom environment can become process-oriented if the use of technology is permitted to enable the search for information on scientific inquiry, and learners are trained on the use of such technology.

Reflection is included in every lesson plan: An effective IBL approach is reflective as it enables teachers and learners to consistently reflect on their teaching practice and learning respectively, to find out if what was learnt reflects the objectives of the lesson plans (Murray, 2013). This careful thought of what was intended and how it was done or obtainable helps the teacher to apply corrective measures after the actual lesson activities in the form of homework or research. Crawford (2000) pointed out that reflection on teaching and learning experiences reveals strengths and challenges. Reflection may not be effective without feedback from learners on their learning experiences, learners may not be able to share their learning experiences if they were not active participants in the teaching and learning approach.

Becoming a learner: The teacher is perceived as a learner when he or she learns from the immense amount of information the learners brought into the classroom for the presentation of their inquiry findings (Johnson, 2018). Learners will be motivated to do more when teachers appreciate their contributions and make them realise that he or she had learnt from their presentation. Teachers who understand and identify with learners' feelings, especially feelings resulting from learning difficulties, will be more sympathetic and flexible in their approach towards their learners (Weimer, 2017). Teachers are expected to care and show an interest in the way they facilitate learning, as they themselves may sometimes encounter challenges and feel pressurised during the collection of relevant information to prepare lesson activities. Being aware of how learners feel when they have learning difficulties should make teachers understand that an IBL classroom discussion may change from the originally planned activities to suit the present and immediate learning needs of the learners (Murray, 2013). Teachers will not make any meaningful difference by keeping to the original lesson plan or activities if there was a genuine need for an adjustment to the lesson plan or activity.

Avoid the yes or no answers: A yes or no response to questions asked is not typical of an IBL classroom environment (Weimer, 2013). Murray (2013) aptly agrees that the IBL classroom requires open-ended questions that begin with "how" and "why", leading to an investigation with various alternative answers to a single question; and as such a yes or no answer has very little or no space in the inquiry process. Informal and formal assessments should provide an opportunity for learners to not only express themselves but also to improve and develop their problem-solving and critical-thinking skills.

More hands-on and practical work: Transforming a passive teaching approach where learners are unmotivated to learn into an IBL classroom requires an increase in hands-on or real inquiry activities where learners become more active learners (Murray, 2013). Learners who are explicitly told what and how to discover ideas or concepts during their investigation may be deprived of the opportunity to acquire scientific knowledge. One of the major reasons for integrating hands-on and practical activities for learners is to ensure learner-driven learning rather than teacher-driven teaching. Actively engaging learners in hands-on and inquiry activities is more important than spending lesson time answering the teacher's questions (Murray, 2013; Weimer, 2013).

Teachers who integrate the characteristics discussed above into their teaching and learning will be able to create and maintain a diverse and all-inclusive classroom environment where all learners can seek support when and where necessary throughout the inquiry process, and be accommodated irrespective of their learning styles or difficulties. The IBL classroom should be a friendly environment where all learners are motivated to develop confidence to acquire scientific knowledge, have a sense of belonging, and are able to take responsibility for their learning experiences.

2.13 LIFE SCIENCES AND IBL ASSESSMENTS

Nusche, Laveault, MacBeath, and Santiago (2012) state, "The term assessment is used to refer to judgments on individual learner performance and achievement of learning goals, it covers classroom-based assessment as well as large-scale, external tests and examinations". An IBL approach enables the teacher to frequently assess the learners both informally and formally.

Kishwar (2016), argues that assessment forms an essential aspect of teaching and of learners' learning development. Competent teachers can use an IBL approach to assess and develop learners' scientific skills.

Life Sciences learners can be assessed through a continuous planned process of identifying, gathering, and interpreting information on their performance, and by deploying different kinds of assessment forms. It includes generating and collecting evidence of achievement; evaluating the evidence collected, recording the findings, and using the findings to take informed decisions to enable learners' development and to further improve the process of learning and teaching (DoBE, 2011).

An IBL approach is very effective for informal and formal assessments due to the learners' active participation in the process of learning, and where teachers are quick to monitor, supervise and facilitate teaching and learning simultaneously with the inquiry progresses. It gives the teacher ample opportunity to assess learners' learning from the beginning of the teaching and learning process. These assessments could be done informally or formally depending on the stage or phase of the inquiry.

DoBE (2011) emphasises the importance of conducting both informal (Assessment for Learning) and formal (Assessment of Learning) regularly to observe learners' knowledge attainment and to provide learners with feedback that will enhance their learning experience.

The IBL approach creates an opportunity for teachers to conduct several assessments of learners' performances at different stages of the teaching and learning process, learners could be assessed informally or formally as learning progresses. Coe et al. (2014) aptly notes that specific practices like effective questioning, review of previous learning, provision of models (scaffolding) etc. form high quality instruction relevant for assessing learners learning progress.

Assessment of learners is crucial in determining the level of progress of implementation of the IBL approach. Teachers will not be aware if learning is taking place without such assessments. Appropriate assessment tools should be employed by teachers to ensure the success of teaching and learning which the aim of the IBL approach is.

Duckworth (2009) explains that asking open-ended questions is an excellent IBL classroom practice. The subject matter should be the source of authority without the teacher standing in between it and the learners. Learners' interest deepens when teachers allow their ideas and thoughts to drive the scientific inquiry of the subject matter or question raised. This is because it enables the learners to develop their scientific thinking or reasoning skills and makes them focus better. This will also give the teacher the opportunity to observe learners' progress and provide them with needed resources and a follow-up open-ended question to facilitate further learning.

2.14 THE CONCEPT OF ZONE OF PROXIMAL DEVELOPMENT FOR IBL EFFECTIVENESS

The zone of proximal development (ZPD) was originally developed by Lev Semenovich Vygotsky (1896 to 1934), he defined ZPD as

> *"The distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with a more capable peer."*

The concept of ZPD among others implies that teachers should examine learners' ability to solve scientific problems independently, and to support their ability to solve a complex scientific problem through the supervision of a teacher or by learning from more knowledgeable learners during group activities.

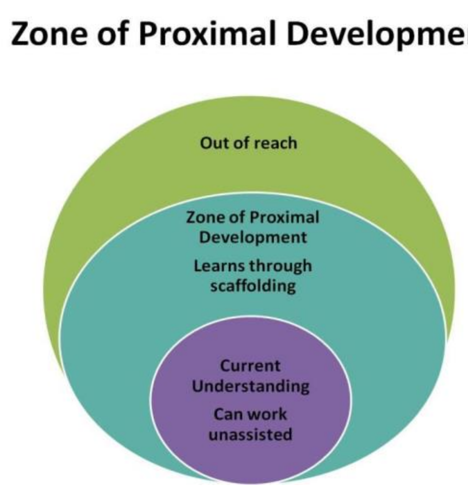

Figure 2.2: Diagrammatical Description of Zone of Proximal Development (https://educationjunkieblog.wordpress.com/2015/11/09/zone-of-proximal-development/)

When designing IBL tasks, teachers must avoid preparing too easy tasks (can work unassisted) leading to boredom where learning or acquiring new scientific skills is not achievable. The tasks must not be unaided or too difficult (out of reach) for the learners, which may also frustrate them and prevent them from learning new scientific skills.

In administering IBL tasks, teachers must always ensure that learners are within the ZPD that will challenge them to learn and constantly allow them to build on prior scientific knowledge. An IBL classroom environment should allow for collaborative and or cooperative group work strategies for solving scientific problems.

Learners can actively and collaboratively construct new and higher scientific knowledge when the current inquiry task is connected to their prior knowledge (Rutten, van der Veen, & van Joolingen, 2015). The inquiry task should challenge the learners to rely on prior knowledge or on scientific sources of knowledge within their reach.

G12LSTs should ensure that their learners are constantly within the zone where they are motivated to learn meaningfully by engaging them with inquiry tasks that make them rely on prior scientific knowledge to acquire more complex scientific skills.

2.15 EPISTEMIC DEVELOPMENT AND IBL APPROACH

Beliefs about knowing and knowledge are potentially important determinants of intellectual performance. It is not surprising that the ideas people conceive about the acquisition of knowledge – how it occurs and what it achieves – influence its operation in their own lives (Kuhn, Cheney, & Weinstock, 2000).

Epistemology of science is the aspect of nature of science which concerns itself with the way learners construct knowledge, the values they place on science and their beliefs about science to essentially develop scientific knowledge (Lederman, Lederman, & Antink, 2013).

Scientific inquiry process in which learners are engaged in SPS activities may be a good learning avenue for G12LSTs to acquire detailed information of learners' unique thinking processes that will assist the teacher in guiding and enhancing their learning effectively (Olfos et al., 2014; Alabdulkareem, 2016). Epistemic Cognition and Development of learners is a vital aspect the G12LST is expected to explore in finding out how different learners construct scientific knowledge through IBL activities. Understanding different learners' learning styles and learning difficulties will promote achieving these objectives.

The teacher's understanding of how learners acquire knowledge to gain scientific skills is vital in facilitating learners' epistemic development. Learners' ability to continually acquire knowledge is enhanced by allowing them to use their reasoning, intuitive and pre-scientific skills in gathering relevant information to solve scientific problems achieving this objective may be difficult without an IBL approach to teaching and learning.

2.16 BELIEFS AND ATTITUDES OF GRADE 12 LIFE SCIENCES TEACHERS TOWARD IBL APPROACH

The G12LST should not only be a mentor who regularly motivates the learners but also must be an inspiration for the learners to reach their desired career objectives. The positive influence of the teacher's attitude would be vital to achieving these objectives. An IBL approach encourages learners to take responsibility for their learning experiences such that at the end of the scientific inquiry, they can be proud of their findings, discoveries and acquisition of scientific skills, concepts, or ideas for solving scientific problems. The learners need inspiration and support from the teacher to actualise this.

The G12LSTs' positive attitudes, beliefs and willingness to empower learners by actively engaging them in the IBL process is vital to achieving the set objectives. As leaders or managers of their classrooms, teachers must become positive influencers and inspiration that will enable learners' development and constant acquisition of scientific skills. The best amongst teachers are those who empower their learners to become less dependent on them in the teaching and learning process.

Beliefs are the judgments made from personal ideas or understandings about ourselves, others and the world around us; teachers' beliefs are vital to understanding how they plan teaching strategies, make decisions, and how they impart scientific knowledge in the classroom (Gilakjani & Sabouri, 2017). The judgments made because of beliefs may not be acceptable to all if desired expectations of learning are not realised after practicing such beliefs in classrooms.

According to Hofer and Lembens (2019), inquiry-based learning has not become an established practice in science education because teachers' perceptions, beliefs and attitudes have a crucial influence on their classroom practise.

The Life Sciences teacher as a leader and manager of the classroom is expected to empower the learners with scientific skills and setting before them clear scientific goals, guidelines and expectations that give learners the sense of owning their achievements or successes. Positive attitudes will further make learners take responsibility for their learning experiences. A learner's desire to be recognised for a scientific breakthrough or achievement becomes a powerful force that drives him or her to become an insatiable researcher of scientific knowledge.

It is imperative to examine science teachers' beliefs on how they view science as this plays an important role in the scientific inquiry process, being aware of their beliefs and philosophy will help them make adjustment where necessary to become effective science teachers (Alabdulkareem, 2016). In the same way organisations conduct staff evaluations to improve their service delivery, science teachers who take it upon themselves to evaluate their beliefs and apply corrective measures may improve and develop a good PK.

What teachers do or how they respond to the IBL approach to teaching and learning is identified by their beliefs, their beliefs are reflective of their achievement and also of the attitudes and beliefs of their learners (Gilakjani & Sabouri, 2017). The enthusiasm and energy the science teacher brings into the classroom to conduct and supervise learners during the inquiry process is reflective of his or her positive attitude and beliefs of the

IBL approach, which can also motivate the learners to actively participate in the inquiry process.

The teachers' perceptions or beliefs about the IBL approach are indicative of how learners develop scientific knowledge (Lederman et al., 2013). One of the reasons for underperforming science learners is related to teachers' poor perceptions or unimplemented IBL approach. Learners develop their scientific skills more and quickly when they participate actively in the inquiry process. They are influenced to participate actively by the teacher's positive attitude.

According to McGinnis (1992), some teachers perceive certain topics such as evolution, human reproduction, dissecting animals in science laboratories, etc. as being taboo in their local cultures and are reluctant to teach them. Learners under the tutelage of such teachers will be deprived of the acquisition of the scientific skills related to these "taboo" topics, and under such circumstance, IBL or the inquiry process cannot thrive.

Teachers derive great satisfaction from IBL activities which arises from their positive attitudes, including a passion and enthusiasm for conducting experimental investigations, and the sheer delight of enlightening learners (Szydlo, 2014).

Teachers who have passion, an interest in, and care for the learners are more likely to derive satisfaction in the way they conduct teaching and learning since their desire is to encourage learners to develop an interest in learning. Teachers' enthusiasm, satisfaction, and sincere concern for learners to acquire scientific knowledge are some of the signs of their belief in the benefits of an IBL approach.

Teachers' beliefs and attitudes consequently influence their choice of instructional strategies and how they implement these strategies in the classroom (Hofer & Lembens, 2019). Science teachers with positive attitudes will vigorously see that meaningful learning takes place by employing different creative ways to impart knowledge even with limited resources.

Teachers' beliefs about IBL are the conceived and implied ideas or notions about how learning activities should be structured, and how learners should be taught (Kagan, 1992). Implementation of an IBL approach is not guaranteed due to teachers' educational qualifications or competence, their choice of teaching strategies will become ineffective if their beliefs conflict with IBL practices (Ramnarain & Hlatswayo, 2018).

Teachers' beliefs do not only have great impact on their procedures and roles but they also have a great impact on their learners' learning success. Their beliefs also have great influence on their knowledge on planning their lessons, and on the types of decisions they make in running their classrooms.

2.17 BELIEFS AND ATTITUDES OF GRADE 12 LIFE SCIENCES LEARNERS TOWARD IBL APPROACH

When learners' beliefs and attitudes toward an IBL approach complement teachers' positive beliefs and attitudes, teaching and learning will be productive (Gilakjani & Sabouri, 2017). Learners' perceptions of IBL and learning success is partly influenced by their teachers' own beliefs and attitudes towards IBL practices. Learners' confidence in their teachers to guide, supervise and primarily support them through the inquiry process will determine how they embrace IBL practices.

Teachers' negative beliefs and attitudes about female participation in science can negatively influence female learners' development in the field of science, as these beliefs paint a picture of male scientists or male learners as being the true image of science (Gasant, 2012). The notion by a few teachers, stemming from their cultural beliefs that language is meant for female learners while science is meant for their male counterparts is seriously misleading and detrimental to the educational growth of both genders, the effective learning of science or acquisition of scientific knowledge cannot be divorced from having good language or communication skills. Makarova, Aeschlimann, and Herzog (2019) found that the attribution of masculinity to science does not differ significantly from the attribution of femininity to science, which implies that female learners perform strongly in science similarly as the male learners.

The school is always the first formal setting where learners have an established contact to learn a course or subject, and where learners' beliefs are mostly influenced by their teachers' beliefs, this also influences their behaviour regarding learning objectives, performances, subjects considered difficult or problematic, the way they learn and common knowledge. These beliefs, if taken for granted would result in poor learning and acquisition of scientific skills. Science subjects must not be perceived by teachers and learners as being difficult subjects meant for only a few high-performing learners.

Self-efficacy is the belief or judgment of one's own confidence or ability, especially abilities to meet challenges and to be able to achieve set objectives (Pajares & Schunk, 2002; Ackerman, 2020). Like the Pygmalion effect, learners can be positively influenced to increase their self-efficacy by the expectations that teachers have of them. Teachers' beliefs about IBL practice and of their learners can encourage learners to act in accordance with such beliefs and thereby develop positive beliefs about themselves, which resulting actions will positively impact them to acquire scientific skills to achieve learning objectives. Teachers' and learners' behaviours during teaching and learning are indicative of their beliefs and natural ability to impart knowledge and to learn respectively, which is, likened to self-efficacy beliefs (Pajares & Schunk, 2002). G12LSTs must take advantage of their positive attitudes toward the IBL approach to ensure that effective teaching and learning always takes place.

The use of an IBL approach is aimed at reversing learners' negative science-related attitudes and their decreasing interest to engage in the learning of science subjects, an attitude that is still a major factor against learning science (Rutten et al., 2015; Pyatt & Sims, 2012). They also found that learners develop positive attitudes and are increasingly motivated to acquire scientific knowledge when technology is harmonised with an IBL approach. To effectively reverse learners' negative attitudes towards learning science and the IBL approach, teachers must see the need to not only create a warm and friendly classroom but also to integrate current technologies that aid the learning of science and that increase learners' interest to learn science.

Camenzuli and Buhagiar (2014) found that the improved behaviour and attitudes of social emotional and behavioural difficulties (SEBD) learners are closely linked to the introduction of an IBL-friendly classroom atmosphere and pedagogical changes. The motivation that comes from an IBL approach enables the improvement of SEBD learners' behaviour and attitudes to participate actively in the inquiry process.

Effective IBL practices require unified positive beliefs and attitudes of both teachers and learners. The attitude of the learners is an aspect that requires careful monitoring by the teacher during the inquiry process as this can determine their learning success (Kurniawan et al., 2019). Careful monitoring of learners' attitudes toward an IBL approach will be necessary if the teacher does not have a positive attitude towards the IBL approach because his or her attitude is contagious.

2.18 EFFECTIVENESS OF IBL APPROACH IN TEACHING GRADE 12 LIFE SCIENCES

The Macmillan Dictionary (2020) defines effectiveness as the degree to which something works well and produces the results that were intended. The effectiveness of an IBL approach to teaching G12LS is the degree to which the objectives of implementing an IBL approach were achieved or the level to which IBL implementation yields expected results. To achieve these objectives, G12LSTs are expected to have adequate SCK and PK to understand learners' science preconceptions or misconceptions, their needs and learning styles, beliefs, and attitudes towards an IBL approach to be able to effectively facilitate scientific inquiry or task.

Llewellyn (2011) stresses the need for differentiated teaching based on learners' needs and levels of interest and readiness, he also argued that the teacher and not the learners decide on the appropriate method and topic to be taught and how learners are expected to demonstrate their understandings. With the above mentioned, G12LSTs must realise that learners bring their individual unique talents or gifts into the science classroom, which must be appreciated by teachers by creating a learning environment that accommodates all learners and their individual uniqueness to learn through scientific inquiry.

It may be very challenging for G12LSTs using a traditional teacher-centred approach to integrate differentiated teaching, because, in the teacher-centred approach, learners with their different kinds of needs and learning styles, levels of interest, and uniqueness are expected to act or respond to a scientific problem in the same way (Llewellyn, 2011). The IBL approach offers the needed flexibility for individual learners irrespective of their uniqueness or learning styles. Learning becomes effective when G12LSLs can propose various alternative ways of solving the same scientific problem through prior scientific knowledge or concepts.

An IBL approach is an effective way to understand the nature of science (Lyngved et al., 2012; Ramnarain & Hlatswayo, 2018). An IBL approach without teachers' positive attitudes and effective roles play may not lead to learners' understanding of the nature of science.

The G12LST plays a vital role in ensuring the learners' academic success, however, this success can be sustainable and developmental if the learners are equipped with the necessary scientific skills to avoid being over-reliant on the teacher and that sets the learners on a lifelong learner's path. The effectiveness of the IBL approach to teaching and learning is crucial to achieving the objective of a lifelong learner. It is dependent on teachers' and learners' positive attitudes towards an IBL approach, and the proper integration of the characteristics of IBL practices in daily teaching and learning processes.

The effectiveness of the IBL approach may not be properly examined without highlighting some of the roles of Life Sciences teachers and learners in an IBL classroom environment. The major role of the teacher in the IBL approach should be as a facilitator. This is an important role in the IBL approach to Life Sciences teaching as it provides the learners with necessary resources or materials that will actively engage them in the inquiry of real questions, and in turn stimulate and enhance learning. The teacher as a facilitator of IBL may influence learners' learning and motivation either positively or negatively depending on his or her role in the inquiry process and the pedagogical skills deployed by the teacher, or of the teachers' lack of PK.

IBL as one of the constructivist approaches is very effective for teaching Life Sciences. The dynamic roles of the Life Sciences teacher change as the inquiry tasks change (Crawford, 2000). Some of these roles which enable the effectiveness of an IBL approach to teaching and learning are discussed below:

a. **Motivator:** The role of motivator involves the teacher encouraging learners to take responsibility for their own learning (Crawford, 2000). Learners have increased motivation to learn in some lessons and decreased motivation to learn in other lessons or topics, this is because the expectancies, values, and beliefs they attach to lessons or topics differs (Palmer, 2020). Teachers need to deploy their SCK and PK creatively to arouse learners to show interest in and to actively participate in all lessons including lessons or topics where they lack motivation to learn.

   Palmer (2020) posits that a motivated lesson is a lesson or topic the learners are good at, enjoy learning and easily understand the subject and vice versa for unmotivated lessons. Learners develop a personal interest and increase of confidence level in a lesson the more they acquire scientific knowledge or skills.

   Learners learning objectives and envisaged career choices become motivational tools that inspire learners to actively engage in teaching and learning (Palmer, 2020). Teachers who discuss and counsel learners about their career choices and offer advice on how they can attain their career objectives are more likely to understand how to relate to the learners to increase their motivation to learn.

   The traditional teacher-centred approach may demotivate learners, and should be balanced with a more learner-centred approach to increase learners' interest and motivation to learn meaningfully (Vani, 2010). The IBL approach enables Life Sciences teachers to inspire learners by building strong character that will increase motivation and creativity, and develop existing and new scientific skills. Vani (2010) argues that strong character can be built when learners are allowed to engage in various learning activities leading to self-motivation. Conversely a teacher-centred approach does not allow learners the opportunity to be actively engaged.

Making learners aware that they are reliable and trusted to accurately produce scientific explanations and findings on the inquiry activities, helps to build learners' confidence and in turn motivates them (Crawford, 2000). Learners will acknowledge and reciprocate the teachers' motivational role by increasing their interest in cooperating and actively participating in teaching and learning.

b. Diagnostician: The Life Sciences teacher as a diagnostician is expected to identify the strengths and challenges or learning difficulties of individual learners, and support the learners in improving their strengths while finding relevant means of addressing their challenges or learning difficulties (Galloway & Lesaux, 2014). Learners may not be able to express themselves without an IBL approach, hence it will also be impossible for the teacher to identify learners' strengths and learning difficulties without the opportunity for learners to participate actively through IBL.

How teachers perceive their role as diagnosticians is important to achieving the overall objective of teaching and learning. The implementation of recommendations made by either experts or the class teacher should be taken seriously to help learners with learning difficulties, there should be continued support once these difficulties are identified (Guerra, Kupczynski, Mundy, & Garza, 2017). Again, the attitudes or perceptions of teachers toward an IBL approach are significant to their ability to identify struggling learners and how they apply corrective measures or implement recommendations prescribed for learners with learning difficulties.

This unique role requires that the G12LSTs create a learning environment where learners can express themselves while critically observing them to identify not only their level of understanding and strengths but most importantly to discern their learning difficulties (Crawford, 2000). The teacher can only rely on his or her PK skills to identify the strengths or learning difficulties of learners when learners are actively engaged in learning activities. Teachers must be able to determine the appropriate educational needs of affected learners and properly plan the resources needed to match the timeline required to cover the syllabus (Guerra et al., 2017).

Crawford (2000) states that allowing learners to reflect on their learning experiences in the form of feedback which includes how they feel, their knowledge acquired, and the difficulties experienced could be very helpful in identifying their strengths and learning difficulties. This kind of evaluation normally forms part of the lesson plans which all teachers are expected to conduct at the end of each lesson to ascertain not only the level at which learning objectives were achieved but also to identify areas where learners need continued support to resolve their learning challenges.

c. **Guide:** Directing and guiding the learners to develop scientific skills is an important role of the teacher (Crawford, 2000). After identifying the strengths of the learners, the teacher is required to ensure that learners constantly develop and improve on their scientific skills to prepare them for more complex scientific problems.

As an educationist, teachers' other roles include offering guidance, being a counsellor, and acting as a surrogate parent, all of which may take the form of supporting, taking remedial action where necessary and developing the learners academically towards achieving their career choice (Lai-Yeung, 2014).

The role of the teacher as a guide and counsellor is essential to the progress of all schools, the importance of organising a guidance and counselling training for teachers cannot be overemphasised to ensure the overall academic success of the school (Lai-Yeung, 2014). Crawford (2000) emphasises the use of observation and follow-up questions to facilitate effective guidance and counselling. Ineffective guidance could result from the teacher's personal qualities, bias against learners and time constraints (Lai-Yeung, 2014).

Offering guidance and counselling to learners should continue before, during and after classroom activities (Lai-Yeung, 2014). Guidance and counselling are expected to continue to ensure that learning difficulties are eliminated and that all learning objectives are achieved.

d. **Innovator:** Innovator is a dynamic role of the teacher which requires designing of learning instructions, lesson plans or of restructuring the classroom to accommodate new ideas that will facilitate teaching and learning (Crawford, 2000). Sometimes, the teacher presents the learners with a real hands-on activity, experimentation, or group projects in which the learners develop scientific skills during the inquiry activities to complement lessons taught in the classroom.

Galan (2015) stresses that the challenges that innovative teachers often encounter by constantly changing or adjusting their lesson plans or activities to meet the learning needs of their learners. It requires teachers' creativity and good PK to introduce and implement innovative ideas in the teaching and learning process, and sometimes it includes the use of technology to aid the acquisition of scientific knowledge.

The teacher cannot afford to be engaging the learners in the same nonflexible teaching and learning routine (teacher-centred approach) and expect to make a positive difference. Alvarado and La Voy (2006) describe the teacher's role as an innovator who has the mental and physical ability to design and do new things in an entirely different and creative way but still achieves learning objectives efficiently. As teachers welcome new sets of learners to their classroom annually, the demand for flexibility, creativity and pedagogy becomes even greater in the subsequent enrolments. Tripathi and Dwivedi (2016) stress that for teachers to be successful, they must be advanced in their thinking and approach to teaching (learner centred approach such as IBL).

Alvarado and La Voy (2006) note that schools must support the teachers to be autonomous by making provisions for learning resources and empowering them to have confidence to make innovative decisions without unnecessary interference with their teaching practice.

e. **Experimenter:** The teacher as an experimenter is dynamic in the way lesson activity and assessments of learners are conducted (Crawford, 2000). The role of experimenter enables teachers to develop lesson plans or activities in which learners are jointly engaged in testing to evaluate different alternative ways to solving a scientific problem; this practice helps to eliminate boredom in the teaching and learning process. The teachers' effective role as an experimenter will cause the learners to adjust in their approach to solving a scientific problem through experiments (Snodgrass & Rosenthal, 2010). The role of experimenter will enable more hands-on and practical learning activities.

f. **Researcher:** Teachers who constantly evaluate their own teaching and who seek ways of improving their teaching practice can function effectively as researchers (Crawford, 2000). The role of a researcher requires the teacher to always request the learners to give feedback especially on aspects of teacher's instructions on lesson or inquiry procedures that seemed unclear to them, as this will help the teacher to modify the instructions or inquiry procedures for better understanding and to improve teaching and learning.

The teacher as an agent of change must assume the role of a researcher to impact the needed change, this role of a researcher and an innovator are interrelated (Tripathi & Dwivedi, 2016). If the teacher is to remain relevant in his or her role of an innovator, there must be continuous research work conducted in the relevant field of discipline and the ideas gained from the research work should be relevant to improving the teacher’s role of innovator, which will be applied in his or her teaching practice.

g. **Modeller:** The teacher as a role model to the learners is expected to have positive attitudes and attributes that portray him or her as a scientist with the objective of making the learners emulate these desired attitudes and attributes (Crawford, 2000). The learners are inspired, empowered, and encouraged to strive for greatness due to the teacher’s role of modeller, they constantly learn from the teacher’s commitment to make them realise their goals by guiding them through their career paths.

   The teacher is a positive influence who is always there for the learners and makes them feel important in the classroom; he or she is approachable and acts as learners’ confidante (Curtis, 2019). A great example of a role model is to assure learners that teachers are always available to listen to their needs, challenges and will find ways to help them. When learners think of their academic achievements, they remember certain teachers who made it possible (Barmao & Ndeke, 2022). Barmao and Ndeke further stress that learners tend to imitate teacher’s positive influence as they are motivated by the role modelling.

h. **Mentor:** Zachary (2002) describes mentoring as “a reciprocal and collaborative learning relationship between two or more individuals who share mutual responsibility and accountability for helping a mentee work toward achieving clear and mutually defined learning goals”. This relationship requires the teacher to encourage the development and growth of the learners by constantly supporting the learning of scientific work (Crawford, 2000). The responsibility of the teacher includes supervising and helping the learners through an enduring and meaningful inquiry process. Effective mentoring requires building and maintaining a collaborative learning relationship to ensure learners’ academic and personal development (Zachary, 2002). The learners view their teacher as knowledgeable and capable (Crawford, 2000). Being a mentor requires adequate preparation to not only enrich the teachers' teaching practice and professional development but also to help learners reach their full potential through a process of self-discovery.

The teacher-centred approach has been replaced with learner-centred characteristics due to effective mentoring practice involving the transfer of scientific knowledge, knowledge application and critical reflection (Zachary, 2002).

i. **Collaborator:** The teacher as a collaborator enables a teaching environment where teacher and learners regularly exchange ideas, share information, and sometimes allow learners to take on the role of teacher to improve teaching and learning (Crawford, 2000). Collaboration is beneficial to both teachers and learners, although some teachers could be reluctant to share their role with the learners. However, teachers should create their own specific roles to help maximise learners' potential as the learners become aware of their motivating roles in the teaching and learning process (Franklin, 2019). Effective use of collaboration strengthens teamwork among learners and their teacher (Loima, 2016). A well-planned collaboration creates a sense of responsibility and direction for both teachers and learners, especially when ideas and lesson activities are shared to achieve learning objectives. It helps in providing feedback and building of trust (Crawford, 2000; Franklin, 2019).

j. **Learner:** The teacher's role as a learner enables a teaching and learning environment where the teacher opens himself or herself to learning new concepts and the learners can perceive the teacher as being a learner because of the teacher's openness to learning new ideas and taking the role of learner (Crawford, 2000). Life Sciences teachers are expected to constantly equip themselves with relevant information or scientific knowledge through research activities and learning resources to keep abreast with the current issues in science education.

The roles of modeller, mentor, collaborator, and learner emerged as the original roles for teachers using an IBL approach to facilitate the teaching of G12LS's topics, the point emphasised here is that teachers' efforts in an inquiry-based classroom require them to take on numerous roles that demand a high level of expertise (Crawford, 2000). These expert characteristics are inherent in the Life Sciences teachers' SCK and PK.

The various roles expected from the G12LSTs during the scientific inquiry process should prompt the learners to be engaged in their SPS activities, although some of the learners' roles may be like roles in the teacher-centred approach where learners listen and take notes on inquiry procedures, however, learners' roles or activities should portray them as scientists (Crawford, 2000). The effectiveness of the IBL approach is indicative of overall learning success or learners learning achievements, with these learning objectives achieved due to the teachers' supportive roles and the learners' roles of active collaborator, apprentice, and some of the roles normally assumed by the G12LSTs in the scientific inquiry process.

The role of the learner

IBL being a learner-centred method of teaching and learning, the role of the learner should emphasise the importance of the active construction of learning. However, learners are expected to ask questions, make decisions, design plans and experiments, discuss, collaborate, communicate results, and propose substantial solutions to problems posed.

The IBL approach requires more responsibilities from the learners in the teaching and learning process, it also fosters a rapport between the teacher and the learners such that learners' confidence levels are built to ask questions, think critically, work in groups to share ideas, devise alternative ways to solve problems and discover new concepts on their own, all of which would not be possible without proper execution of the teachers' roles in the IBL approach (Crawford, 2000).

The teacher must believe that the learners should have some degree of control over the teaching and learning process. Although the teacher is the key element in the process, he or she is expected to guide the IBL classroom activities by asking open-ended or divergent questions, allowing a short period after asking the questions to enable learners to exercise their critical thinking skills, encouraging learners' attempts to question, and motivate them to actively participate, he or she must avoid telling learners what to do while maintaining a disciplined classroom.

In an enabling environment which allows for an IBL approach, some of the learners' roles would be:

i. Participating actively in the teaching and learning process,
ii. Asking questions and expressing their own ideas or understanding,
iii. Applying prior knowledge or experience to the subject matter which will allow them to construct their own knowledge and use it where applicable,
iv. Accepting increased responsibilities,
v. Motivating himself or herself to think innovatively, preparing themselves to learn more about new concepts or ideas generated,
vi. Sourcing and gathering materials or information needed and ensuring that specimens or other relevant materials used are returned after use,
vii. Making use of information or following the guide provided by the teacher, and
viii. Cooperating with team members in a group work task.

Learners' learning progress and achievement should be the criteria by which G12LST's quality and IBL implementation is measured (Coe et al., 2014). For a reliable judgment on whether teaching is effective or ineffective, it must be checked against the learning progress made by learners. There should be collaborative efforts between the teacher and the learners toward achieving the success of an IBL approach to Life Sciences teaching and learning, this is because it precedes some benefits for both the teacher and the learners (Crawford, 2000).

2.19 BENEFITS OF IMPLEMENTING IBL APPROACH IN TEACHING LIFE SCIENCES

Bhagat (2017) found that an IBL approach enables the acquisition and improvement of scientific reasoning and critical-thinking skills that are relevant for the 21st century. Learners taught with this approach, achieve much more in critical thinking and examination performance than learners taught using the traditional teacher-centred approach.

Bhagat's (2017) emphasis on the benefits that can be derived from an IBL approach reaffirms Bruder and Prescott's (2013) findings that an IBL approach enables significant improvement in learners' interest in learning, understanding of content and process, meaningfully engaging in practical work and using laboratory equipment effectively. Discovering Science through Inquiry (2009) aptly agrees that learners gain increased interest, and enthusiasm and are motivated to learn more in an IBL approach.

Discovering Science through Inquiry (2009) found that learners learn science meaningfully and improve their inquiry process skills when they participate in first-hand scientific exploration and investigation. The National Research Council (1996) agrees that an IBL approach is central to the acquisition of scientific knowledge, as it enables learners to regularly use their critical and logical thinking skills.

Learners with SEBD can inclusively benefit from the IBL approach if teachers conduct inquiry activities in a manner that addresses their learning difficulties as stipulated in the science curriculum (Camenzuli & Buhagiar, 2014). Learners with special educational needs can also benefit from the IBL approach, although it will require a teacher with specialised skills to conduct lesson activities that are applicable to special learners.

Some of the benefits learners derive from the IBL approach to teaching and learning are deeper understanding of subject matter, application of scientific knowledge, exploration and understanding of phenomena in the natural world, and increased academic success (Coffman, 2009; Bhagat, 2017).

Guido (2017) stressed the need for teachers to engage learners actively through an inquiry process and highlighted seven benefits of the IBL approach to the learners and teachers as follows:

1. **Reinforces curriculum content:** Some teachers viewed the IBL approach as entirely different from the curriculum and therefore not compatible in a practical sense, however, the IBL approach can be used to reinforce essential aspects of the science curriculum (Guido, 2017). Without scientific inquiry activities, the theoretical aspects of the learning aims may be very difficult for learners to

properly comprehend. The IBL approach helps to improve SCK, especially in science subjects.

DoBE (2011) emphasises how the Life Sciences curriculum can be implemented using scientific inquiry to develop learners' SPS and the ability to think objectively and critically. Since 1994, the school curriculum has undergone several significant reforms in the South African education sector (Gumede & Biyase, 2016). Besides redressing past injustices in the educational sector, one of the major reasons for several curricular reforms was to integrate an IBL approach to make the curriculum more learner-centred and to engage them in more practical work that will make them appreciate the curriculum content. Doing science will increase learners' curiosity on specific topics and therefore enhance their understanding of both theoretical and practical aspects of the learning aims (Guido, 2017).

2. **Prepare the mind for learning and brainstorming:** Teachers using an IBL approach can create a comfortable atmosphere by introducing the background knowledge of inquiry tasks to learners, granting the learners relevant information to aid their understanding and investigation of the entire process of the inquiry task (Guido, 2017; The PRIMAS project, 2013). The IBL approach enables inquiry activities before, during, and after the specified period meant for the lesson tasks or activities, consequently, scientific learning is not limited to a lesson period or physical classroom.

   Guido (2017) notes that an open question posed in an IBL classroom can trigger scientific curiosity, leading to learners brainstorming and developing their critical and problem-solving skills. The IBL approach enables learners to work collaboratively in groups to brainstorm on possible solutions or alternatives, individual ideas are collected during the investigative inquiry to find a solution for a scientific problem. It is mutually beneficial for learners to work collaboratively.

3. **Promotes a deeper understanding of content:** Guido (2017) observed that the IBL approach aids learners in developing scientific concepts by understanding how ideas are generated and how they are applied to real-life situations. The

inquiry process allows learners to not only generate research questions and investigate their findings but also provides the opportunity for learners to better grasp the content, think critically, and own learning experiences. In support of the above observation by Guido (2017), Ramnarain and Hlatswayo (2018) found that learners develop their science conceptual understanding during active participation in the scientific inquiry process. Learners develop self-awareness to find alternative solutions to problems posed during scientific inquiry which enables a deeper understanding of subject content.

An IBL approach can help teachers to acquire sufficient knowledge about task characteristics, understand challenges arising from the use of the IBL approach, and are able to critically reason on applicable strategies to overcome the challenges. This is successful due to teachers' training and development (Lyngved et al., 2012). It implies that teachers will develop their pedagogic skills as they continue to use the IBL approach to facilitate the transfer of scientific knowledge to their learners.

4. **Helps make learning rewarding:** Learners are intrinsically motivated and build self-confidence to increase attainment in science learning as an IBL approach inculcates in them a positive mindset in the discovery of scientific concepts and the excitement of not only doing science but also finding solutions to scientific problems (Guido, 2017; The PRIMAS project, 2013). In this context, learners' excitement to learn does not come from teachers' approval of them or parental rewards, but their satisfaction is derived from their ability to independently solve scientific problems during the inquiry process. Guido (2017) notes that learners' continued desire to learn comes from a simple inquiry task.

   Ramnarain and Hlatswayo (2018) maintained that the IBL approach is characterised by observation, investigation, hands-on experiments, and practical activities and that these motivate and stimulate learners' interest to learn science effectively. Lyngved et al. (2012) emphasised that learners gain autonomy to work independently or collaboratively during IBL class activities or tasks, thereby increasing curiosity and the desire to learn more as they develop creative and critical thinking skills in subsequent inquiry activities. The IBL approach serves as a rewarding approach to learners because of an increased inner desire to learn more and to own their learning experiences.

5. **Builds initiative and self-direction:** Lyngved et al. (2012) found that the IBL approach enables learners to be self-motivated, disciplined, and more effective in acquiring scientific skills when compared with learners in the traditional teacher-centred classroom, it also equips learners for future challenges and prepares them to become lifelong learners. Guido (2017) agrees that an IBL approach is responsible for learners' self-motivation, inventiveness, and enthusiasm to learn science continuously and independently.

   The PRIMAS project (2013) found that IBL encourages higher-order thinking in learners and helps to develop and use their SPS and scientific knowledge optimally, it is also an effective way to increase female learners' participation in scientific inquiry.

6. **Works in almost any classroom:** IBL activities can be used in almost any classroom due to their flexibility. Inquiry activities can be reorganised by teachers to suit classroom conditions. The efficacy of IBL is evidenced in learners with various abilities, negative attitudes towards learning science, and learners with different cognitive capabilities, all of whom improve with an IBL approach (Guido, 2017; The PRIMAS project, 2013). The inquiry activities designed by the teacher can be modified and reused for several classes in the subsequent years, therefore, teachers will be able to manage and use learning resources efficiently while maximising the benefits that IBL offers both the teacher and the learners.

7. **Offers differentiated instruction:** Guido (2017) emphasised that an IBL approach allows the teacher to integrate differentiated instruction to the inquiry process, thanks to the flexibility of the IBL approach. Learners with different learning needs, interests, styles, and cognitive capability can be accommodated effectively by preparing lesson resources and or content that are applicable to all groups of learners. It implies that all learners can benefit from the IBL approach irrespective of their different learning needs, styles, and difficulties.

> Layton (2016) found that differentiated instruction enables all learners to be supported in the inquiry process, improves teacher's pedagogic skills, by encouraging the teacher to develop new learning materials or lesson activities, and by allowing for greater creativity and flexibility. In an IBL approach, differentiated instruction comes with its own challenges of increased workload for the teacher and time constraints. Guido (2017) argues that differentiated instruction in an IBL approach helps to transfer scientific knowledge to several learners despite their distinctive learning needs, styles, and difficulties; it also improves learners' engagement and learning objectives.

Learners who lack cognitive capability may find it challenging to acquire scientific skills in an inquiry process, although previous studies have shown that the IBL approach has enabled the transfer of scientific knowledge and improved the cognitive capability and or attitudes of learners towards science subjects (Bruder & Prescott, 2013). An IBL approach can eliminate learners' negative attitudes towards science learning, as it promotes an all-inclusive science education (The PRIMAS project, 2013).

2.20 FACTORS RESPONSIBLE FOR IBL INEFFECTIVENESS AND ITS IMPLICATIONS

Effective implementation of the IBL approach to teaching and learning undoubtedly offers appreciative benefits to the teachers and more importantly to the learners, however, the approach is not free from hindering factors and criticisms. The problems arising from the non-implementation of the IBL approach have negative implications for the development of science and technology as there will be shortages of scientifically skilled learners and graduates who are equipped to deal with the complexity and challenges brought by advances in science and technology (Kang & Keinonen, 2016; Gholam, 2019; Ibrohim, Sutopo, Muntholib, Prihatnawati, & Mufidah, 2020).

For Anderson (2002), the implementation of an IBL approach can include some difficulties which could be frustrating for teachers. To mitigate or eliminate these problems, it is important to identify the difficulties encountered while implementing the IBL approach. These problems include shortages of competent science teachers, incompetent teachers, teachers' lack of training and development, teachers' and learners' negative attitudes and beliefs to the IBL approach, and inadequate learning resources to facilitate an IBL approach.

2.20.1 Insufficient competent Life Sciences teachers

Learners' low enrolment in science subjects and its accompanying dropout challenge will undoubtedly contribute to a shortage of competent science teachers in the future.

Holmqvist (2019) states that one of the major challenges in the 21st century is to meet the overwhelming demand for qualified teachers. Yet, as the demand increases, the number of enrolments in teacher education is not encouraging.

The quality of science education is largely dependent on the quality of science teachers, and the problem of implementation of the IBL approach will be multifaceted with a shortage of competent G12LSTs as the academic achievement of the learners is dependent on the availability of these teachers (Banerjee, Das, & Mohanty, 2014; Kishwar, 2016). A lasting solution is provided by increasing the number of competent sciences teachers but integrating IBL characteristics may remain a challenge, with many learners deprived of the opportunity of inquiry activities to develop their SPS. Consequently the transfer of scientific knowledge will be difficult and the negative implication for science education will obviously deter development of science and technology.

2.20.2 Lack of training and development

It requires a considerable number of teachers' SCK and PK to be able to effectively implement the IBL approach in the classroom. Teachers lacking training and support from the school or principal to improve in their teaching practice may struggle to effectively implement an IBL approach.

Bhagat (2017) found that the acquisition of adequate skills required for science teachers to effectively integrate IBL characteristics in teaching and learning, remains one of the major challenges for IBL implementation. Anderson (2002) notes that technical factors such as teachers’ inadequate skills to facilitate inquiry activities, insufficient training, the challenge of designing new tasks repeatedly and assessing the learners’ inquiry activities to achieve learning objectives, are some of the barriers resulting in non-implementation of the IBL approach.

In the IBL approach, science teachers are expected to facilitate in ways they themselves may not have experienced during their science learning (Onwu & Stoffels, 2005). Hence, there is a need for teachers’ training and development on how to constantly improve their teaching practice and effectively integrate an IBL approach.

Holmqvist (2019) says that the importance of training teachers to enhance their competencies in facilitating classroom inquiry activities cannot be overemphasised. The Department of Education (2006) in the National Policy Framework for Teacher Education and Development, states that learners enrolled in teacher education in South Africa are expected to pass compulsory teaching practice modules before graduating. The professional training and development are expected to enable learner-teachers to acquire conceptual knowledge, SCK, and PK in preparation for the tasks ahead. However, for sustainability, the training and development should be conducted periodically beyond the teacher education programme due to the flexible and dynamic nature of the IBL approach.

2.20.3 Negative attitudes and beliefs of teachers and learners

Lyngved et al. (2012) argue that learners’ declining interest in science subjects can be attributed to the passive way they were taught during their primary and secondary education. They assert that to reverse this trend, there is a need to introduce an IBL approach in the early stages of their education.

Anderson (2002) notes that the main factors impeding IBL implementation are attitudinal problems such as teachers’ beliefs and the values that they attach to the approach. Pressure to educate and prepare learners to meet higher educational requirements is also regarded as one of the cultural problems. Teachers must first change their negative beliefs and attitudes before they can help to reverse learners’ negative attitudes.

The notion that an indiscipline problem may arise where teachers allow learners absolute control of the entire inquiry process is a challenge to IBL implementation. Also learners' active roles may be in conflict with some teachers' beliefs or perceived professional ethics where they view relinquishing their active roles to the learners as problematic (The PRIMAS project, 2013). Some science teachers did not learn science through an IBL approach, hence adopting the IBL approach - where learners take on the active role - may be viewed as testing the teacher's autonomy and will be challenging for such teachers. However, once they start to enjoy the benefits that an IBL approach offers to both the learners and teachers, they will see the need for the implementation of the approach. Discovering Science through Inquiry (2009) disagree that indiscipline problems may arise when learners are allowed to take control of their learning experiences, however, it notes that unpreparedness to adopt an IBL approach, and poor teachers' planning, are mostly responsible for indiscipline problems and for learners' negative attitudes towards the IBL approach.

The PRIMAS project (2013) argues that some learners struggle to replace their passive role with an active one, as they feel comfortable with passive listening, note taking and following the teacher's instruction. Changing these negative beliefs and attitudes will require that the teacher introduces IBL in an attractive way that will interest the learners so that they embrace inquiry based learning and not feel that they are being coerced by the teacher to assist in his or her responsibilities.

Teachers' commitment to changing negative attitudes towards IBL is important – not only in meaningfully eliminating the barriers to learning G12LS's topics, but also in motivating learners to participate actively in the investigative inquiry process, thereby developing their scientific skills, and creating a conducive and friendly learning environment for continuous IBL implementation.

2.20.4 Large classes

Life Sciences teachers with large classes will find it difficult to effectively integrate IBL characteristics in their teaching and learning process. This problem will be exacerbated by insufficient competent science teachers and inadequate learning resources to facilitate the scientific inquiry process.

Ramnarain (2014) found that not all learners in a large class get the necessary learning support needed in an inquiry process. The challenge of acquiring scientific skills in such circumstance is likened to being the same problem as will be encountered in an under-resourced classroom or school.

Collaborative learning between the teacher and learners will be limited in a large class. Identifying learners with learning difficulties may pose an additional challenge for the teacher as he or she may feel compelled to adopt a teacher-centred approach. Over-reliance on IBL as the only instructional design for the teaching and learning of all science topics or lessons may not be appropriate as some science topics or lessons will require a combination of two or more instructional designs to effectively transfer scientific knowledge (Bruder & Prescott, 2013).

The teacher may struggle to control a large class during inquiry activities as it may lead to an indiscipline problem and the occurrence of an accident during an experiment in the laboratory. Extra precautionary measures will be required during inquiry activities that include working in the science laboratory, this is because the IBL approach allows learners a considerable amount of independence in the inquiry process (The PRIMAS project, 2013). However, teachers are expected to plan to ensure the safety of all learners and to prevent accidents from occurring.

2.20.5 Inadequate teaching and learning resources and lack of science laboratory

Onwu and Stoffels (2005) found that teachers in under-resourced and large classes often turn to a teacher-centred approach and demonstration method of teaching as they often have very little opportunity to engage the learners in the scientific inquiry process. Limited teaching and learning resources and the lack of a science laboratory limit the use of an IBL approach with the consequent low acquisition of scientific knowledge.

The supervision of learners by a competent G12LST may not be effective in an IBL approach, without the availability of relevant learning resources. Anderson (2002) identified the lack of learning resources as one of the political problems impeding IBL implementation. Some lessons in science require a well-equipped science laboratory to effectively facilitate learning (The PRIMAS Project, 2013). It may be very challenging for some schools to afford expensive laboratory equipment to aid scientific learning, hence, government intervention is required to equip schools lacking necessary learning resources.

2.20.6 Cognitive capability and learners with learning difficulties

Fisher, Grant, and Frey (2009) argue that the lack of prior scientific knowledge will affect learners' learning of science and that underachievement in science persists because inquiry approaches are not effectively practised by teachers. Does this imply that for learners to achieve in an IBL classroom, they must have attained a certain level of cognitive capability? Guido (2017) stresses that competent teachers with good pedagogical skills can use an IBL approach to assist learners with low or less-than-average cognitive capabilities to engage in the inquiry process, by providing them with relevant learning tasks to aid their science understanding.

The notion that an IBL approach thrives only with learners with high cognitive capabilities and that learners with very low cognitive capability will struggle to get along in the inquiry process, persists. However, The PRIMAS Project (2013) found that learners with average or less than-average cognitive capabilities can improve their science learning when teachers design and conduct inquiry tasks applicable to such learners' cognitive capabilities when using the IBL approach. Starting with demonstrated inquiry, moving to structured inquiry and to guided inquiry will pave the way for such learners to conduct a self-directed or open inquiry. The teacher may also integrate differentiated instruction into the IBL approach to accommodate all learners irrespective of their cognitive capabilities. Discovering Science through Inquiry (2009) aptly agrees with the PRIMAS project in that an IBL approach is appropriate for all learners irrespective of their cognitive capabilities if a teacher with good pedagogical skills was facilitating the teaching and learning.

The National Research Council (1996) observed that learners with SEBD can also be assisted to acquire scientific knowledge but expect the teacher to conduct the inquiry activities in a manner that will accommodate them and their learning difficulties. Camenzuli and Buhagiar (2014) aptly agree that an IBL approach can be used to develop learners with high cognitive capabilities and those with special educational needs.

2.20.7 Life Sciences curriculum

The South African science curriculum emphasises the importance of the inquiry-based learning approach, and it also encourages science teachers to be flexible in the manner in which they conduct Life Sciences teaching and learning (DoBE, 2011). However, teachers have consistently pointed out as major factors for poor IBL implementation, insufficient time to cover the syllabus, and inadequate learning resources which include poorly funded science laboratories and libraries. A flexible Life Sciences curriculum that accommodates more practical tasks and less content oriented should be developed to assist science teachers to effectively using IBL.

The PRIMAS project (2013) found that a predominantly content-oriented science curriculum with very little hours to engage learners on process-oriented activities could pose a problem for implementation of the IBL approach. The science curriculum should be more practical to be able to equip learners with critical thinking and creative skills.

Teachers are often under pressure from the principal and other educational authorities regarding their completion of the science syllabus and meeting relevant deadlines (Anderson, 2002). The challenge of having to complete the science syllabus at the specified period as stipulated in the Life Sciences curriculum is thus another aspect of concern for most teachers. Teachers are aware that due to its flexibility completing a lesson activity or task using an IBL approach could be time consuming.

Anderson (2002) notes that some science teachers view the textbook as an authority that learners are expected to master by rote. Learners under the tutelage of such teachers may not enjoy the benefits that an IBL approach offers. Strictly mastering the textbook as a learning activity is in contradiction with the integration of IBL characteristics of teaching and learning.

It will require more time in an IBL approach to complete the same lesson task than when using a traditional teacher-centred approach, this is because learners require more time to explore, conduct investigative inquiry, and come up with their own findings in the IBL approach (The PRIMAS project, 2013). In the IBL approach it should not be viewed as a waste of time, but rather be seen as a learning opportunity when learners fail to produce the expected results or findings of their inquiry question or experiments. Consequentially, learners must have learnt a more effective way to conduct an inquiry activity that applies or pertains to such questions or experiments.

2.20.8 Life Sciences language of learning and terminologies

According to Mammino (2010), development of language or communication skills is essential to the development of scientific concepts that lead to the acquisition of scientific knowledge. Learners lacking in communication skills or who are not proficient in the language of learning may not be able to effectively participate in the inquiry activities. Mammino also stresses that language is fundamental to understanding visuals and scientific symbols. Language is essential for all the inquiry aspects of an IBL approach. Learners' scientific literacy and language communicative skills must be improved upon to ensure the implementation of the IBL approach.

Alexander (2018) reports that the English-speaking population of South Africa is approximately 10% of the total population. Yet most scientific journals, articles, and textbooks, including online scientific information, are published in the English language, a factor that puts most South African learners in a disadvantaged position. Transferring scientific knowledge into all the other indigenous South African languages is an almost impossible task considering the insufficient number of competent science teachers and the insufficient resources available to cater to all other indigenous languages. Non-English-speaking learners will continue to struggle to cope with scientific and investigative inquiry due to print and language barriers.

The IBL approach encourages learners to be independent in the inquiry process, but this could be challenging for non-English speaking learners' acquisition of SCK and in-depth understanding of science terminologies (Fisher et al., 2009). Acquiring practical knowledge separately from the SCK may prevent learners from gaining holistic scientific knowledge.

Mammino (2010) posits that getting acquaintance with scientific concepts and science terminologies will help learners develop scientific knowledge quickly and effectively. Fisher et al. (2009) note that improving learners' understanding of science terminologies and vocabulary will enhance their inquiry activities. An IBL approach will thrive if learners can acquire the language of learning and communication skills and have sufficient knowledge of science terminologies.

English is inarguably a global language, so it is understandable that some have the notion that it should be used as the major medium of instruction in all schools. This notion may have been proved wrong though by some developed and fast-growing economy countries such as Norway, Netherlands, Iceland, Japan, and China, whose curricula, including science curricula, are designed with their own languages; they use their home languages as the medium of instruction and only learn English as a foreign language. These countries have advanced in science and technology, yet their science curricula and educational systems are free from English language dominance.

Implementation of IBL is dependent on the availability of competent science teachers, regular training and development for science teachers to keep abreast with the dynamic nature of IBL, developing teachers' and learners' positive attitudes, making the teaching profession robust and attractive so as to increase enrolment in teacher education and to avoid teacher attrition, the provisioning of teaching and learning resources in sufficient quantities and also attending to the needs of learners with learning difficulties, through a more process-oriented science curriculum.

2.21 CONCEPTUAL FRAMEWORK

Framework in research refers to a set of broad concepts that provide the fundamental structure required for the research study (Grant & Osanloo, 2015).

The conceptual framework of the research study is a set of related abstract ideas or principles combined to provide a detailed understanding of a phenomenon being investigated or studied (Shava, 2019; Kothari, 2004). It is most applicable and appropriate for qualitative research, and it forms a vital feature of the research study (Gumbo, 2019).

Constructivism theory is widely known as an effective model for explaining how knowledge is generated and how learners learn (Shah, 2019). Constructivism as a theory of knowledge and learning, assists in investigating G12LSTs' perceptions of IBL in teaching G12LS, and understanding how learners construct scientific knowledge through the IBL approach used by their teachers for teaching and learning (Mudau, 2013).

The researcher used a model by Mudau (2016), the classroom Practice Diagnostic Framework (CPDF) to understand teachers' perceptions of the IBL approach to teaching G12LS. In addition, to ascertain how they implement the teaching approach, using various components to ensure that their learners actively engage in doing science to acquire scientific skills and knowledge. The CPDF model is appropriate for identifying how learners actively participate in teaching and learning and acquire scientific skills and knowledge continuously (Mudau, 2016; Peters, Le Cornu, & Collins, 2003).

The CPDF model enabled the researcher to ascertain G12LSTs' understanding of the concepts of IBL, their SCK and PK, and instructional strategies used to engage their learners to collaborate, interact, and acquire scientific knowledge from their prior scientific knowledge (Mudau, 2016; Vicente, 2013).

The researcher included infusion and interactive models; both models promote learner-centredness, collaborative learning, critical and creative thinking skills, researching and problem-solving skills, and cognitive thinking skills (Mudau, 2016; Zulhelmi, Abdullah, Abdul, & Ibrahim, 2017). Developing learners' cognitive ability in science education is one of the major objectives of the CAPS curriculum (DoBE, 2011).

Infusion and interactive models were evident in how an IBL approach enabled the integration of relevant and engaging materials, and technology in lesson activities to eliminate boredom and rote learning (Tristanti & Nusantara, 2023). Consequently, increasing interaction and collaboration between learners and their teachers (Mudau, 2016; Tristanti & Nusantara, 2023). The IBL approach used by the teachers enabled the infusion of modern technology into teaching and learning.

The researcher used the CPDF model by Mudau (2016), to conceptualise the research study. The model consists of four main frames, the teacher knowledge, instructional strategies, interactions and discourse, and diagnosed classroom practices. The researcher applied "teacher knowledge" in frame A, to G12LSTs' understanding of the concepts of IBL approach to teaching, their SCK, and the cognitive capabilities of their learners (Mudau, 2016; Rutten et al., 2015). The "instructional strategies" in frame B, implied the G12LSTs' decisions on the appropriate learning materials for inquiry tasks, the integration of teacher-centred where applicable, the use of differentiated instruction and differentiated types of inquiry, their PK, and identifying how different learners acquire scientific knowledge (Mudau, 2016; Lederman et al., 2013). Frame C, "Interactions and discourse" indicated how the components of the teacher knowledge in Frame A, and instructional strategies in Frame B, kept the learners actively involved in the teaching and learning process. Inquiry tasks, group activities, research, collaboration, questioning and answer sessions, and informal assessments are some of the activities used by the G12LSTs to keep their learners actively involved in the teaching and learning process (Mudau, 2016; Kurniawan et al., 2019; Adom et al., 2016). Frame D, "diagnosed classroom practices" applied to the outcomes of analysis in all the frames. These outcomes represented the characteristics responsible for the effective implementation of IBL, achieved learning objectives, factors impeding effective implementation of IBL, and the remedial actions put in place to mitigate against the factors impeding effective implementation (Mudau, 2016).

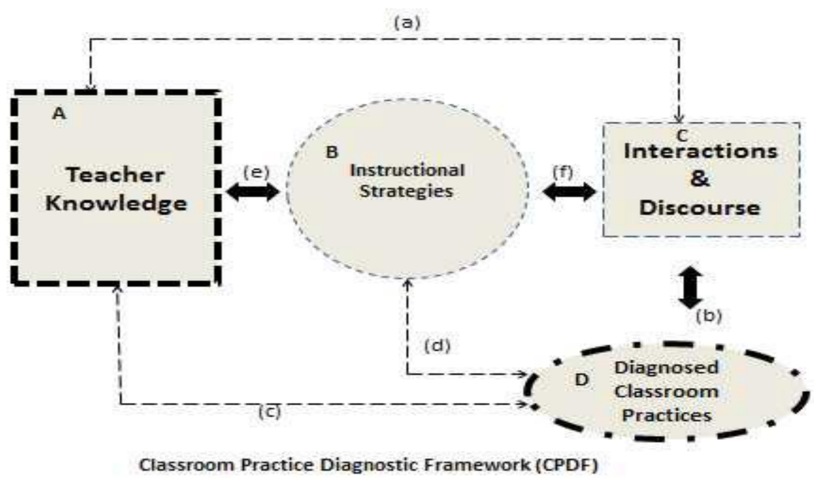

Figure 2.3: The Classroom Practice Diagnostic Framework (CPDF) (Mudau, 2013).

The various concepts reviewed in this chapter formed the underlying ideas intended to provide support and structure for this study. The researcher used Mudau's (2016) CPDF model to diagnose G12LSTs' perceptions of IBL, their understanding of the concepts of IBL, and their attitudes toward the approach to teaching G12LS. The model enabled the researcher to ascertain G12LSTs' SCK and PK, instructional strategies employed to engage their learners in inquiry activities.

2.22 CHAPTER SUMMARY

This chapter focused on teachers' perceptions of IBL and the effectiveness of the IBL approach to teaching of G12LS. It discussed the teaching of Life Sciences from the historical, CAPS and IBL perspectives. It compared the traditional teacher-centred approach with the IBL approach. It also reviewed the types of inquiries used in IBL tasks and the phases involved in an inquiry cycle. Discussion of IBL also included how teachers engage their learners to understand their ability to acquire scientific knowledge.

The teachers' SCK and PK and their attitudes towards the IBL approach were discussed to ascertain the benefits derived from its effective integration. The factors and implications for the non-implementation of an IBL approach in teaching G12LS were included in the discussion, and the chapter was concluded with a conceptual framework.

The next chapter will focus on the research design and the methodology employed by the researcher. It will explore the different data collection methods used in the study to answer the research questions and address the research statement of the problem.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

In the previous chapter, an extensive literature study was conducted with the aim of gathering relevant information to determine teachers' perceptions of IBL and the effectiveness of an IBL approach to teaching and learning of G12LS's topics, it further examined the benefits derived from effective implementation of IBL as well as the factors responsible for its ineffective implementation. The continued low rate of enrolment of science learners into both secondary and university education and poor performance leading to dropout necessitate the examination of G12LSTs' understanding of the IBL approach to teaching and learning.

The purpose of this chapter is to outline the research design used in this study to understand teachers' perceptions of IBL, explore the effectiveness of the IBL approach used by G12LSTs, and their learners' learning success.

3.2 RESEARCH DESIGN

McMillan and Schumacher (2014) describe research design as the research plan which explains the conditions and procedures required for collecting and analysing data. Kothari (2004) states that research design constitutes the process involving what, where, when, how much, and the way research will be conducted and how relevant it is to the research problem. Research design enables the implementation of intended tasks in a logical manner (Rajasekar, Philominathan, & Chinnathambi, 2006).

3.2.1 Research paradigm

Creswell (2012) described the paradigm as the "worldview-method argument", a set of ideas or concepts on how things work. Microsoft Encarta English Dictionary (2019) defines paradigm as a pattern or model which forms the basis of a methodology or theory.

A constructivist research paradigm with a qualitative approach facilitate data gathering and analysis in this study. According to McMillan & Schumacher (2014), a constructivist research paradigm is used to generate knowledge through a systematic procedure which maintains multiple socially constructed realities. Adom, Yeboah, and Ankrah (2016) emphasise that a constructivist research paradigm strengthens educational research, it enables construction of own understanding and knowledge of a phenomenon through experiences and reflections.

The researcher used professional judgements guided by the rich information gathered in the literature review to interpret the empirical data collected during the face-to-face and in-depth interviews with the participants. This paradigm is best suited for the research study because of the need to systematically construct knowledge that will be helpful to achieving credible research findings.

3.2.2 Research approach

Kothari (2004) describes a qualitative approach to research as research which “is concerned with subjective assessment of attitudes, opinions and behavior”. He stressed that it is subjective because of the researcher’s insights and impressions about the research topic, and its influence on the findings.

McMillan and Schumacher (2014) maintain that qualitative research designs are systematic and distinct from quantitative research designs in its unique way of data gathering of natural phenomena in the form of words rather than numbers. A qualitative design is used to enable an insightful analysis of relevant facts and to inductively source meaningful data in determining the effectiveness of the IBL approach used by G12LSTs, and discovering how the method contributes meaningfully to learners’ understanding and experiences of Life Sciences. This design has helped to address the research purpose and questions.

3.2.3 Research strategy

A phenomenological study enhances the understanding of lived experiences, it also seeks to clarify meanings different participants give to events or make of phenomena (McMillan & Schumacher, 2014). It was used to focus on gathering more and diverse views of the participants rather than relying on a single idea which may lead to generalisation (McMillan & Schumacher, 2014). It was adopted by the researcher due to its qualitative tendencies. The approach was helpful in that it provided access to participants' real and lived experiences and to their understanding of IBL's effectiveness in the teaching and learning of G12LS's topics.

3.3 RESEARCH METHODS

McMillan and Schumacher (2014) describe research methods as "the procedure used to collect and analyse data." The researcher carefully identified and selected real participants that fit appropriately to provide authentic data required to solve the research problem. Data collection was done through interviews, classroom lesson observations, and document reviews before being analysed to derive the research findings.

3.3.1 Selection of participants

"Not everything that can be counted counts, and not everything that counts can be counted" Albert Einstein.

Rajasekar et al. (2006) argue that identifying and selecting appropriate participants, or sources of data from the entire population, to ensure credibility and trustworthiness, is one of the significant aspects of the researcher's responsibilities to finding authentic solutions to the research problem.

A population is a group of elements or cases, whether individuals, objects, or events, that conform to specific criteria and to which we intend to generalise the results of research (McMillan & Schumacher, 2014). This group is also referred to as the target population or the universe (McMillan & Schumacher, 2014). The sample is representative of a population and data collected from the participants should therefore be a true reflection of the entire population it represents (Creswell, 2012). Nonprobability sampling is regarded as the most common type in educational research, purposive sampling is one of the nonprobability sampling procedures used in qualitative research (McMillan & Schumacher, 2014).

In purposive sampling, the researcher selects elements from the population that will be representative or informative about the topic of interest (McMillan & Schumacher, 2014).

The purposive sampling procedure was used in this study because of the practical and phenomenal nature of the qualitative research design, and because it was imperative to concentrate and source data from real and concerned participants in the field of study.

Participants were G12LSTs and G12LSLs who were a repository of rich information that will be helpful for the aim and objective of the study. Purposive sampling facilitated the gathering of data leading to information that had a major impact on addressing problems encountered by a larger population of South Africa in science education.

Three teacher participants from three different secondary schools and six learners (three female and three male) of each of the first and second teachers in two different schools, and seven learners (four female and three male) of the third teacher in a different school were identified as participants. Consequently, a total of 22 participants took part in the interview process. Male and female learner participants were identified and selected to derive the benefits of gathering data from both genders' viewpoints on the subject matter. This was to clear the wrong notion that science is a difficult subject for the female gender and that it was meant for the male gender. The learner participants were low, average, and high achievers. This was necessary, to have learners with different levels of cognitive capabilities, share their views on the effectiveness of the IBL approach (details in Table 3.1). Data was collected from three secondary schools in the Bojanala district of the North-West Province of South Africa.

Pseudonyms were used for the three teacher participants, and they were addressed as **Mr. Andile, Mr. Bulunga, and Mr. Chipo,** and six learners (three male and three female) of each of the three teachers were addressed as **Learner A to Learner F,** except for the third teacher whose learners were seven (four female and three male learners), with the seventh learner participant being addressed as **Learner G.** Twenty one participants were intended for the research interview, however, twenty-two participants actually participated in the interview process. Overall, three teacher participants and nineteen learner participants took part in the interview process.

The interview was conducted with teacher participants in a single interview session, except for the teacher participant in school A, whose classroom lesson observation split his interview session into two halves. A single interview session was conducted with each group of the learner participants. A single lesson observation was conducted in each of the teacher participants' classrooms. Demographical details are in the table below.

Table 3.1: Participants' Information and Demography

Descriptions	**School A**	**School B**	**School C**
Teacher Participant & Gender	Mr. Andile (Male)	Mr. Bulunga (Male)	Mr. Chipo (Male)
Age Group of Teacher	40 – 44	50 – 54	40 – 44
Years of Teaching Experience	16 Years	11 Years	12 Year
Highest Qualification of Teacher	B. Tech Honours	PGCE	Master of Science
Size of Class (Learners to Teacher)	26 Learners	87 Learners	49 Learners
Other G12LSTs	2	1	None
Grade of Learner Participants	Grade 12	Grade 12	Grade 12
The subject of Learner Participants	Life Sciences	Life Sciences	Life Sciences
Topics of G12LS	Reproduction	Cloning, Nervous System	Genetics
Number of Learners Interviewed in a Single Group Interview	6	6	7
% of Participants to Size of Class	23.1 Percent	6.9 Percent	14.3 Percent
Gender of Learner Participants	3 Female, 3 Male	3 Female, 3 Male	4 Female, 3 Male
Levels of Academic Performance of Learners **Low, Average, High (Achievement)**	1 low achiever 1 average achiever 4 high achievers	2 low achiever 2 average achievers 2 high achievers	1 low achiever 2 average achievers 3 high achievers
District/Location	Bojanala/Rustenburg	Bojanala/Rustenburg	Bojanala/Rustenburg
Research Site	School Premises	School Premises	School Premises
Date/Duration of Interview (Teacher)	26.02.2022/57m06s	23.04.2022/1h17m29s	09.04.2022/59m41s
Date/Duration of Interview (Learners)	26.02.2022/22m52s	23.04.2022/58m11s	09.04.2022/59m24s
Date/Duration of Lesson Observation	26.02.2022/1h53m34s	23.04.2022/45m22s	09.04.2022/40m55s
Date of Document Review	26.02.2022	23.04.2022	09.04.2022

Table 3.1 revealed vital information regarding the participants, dates, and duration of data collection. It was necessary for effective presentation of data and analysis. The researcher used the data in the table for further explanations and references where applicable in the research study.

3.3.2 Data collection

To achieve qualitative data collection of relevance to address the research problem, the researcher considered the what, how, when, and where of a thing – its essence and ambience (Berg, 2001). The following data collection methods were used: (a) interviews (b) classroom lesson observations (c) document review.

a) Interviews

Semi-structured interviews with open-ended questions were used during the interview with teachers and the learners. This was particularly important for the research study, because of its flexibility and the lived experiences from participants to generate the appropriate data required to solve the research problem. Interviews can be productive since the interviewer can pursue specific issues of concern that lead to focused and constructive suggestions and findings (Shneiderman & Plaisant, 2005). The interview questions were specifically prepared to address the research study problem statement and to generate research findings that are useful for the effectiveness of IBL in teaching G12LS's topics e.g. reproduction, cloning, nervous system, and genetics. The transcribed data of participants' responses to each of the research questions were next to each other for comparison, formulation of themes, and drawing conclusions on the research findings.

Appendices V and X, are the teacher's interview guide and learner's interview guide respectively, the interview questions in the interview guides were generated from the research questions. The audio recordings during the interviews with teacher and learner participants were transcribed and labelled as appendices W and Y respectively.

b) Classroom lesson observations

Classroom lesson observation is necessary to establish the link between interviews' data collection and classroom reality. Observing teaching and learning is one of the vital natural phenomena that can be relied on for authentic data collection. Immediate note-taking by observing teachers' and learners' lesson activities, responses, and participation during an IBL lesson will be conducted. Data collected was used to complete classroom lesson observation schedule sheets for processing. The completed sheets were to complement data collection and findings from the interviews and document review. The normal teaching method used by teachers if different from the IBL approach was observed and compared with the level of progress made in teaching and learning using IBL.

Appendix Z, the lesson observation schedule was used for the collection of relevant data during the teaching and learning process. Data collected during the classroom lesson observations in the three schools supported data collected during the interviews on learners' engagement and the type of teaching approach used by teachers.

Mr. Andile, the G12LST in the first school completed the topic on reproduction. He made use of worksheets, slides, and projector, and video clips during classroom lesson activities to facilitate teaching and learning. Mr. Bulunga, the G12LST in the second school completed the topic on cloning and started a new topic on the nervous system. He made use of worksheets, slides, and a projector to aid teaching and learning. Mr. Chipo, the G12LST in the third school continued with the topic of genetics. He used worksheets, slides and a projector to facilitate teaching and learning.

Data collection from classroom lesson observations were detailed in tables 4.3, 4.4, and 4.5 in Chapter Four of this research study.

c) Document review

Document review represents the secondary source of data collected from the participants by the researcher to evaluate and supplement data collected from interviews and classroom lesson observations (Dalglish, Khalid, & McMahon, 2020). It enabled the examination of some relevant documents already existing before the data collection process commenced. These hard copy and electronic documents related to teacher and learner participants include among others, teacher’s guide and lesson plans prepared by the teachers, Life Sciences curriculum and syllabus, the textbooks and workbook for learners, electronic tablets, internet sources, and attendance registers.

Mr. Andile, in the first school, prepared lesson plans and lesson activities on the concluding part of the human reproductive system, under Term 1. Mr. Bulunga prepared two separate lesson plans and lesson activities for the concluding part of cloning and the first topic on the nervous system under Term 2. Mr. Chipo in the third school prepared lesson plans and lesson activities on the continuation of genetics under Term 2.

Some of these documents were meant to derive data on how teachers plan and prepare lesson activities and facilitate teaching and learning progress, while others were meant to generate data on aspects of support the learners received on academic matters, where underperforming learners were given extra textbooks for support. Document review plays a vital role in complementing the data collection from interviews and classroom lesson observations. It is also meant to strengthen the findings derived through interviews and classroom lesson observations.

The data collection helped to reflect different participants’ perspectives on the subject matter and its importance to the research problem statement and research findings. Document review was aimed at providing insights into the nature and connection of all the data collection instruments and how it facilitates the analysis, and presentation of results in Chapter Four of this study.

3.3.3 Data analysis

Qualitative data analysis is an iterative and reflexive process that begins as data are being collected rather than after data collection has ceased (Stake, 1995). Data analysis is the process of bringing order, structure, and interpretation to the mass of collected data, it can be a messy, ambiguous, time-consuming, creative, and fascinating process (Marshall & Rossman, 1999). The researcher adopted thematic data analysis to ensure quality, consistency, and detail with the reduction or elimination of errors and researcher bias from the large quantity of data (Braun & Clarke, 2006; Vaismoradi, Turunen, & Bondas, 2013). The researcher identified themes by interpreting and generating meaning out of the transcribed data (Boyatzis, 1998).

Thematic data analysis was described by Kiger and Varpio (2020) as a method researchers adopted in analysing qualitative data which involves identifying and processing of vital concepts from the transcribed volume of data to formulate themes. The researcher was guided by interview questions formulated from the research questions. The data collected from the interviews was transcribed to enable the generation of themes. Interviews with each of the three teacher participants and each group of six and seven learners from each teacher participant lasted for an approximately sixty minutes.

An approximate six hours of audio recordings were transcribed. Due to a large amount of transcribed data, and the need to simplify and categorise data into themes, tabular descriptions were used to link each research question and problem statement to the interview question(s) they formulated, leading to themes and the findings of the research study.

Note-taking was conducted of verbal and nonverbal salient data during the classroom lesson observation of teachers' and learners' teaching and learning activities, which included learners' interaction and participation in asking and answering questions, collaborating in group tasks, nonverbal expression, identifying challenges and how they were resolved, assessment strategies used by teachers, level of achievements of lesson objectives.

Qualitative coding requires the researcher to reflect, interact, clarify, think, and concentrate on aspects of interest from the collected data (Nowell, Norris, White, & Moules, 2017). It represents a short descriptive phrase, event, context, word, or idea used by the researcher to categorise collected data into meaningful sections or themes that address the research problem statement (McMillan & Schumacher, 2014; Lester, Cho, & Lochmiller, 2020). The researcher established links, similarities, and relevance among the data collected through interviews, classroom lesson observations, and document review. Nine themes were generated from the teacher's interview transcripts, while 5 themes were generated from the learner's interview transcripts; the themes facilitated the research findings.

3.3.4 Measures for trustworthiness

It is strenuous to analyse the trustworthiness of a research study, trustworthiness requires activities of the researcher that are aimed to persuade the readers - including himself/herself - that the research findings are worthy (Nowell et al., 2017).

In a qualitative research study, credibility is one of the criteria of trustworthiness (Nowell et al., 2017). Bias can be a potential threat to the credibility of any research findings. The researcher is aware that the choice of purposive sampling may interfere with data collection, which may lead to researcher bias (Shenton, 2004). To maintain a high level of credibility, truth value was prioritised. There was a considerable time spent on the collection of data, transcribing, analysing, and presenting of analysed data.

The researcher sent the transcribed data via email to participants, and follow up phone calls were made to validate, make corrections or amendments where necessary, this was to ensure that the processed data reflected the words, ideas, thoughts, and concepts of the participants (Gunawan, 2015). There were no deviation from participants' ideas or concepts as they appeared in the transcripts. Comparing data that were derived from different participants enabled the study to arrive at common but helpful themes as they relate to the problems identified.

Attention was given particularly to the study's structural coherence, the flow of argument, consideration on the connections among generated themes to minimise if not eliminate the number of inconsistencies and repetitions. Responses to related interview questions were grouped to generate specific themes. Details of these grouped questions generated themes, and related findings are contained in tables 5.1, 5.2, 5.3, and 5.4 in Chapter Five of this research study.

To ensure consistency in the data collection from the three different schools, the same set of interview questions were used for teacher participants and the same set of interview questions were used for learner participants. These sets of probing interview questions facilitated the collection of data appropriate for revealing facts, ensuring accuracy, and making findings that address the research problem statement.

3.3.5 Ethical measures

Appendix C is the approval letter from the Department of Education (DoE), North-West Province; Appendix D is the Clearance Certificate from the University of South Africa (Unisa) College of Education (CEDU), Ethics Review Committee; Appendices G, L and Q are approval letters from the three different schools where data collection took place. The above-mentioned approval letters and clearance certificate were all obtained before the commencement of the data collection process (ŽYDŽIŪNAITĖ, 2018). The researcher took the necessary steps to ensure credibility and trustworthiness by adhering to the ethical standards required by the university.

a) Confidentiality

McMillan and Schumacher (2014) have stated that **“**Confidentiality means that no one has access to individual data or the names of the participants except the researcher(s) and that the subjects know before they participate who will see the data”. The researcher ensured to describe the procedure to all participants as contained in Appendix T, the participant information sheet. Participants were made aware of the purpose of the interview (ŽYDŽIŪNAITĖ, 2018). All names and data supplied by participants were treated as confidential. This was particularly important to give them the needed confidence to participate freely in supplying authentic data for the research purpose.

b) Informed consent and assent

According to McMillan and Schumacher (2014), informed consent is achieved by providing subjects with an explanation of the research, an opportunity to terminate their participation at any time with no penalty, and full disclosure of any risks associated with the study. Appendices H, I, M, N, R, and S were labelled as consent and assent forms respectively. Information in the consent and assent forms was clear and simple, indicating the nature and understanding of the research study, and devoid of any form of deception (ŽYDŽIŪNAITĖ, 2018). Participants were given the forms to complete and sign voluntarily. Approval letters labelled Appendices G, L, and Q from the schools were obtained before embarking on the process of data collection.

3.4 CHAPTER SUMMARY

In this chapter, the researcher discussed in detail the research design and methods employed in gathering relevant data for the research study, and also significantly for data presentation, analysis and research findings in the next chapter.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND FINDINGS

4.1 INTRODUCTION

In the previous chapter, the researcher gave a detailed account of the research design and methodology employed in gathering data on teachers' perceptions of IBL, the effective implementation of IBL and other teaching approaches from all relevant data sources. This chapter presents, analyses, and organises the raw data collected as they relate to the problem statement and the research questions.

4.2 DATA PRESENTATION AND ANALYSIS

The data presentation was structured in the order of interviews (teachers and learners), classroom lesson observations and document review. Data collected from each category was compared with others to ascertain its relatedness.

The excerpts from the interview transcripts were summarily used with corresponding codes at the end of each short paragraph of the excerpt. The codes indicated areas in the interview transcripts with detailed data or information, which represented the brief excerpts used under themes for presentation and analysis. Samples of the codes (AWQNL1-33, AYQNL1-30) are explained in the table below:

Table 4.1: Description of Codes Used for Excerpts from Interview Transcripts

Codes	Description of Codes
AW	Represents Appendix W is the teacher's interview transcripts
Q	Represents interview question number
N	Represents interview serial number, this could be any number from 1 to 21
L1-30	Line areas of transcripts represented by excerpts used, it could be 3-7, 23-45, 50-60 etc.
AY	Represents Appendix Y is the learner's interview transcripts
Q	Represents interview question number
N	Represents interview serial number, this could be any number from 1 to 8
L1-30	Lines areas of transcripts represented by excerpts used, it could be 1-8, 21-43, 50-71 etc.

Table 4.1 described codes and how they were used for presentation and analysis. Below are examples of the codes that are expected to appear at the ends of each paragraph of excerpts for detailed data or information:

AWQ15L08-33, this code indicates that the detailed data or information for the excerpts can be found in the Appendix W, under the teacher's interview question 15, from line 8 to line 33 of the interview transcripts.

AYQ05L12-35, this code indicates that the detailed data or information for the excerpts can be found in the Appendix Y, under the learner's interview question 5, from line 12 to line 35 of the interview transcripts.

"If a man will begin with certainties, he shall end in doubts. But if he will be content to begin with doubts, he will end in certainties" Francis Bacon.

Doubt opens the way for inquiry which in turn leads to creativity, logical reasoning, scientific and inductive thinking which enable researchers to arrive at new ideas, insights, and findings to solving research problems (Kothari, 2004).

The importance of using relevant interview questions to source for relevant data from participants to solve the challenges highlighted in the statement of the problem cannot be overemphasised. The interview transcripts (Appendices W and Y) were able to generate and give the researcher insights sufficient to clear all doubt about the research uncertainties.

4.3 INTERVIEWS

Semi-structured interviews with open-ended questions were used during the interview with teachers and the learners. The participants' responses to each of the research questions during the interviews were later sorted and put side by side to compare and draw a conclusion from the data generated.

4.3.1 Teacher's interviews

Twenty-one questions (Appendix V) were asked during the interview with each of the three teachers, which lasted for approximately 60 minutes. The interviews were conducted on the school premises of the teacher participants on a research study titled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study."

To address the challenges raised in the statement of the problem, relevant data generated during the interviews were presented and analysed thematically. Themes formulations were based on their relevance to each of the research questions, which gave rise to interview questions, and subsequently, to the interview transcripts. The main and sub-research questions were:

a. Main research question

What is the Grade 12 Life Sciences teachers' understanding of IBL approach in attaining the objectives of teaching and learning of Grade 12 Life Sciences?

b. Sub-research questions

i. How do G12LSTs perceive IBL approach to teaching Life Sciences' topics?
ii. How does the implementation of IBL impact on G12LSLs' academic achievement? and
iii. Why is IBL implementable or impracticable in teaching the Grade 12 Life Sciences' topics?

The three teacher participants showed sufficient evidence of their understanding of the use of an IBL approach. Their positive attitudes, amount of formal training acquired and several years of teaching experiences enabled them to effectively facilitate using the approach. The following generated themes and excerpts from the interview transcripts substantiated the above statements.

Due to the volume of data in the transcripts, excerpts were minimally and summarily used in the presentation and analysis. Detailed information in the transcripts were guided by the codes which appeared at the end of each summary excerpt. Participants' pseudonyms appeared next to the transcript's codes as specified in table 3.1 of chapter 3.

Theme One

Teachers' understanding and perceptions on the use of IBL approach

Theme One emerged from the teacher's interview question 1. What does the term *Inquiry-Based Learning (IBL) approach* mean to you? All the three teacher participants showed sufficient understanding of the IBL approach to teaching and learning of G12LS's topics, the evidence in the following excerpts:

…Kind of learning that involves a learner in the learning process. Checking the background information from the learners …what learners know first before you give them what you have …the teacher constantly involves the learners in the learning process… **AWQ01L12-25. Mr. Andile.**

…Cooperative learning …learners learn in group, they assist each other … you give them activity, and they discuss it together as a group, collaborative… **AWQ01L38-47. Mr. Bulunga.**

…I don't give learners, spoon-feed them. I don't give them information. …but to start with basement assessment, to know what learners know through asking questions and start scaffolding from there, not just dishing out information… **AWQ01L65-69. Mr. Chipo.**

The teacher participants acknowledged and linked the learner-centred approach to the concepts of IBL approach in their understanding and perceptions of IBL. They understood IBL to be an approach which engages learners as active participants in the teaching and learning process. Involving the learners in the learning process, enabling the checking of learners' background knowledge, learners learning in groups cooperatively, learners searching for their own information independently of their teacher, and collaborative learning (Weimer, 2013).

Theme Two

Teachers' attitudes, beliefs and formal training on the use of IBL approach

Theme Two emerged from the combined teacher's interview questions 15. Have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it? 16. Do you think you need more training on IBL or your preferred approach to improve classroom management? and 17. In which areas do you need more training and why? The analysis of the excerpts below revealed the positive attitudes of the teacher participants, on how they integrate an IBL approach to the teaching and learning process. It was obvious that they did not only understood the concepts of the IBL approach, but also possess several years of teaching experience, received several training on IBL, and were willing to have more training on the approach.

…when we got the training …get the learner involved …in everything that we do …I've been trained on each and every curriculum that I have taught, like I told you, I started from what was called the report 550… **AWQ15L05-35. Mr. Andile.**

…these people when they train us, they don't emphasise on how we teach, they will just use slides and they don't put into practise …we have training on CAPS …we were going, many times …we sit down, and they discuss the question paper and stuff like that… **AWQ15L80-104. Mr. Bulunga.**

Yes, yes, I am. It's not 100% applicable …like we were talking about the resources that we have, they limit you to use that method …the way you are trained and the way you must come and present sometimes… **AWQ15L46-76. Mr. Chipo.**

They have all been trained on the use of an IBL approach. **Mr. Andile** confirmed that training on the use of IBL was effective and applicable to the teaching and learning of Life Sciences (Ramnarain & Hlatswayo, 2018). **Mr. Bulunga** expected the training to lay more emphasis on how they should implement IBL and how they should be practically applicable, it should be more formal. **Mr. Chipo** affirmed that the training is not 100% applicable due to insufficient learning resources and time factors (Onwu & Stoffels, 2005). IBL being a time-consuming approach, dominating learners, non-participating learners and having to manage the discipline aspect of the classroom are some of the difficulties impeding IBL effectiveness.

…I'm always welcome to training …there is need for training with regard to planning …remember there are dynamics within subjects, things keep on changing …you need to always adjust and adapt to those changes… **AWQ16L04-22, AWQ17L02-13. Mr. Andile.**

…I need more …maybe there are some that I'm missing …how do you give learners activity and then after that …in a formal way …only on that, not to do a lot of things at the same time …what is IBL? …and then you can put learners in… **AWQ16L26-147, AWQ17L16-50. Mr. Bulunga.**

Yes …I'll say, training is always necessary …you know with the 21st century and the new things that are coming, there is always room for improvement, always the new way to improve …Yeah, classroom management… **AWQ16L152-164, AWQ17L55-84. Mr. Chipo.**

The teachers' willingness for more training on the use of IBL is reflective of their positive attitudes and belief system toward the learner-centred approach (Ramnarain & Hlatswayo, 2018; Gholam, 2019). They chose IBL as the main approach over the traditional teacher-centred approach due to its advantages and effectiveness. **Mr. Andile** indicated the need for more training on planning, classroom management and assessment tasks. The dynamic nature of current learners and the question papers necessitate the need for such trainings. It was necessary to prepare learners for the changing trend of the examination question papers and it distribution of cognitive levels. **Mr. Bulunga** desired more IBL training on how to manage underperforming learners without abandoning the high performing learners and the use of a smart board in an IBL classroom. According to **Mr. Chipo**, the 21st century came with new challenges. Due to the dynamic nature of IBL, he opted for more training on classroom management, laboratory maintenance and time management Mallari (2020).

They all effectively conceptualise the use of an IBL approach to teaching and learning. They were able to identify challenges, and requested for more training to improve in the use of the IBL approach. Their positive attitudes were also replicated during the classroom lesson observations and the same positive attitudes were displayed by their learners during teaching and learning.

Theme Three

IBL and teacher-centred approaches to teaching and learning

Theme Three emerged from the combined teacher's interview questions 2. What teaching and learning approach do you frequently use and why do you prefer the approach to others? 3. May you describe other approaches besides your preferred approach you believe can be equally effective, and 4. In your opinion, do you think an IBL approach can be effective in facilitating all Life Sciences topics and other science subjects? The excerpts below showed that the teachers predominantly used an IBL approach and minimally integrate the characteristic of teacher-centred approach during the teaching and learning process.

…my approach is interactive, it is participative …in the delivery process …the feedback is what is necessary …if you use the inquiry based, if you use the interactive method, participative method… **AWQ02L09-33. Mr. Andile.**

…when I teach, introduce the topic …after reading the objectives …repeating the activities to check if they understand …they don't get bored in the class, when you, you engage, you make them, their brains to work, once they don't, they keep on sleeping …make them busy **AWQ02L36-82. Mr. Bulunga.**

…I use a lecture method first …our syllabus is so broad and diverse. We don't have a demonstration kind of syllabus where we do a lot of practicals …impact content with minimum demonstration …I use a diversity of methods **AWQ02L86-114. Mr. Chipo.**

Teacher participants frequently used an IBL approach and minimally integrated the characteristic of teacher-centred approach where and when applicable.

Mr. Andile prefers the IBL approach because he wants the learners to interact and participate in the teaching and learning process (Twahirwa et al., 2022). He also wants to know their background knowledge and get feedback from them, he encouraged them to always ask questions and voice their opinion to show their involvement in the teaching and learning.

In **Mr. Bulunga's** view, the IBL approach enabled him to introduce the topic by projecting the lesson objectives, explaining lesson notes to the learners. He gave lesson activities to ascertain if the lesson objectives were achieved. It was a means of getting feedback from the learners. Once objectives were not fully achieved, he repeated the lesson using different assessment methods that were more engaging for the learners to be more active (Kishwar, 2016; Coffman, 2009). Consequently, prevented boredom. He confirmed that the IBL approach prevents learners from sleeping in class.

Mr. Chipo preferred that teaching starts with a lecture method because the syllabus does not accommodate sufficient time for demonstrations and practicals. He is compelled to give information at the beginning of the lesson before allowing space for IBL through different methods of informal assessment allowing learners to critically think and understand scientific concepts (Duran & Dökme, 2016).

> *I will call it the lecture method …Life Sciences is a content subject, if you check the number of topics that we need to cover …there is a lot of content, what we need is a lot of contact time with the learners…* **AWQ03L10-39. Mr. Andile.**

> *…because it's a new topic, they don't know anything about it …but sometimes if you want to cover time, you can just teach and teach and teach and after teaching, then you can ask them question until you test that you see if they've understood …give information …so you need to explain to them first…* **AWQ03L71-85. Mr. Bulunga.**

> *…Practical demonstration …to let learners be hands-on, to be involved, if it is live, learners must see the real things, you have microscopes, it really works perfectly. That's one method that I'm 100% sure. The other method, it's when you encourage critical thinking…* **AWQ03L90-98. Mr. Chipo.**

The teacher participants viewed the teacher-centred approach as the alternative approach to IBL (Eltanahy & Forawi, 2019). They all resorted to integrating the teacher-centred approach due to time constraint, in addition, G12LS requires more contact time to explain terminologies and concepts (Siahaan et al., 2017). Giving information to learners at the beginning of a lesson made teacher-centred an alternative approach. Integrating the teacher-centred approach into an IBL approach became necessary due to lack of a science laboratory and certain teaching and learning resources. However, the teacher-centred approach was used minimally because of the need to implement an IBL approach, to achieve set objectives.

…like I indicated in the previous question, not in all …Evolution is an analytical topic, needs learners to analyse theories …introduce the theories to them. So, I will definitely need to lecture …what this scientist proposed… **AWQ04L03-29. Mr. Andile.**

Yes, it helps learners to be effective, um, in case, if you are having gifted learners, there are learners who are very gifted, you can be able to, to assist them a bit …it's good to be applied to …We have kind of learners who are very fast …as you see in the other class, I cannot group that class with that other one… **AWQ04L33-90. Mr. Bulunga.**

Inquiry-based learning …to some extent, yes, it works. But now …the learners that we have, they are blank, so inquiring from them, if they are blank, does not help. I think inquiry-based learning, it helps to learners that have got something… **AWQ04L95-123. Mr. Chipo.**

The teachers revealed that, not all science and Life Sciences' topics can be effectively facilitated using only an IBL approach. Some topics such as Genetics and Evolution have many theories and terminologies, which require teachers to define and explain in detail before learners can comprehend and apply knowledge. IBL approach could be challenging for underperforming learners who lack background knowledge. **Mr. Bulunga** created three groups according to learners' cognitive capabilities, he engaged the high performing group with more IBL inquiry tasks and supervised the underperforming group with less inquiry tasks (Sereynivorth, 2022). **Mr. Chipo** maintained that learners must have attained a certain level of scientific literacy to be able to inquire independently (Bruder & Prescott, 2013). He also reiterated that IBL cannot be effective from the start of a topic, it can only be integrated after the explanation of concepts, theories and biological terms.

Theme Four

Benefits or opportunities of an IBL approach to teaching and learning

Theme Four emerged from the combined teacher's interview questions 9. What learning opportunities or benefits does IBL or your preferred approach provides for you and your learners from your own assessment of their learning progress? and 10. Do you think that one or more of the learning opportunities listed in question 9 above will help to retain learners and minimise dropout among Life Sciences learners? In the excerpts below, the benefits of an IBL approach to teaching and learning were highlighted by the teachers, other benefits were also mentioned by the teachers in their responses to some of the interview questions.

…almost everybody is motivated to work …tomorrow …you should be able to remember the concepts that we discussed today… give them the freedom to express themselves …prepare for the next lesson in advance as they feel good getting involved **AWQ09L04-18. Mr. Andile.**

…assist me to be able to see if learners do understand or not, you will be giving them an assessment after that …if they don't understand what you do, you revisit your outcomes, and then you reassess with a different question… **AWQ09L23-38. Mr. Bulunga.**

…Obviously it helps me to know what the learners know and what they don't know. It is like a continuous assessment …it's not like formal …I know if my learners are following …it helps me also to know the pace that I must move… **AWQ09L42-60. Mr. Chipo**

The IBL approach offers the teacher and the learners many teaching and learning benefits. Some of these benefits were highlighted above and in the teachers' responses to some of the interview questions. The teachers confirmed that IBL approach enabled:

a) Most learners to be motivated to participate in the teaching and learning process,
b) Learners to become active participants in the teaching and learning process, and encourages group tasks and teamwork,
c) Learners to prepare in advance before the next lesson or topic,
d) The engagement of learners in scientific inquiries, research activities and improves the SPS of learners,
e) The development of learners' scientific skills and broadens learners' understanding of scientific concepts and biological terminologies,
f) Learners to enjoy the freedom to express themselves and not to be confined to a single alternative way of solving scientific problems,
g) Learners to take responsibility for their own learning experience,
h) Learners to engage in hands-on activities and conduct scientific experiments or investigations,
i) Brainstorming and development of learner critical thinking skills,

j) Learners to be curious in wanting to learn more and developing the ability to source for references from previously learnt topics or concepts which are applicable to current lesson tasks,
k) Scaffolding in which learners can construct new scientific knowledge from prior scientific knowledge,
l) Learners to feel good and have the confidence to be involved in class discussion,
m) Teacher to assess the learners using different applicable strategies formally and continuously,
n) Teachers to identify mistakes which are critical and vital for learning,
o) Teacher to identify what the learners already know and what they do not know and still need to understand about specific lessons, and knowing the strengths and weaknesses of the learners,
p) Teachers to gain the attention of learners during teaching and learning,
q) An increased interest to teach and learn by eliminating boredom,
r) Self-assessment, to ascertain the level of teaching and learning progress,
s) Teachers to develop pedagogical skills as they constantly think of new strategies or innovative ways to engage learners, to impart scientific knowledge,
t) Necessary feedback to the teacher concerning learners' learning progress, and level of progress made on lesson or topic, to ascertain where continuation on the lesson or topic is expected, and
u) Teachers to use the approach to retain learners and minimise or prevent dropout (Bhagat, 2017; Bruder & Prescott, 2013).

The benefits of an IBL approach to teaching and learning have greatly helped to retain learners and minimise or eliminate dropout among science learners. It has also ensured improved teaching and learning of G12LS's topics (Crawford, 2000). The excerpts generated from interview question 10 below re-emphasised how the benefits of the IBL approach to teaching and learning has helped to retain learners.

Definitely, yes, …we have managed to keep numbers, actually we, we were like even trying to limit them …We have full house here, in Life Sciences …the marketing strategy that we have used and the pride that we have taken in our subjects …the IBL method… **AWQ10L03-31. Mr. Andile.**

…Okay, now I see, this year it will assist them …Yes, it will assist them to retain them and not to drop out …Because ...they actually understand what you're teaching them **AWQ10L51-63. Mr. Bulunga.**

Continuous assessment …it does minimise dropouts in Life Sciences in the sense that, when you assess continuously, you engage your learners, they are involved in the teaching and learning process… **AWQ10L69-81. Mr. Chipo.**

The teachers maintained that the IBL approach has effectively helped to retain learners and prevent dropout. As the teachers showed passion and have pride in their subject, the learners did likewise.

Mr. Andile exhibited so much pride in his subject. Grades 9, 10 and 11 learners were anxious to reach Grade 12 to find out why G12LSLs were happy being in his class. When learners feel good and get involved, other lower-level learners will be encouraged and motivated to be enrolled in that subject (Lyngved et al., 2012).

Mr. Bulunga affirmed that learners will not dropout once they are participating and understanding what is being taught in the class (Hartnack, 2017).

Mr. Chipo used informal continuous assessment to keep his learners engaged to minimise dropout (Murray, 2013). Provided that the learners are actively participating in the teaching and learning process, regular feedback will inform the teacher of areas where the learners need help and guidance. Learners will be guided to make learning progress which will prevent dropout and unwanted surprises. The IBL approach provided various benefits for the teachers and learners to achieve a high retention rate, prevent dropout, and enable learning success.

Theme Five

Effectiveness and ineffectiveness of the IBL approach on teaching and learning

Theme Five emerged from the combined teacher's interview questions 5. How would you describe the level of your learners' participation, motivation, and performance when using an IBL approach or your preferred approach to teaching Life Sciences? 6. How does an IBL approach or your preferred approach allow your learners to construct new scientific knowledge from their prior scientific knowledge? 7. How would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any? 12. How would you describe your learners’ examination success or pass rate in the past three years? and 13. Has there been an increase in the number of learners enrolling in Life Sciences and other science subject in the past three years? The excerpts below revealed the effectiveness of IBL approach and factors impeding its effectiveness.

…I've learnt how to motivate them …I've used a lot of incentives a lot of motivational approaches to ensure that learners in class are participating, learners in class feel good, feel confident in participating and the inquiry-based approach is actually a very important approach for us… **AWQ05L04-61. Mr. Andile.**

…due to gaining attention, during lessons, which start from previous knowledge to the unknown. …when I started the lesson …like what is it that learners know? And I have reckoned the learners develop a curiosity on what is to come… **AWQ05L65-88. Mr. Bulunga.**

…I'll say learners …respond well …but not from everyone, what I would say, inquiry-based learning, it works for a certain group of learners. …you have, obviously a diversity of learners in a class, it is not going to work for everyone. That's why you have to infuse different teaching methods… **AWQ05L93-103. Mr. Chipo.**

The effectiveness of IBL is measured by the level of learners’ participation, acquisition of scientific skills and knowledge, and examination success. It was evident from the excerpts under Theme Five that the IBL approach enabled learners to prepare in advance for the next lesson, encouraged critical thinking and hands-on activities (Murray, 2013). The learners felt good, were confident and motivated to participate in the teaching and learning process.

The IBL approach accommodated all learners in group discussion. It helped the teacher to identify and assist weak learners. Mistakes made during teaching and learning were critical for learning. IBL enabled learners to use previously learnt skills to attain new scientific skills and knowledge (Rodriguez & Harron, 2019). Learners develop curiosity to learn and eliminate boredom as they become more actively involved. However, it becomes ineffective for weaker learners who get intimidated by very active and high-performing learners. The lack of foundational knowledge made teachers to resort to giving information rather than allowing struggling learners to conduct the inquiry themselves.

The learners feel part of the learning process …they are always eager to research, trying to strictly answer based on prior versus the new knowledge …I always make them to get reference from their previous years, and then carried forward… **AWQ06L03-19. Mr. Andile.**

Hmm, continuity, also previous knowledge to unknown, curiosity level is high, because moving from previous to unknown, their hunger is going to be very high, which makes learning interesting to all the learners … they want, they have that hunger to, what is it that is going to happen… **AWQ06L22-44. Mr. Bulunga.**

…If you are enquiring, it helps learners to see what they know and what they don't know. If you're asking questions related to that specific topic, then learners would say, okay, sir is asking this because it's related to the topic …it encourages them to see the depth… **AWQ06L49-56. Mr. Chipo.**

It may be challenging for learners to acquire new scientific knowledge without prior scientific knowledge (Vicente, 2013). It was evident from the excerpts that learners must be engaged in research activities, and have the hunger for new scientific knowledge. They must search from relevant sources including previously learnt scientific concepts in lower grades. However, the use of an IBL approach becomes necessary and unavoidable for learners to acquire scientific knowledge.

…I'm excited, last year was good …we have been on the ascendance from 2019, 2020, and 2021. If you check, number one, looking at subject average, we have set up targets. Two, we have also had a new principal, so a new broom, she comes in with new demands… **AWQ12L03-36. Mr. Andile.**

…we were position one like I told, the sub-district, the sub-district is Rustenburg as a whole …so, we become position one …Like 62% average it was 62% …Oh yeah, they are 2019 …so, they actually improve, so I wish this year also …It will move forward… **AWQ12L39-139. Mr. Bulunga.**

I would say, fair, it's not the best. Our school, it is facility, I'm sure you can see …the catchment for our school, we are a township school …the parents are not much involved. Then the other thing …the learners that I teach …some of the learners are not science-oriented… **AWQ12L143-181. Mr. Chipo.**

Teacher participants revealed that the IBL approach enabled examination success and increased pass rates in Life Sciences in the past three years. Teachers were able to support weaker learners by increasing the contact time for teaching and learning. They provided extra learning materials, increased engagement and introduced different teaching and assessment methods (DoBE, 2011). These interventions ensured examination success. Although insufficient teaching and learning resources, lack of science laboratory, lack of parents' supports, and lock-down due to the Covid-19 pandemic were some of the factors that disrupted the progress of teaching and learning.

…Life Sciences specifically, yes, it has been increasing. It has always been increasing …our numbers have always been ballooning out of proportion …but the numbers, I think Life Sciences has been toping up and then Mathematics, then Physics… **AWQ13L03-113. Mr. Andile.**

… It was 9, and then 21 and then 87 …87 learners …It was 21 last year … These learners are doing Mathematics and Science …they are 21 …But in my Life Sciences, they have increased **AWQ13L116-148. Mr. Bulunga.**

…Big increase in the number of learners taking Life Sciences …even in Mathematics and Physical Sciences …the enrolment of the school has gone up. I think that is one contributing factor …it's what has caused these results to be fluctuating …The more the school is becoming bigger …The more challenges that we are getting… **AWQ13L154-250. Mr. Chipo.**

There was a significant increase in the number of enrolments into Life Sciences and some science subjects in the past three years in all the three schools. As the number of enrolled Life Sciences learners increased in the first school, an additional Life Sciences teacher was employed. Learners with common subjects were grouped and apportioned to each of the three Life Sciences teachers in the first school. The school achieved an increased enrolment in Life Sciences followed by Mathematics but with a slight decrease in Physical Sciences learners' enrolment. The second school achieved an increased enrolment in Life Sciences in an ascending order from 9 learners in 2020 to 21 learners in 2021, and 87 learners in the year 2022. However, no additional Life Sciences' teacher was employed despite the increased enrolment. They also achieved a minimal increase in both Mathematics and Physical Sciences because not all the 87 learners who enrolled in Life Sciences took Mathematics and Physical Sciences. The third school also achieved an increased enrolment in Life Sciences including Mathematics and Physical Sciences because general enrolment of the school had gone up.

The increase in all the three schools can be attributed to the pride the teachers have shown in their subject, marketing drive, surrounding community engagement with the school, the success and pass rate achieved over the years. These achievements cannot be separated from the teaching and learning strategies adopted by the teachers (Coffman, 2009; Bhagat, 2017).

…not all learners are active in class, so that gives sort of a challenge …you find overconfident overactive learners …they tend to intimidate others …think my tricks here are working. …there are certain learners with …you cannot break them easily. You cannot easily reach out to them… **AWQ07L03-25. Mr. Andile.**

…teacher to a classroom ratio is making teaching difficult …I started with nine learners …Those nine learners, it is actually difficult again to teach few learners, …when compared to as fifty… **AWQ07L28-100. Mr. Bulunga.**

…you have a class that is very diverse …the range is too wide, you might choose inquiry-based learning, then you end up having few individuals dominating the group …you are asking the learners to give you feedback… **AWQ07L108-119. Mr. Chipo.**

The teachers revealed that, effective implementation of IBL was impeded by some factors. These factors were responsible for ineffective teaching and learning. According to the teachers, implementing the IBL approach becomes challenging when:

a) Not all learners are active in class, especially underperforming learners,
b) Some learners feel intimidated by the active participation and dominance of top achievers,
c) Some learners are not intrinsically motivated to learn and could not be reached easily,
d) The size of the class is very large for a teacher to inspect and assist every learner,
e) There is no science laboratory and insufficient teaching and learning resources to facilitate,

f) The class is very diverse with a wide range of learners with different cognitive capabilities,
g) Some science learners are not science-oriented and lack foundational knowledge,
h) Learners lack prior scientific knowledge to build new scientific knowledge,
i) There is no support for science subjects from the school management and parents,
j) There are no defined stream subjects' combinations for learners, and
k) There is increased enrolment without an increase in the number of Life Sciences teachers and teaching and learning resources (Kang & Keinonen, 2016; Gholam, 2019; Ibrohim et al., 2020).

It will require the commitments of all stakeholders to resolve these challenges. Some of the resolutions are expected to be initiated through teachers' interventions, while others are expected to be advocated by the school management, parents, and the government's education representatives.

Theme Six

Science laboratory, teaching and learning facilities or resources and class size

Theme Six emerged from the teacher's interview question 18. How would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class? As much as the implementation of an IBL approach consumes time, it also requires sufficient teaching and learning resources and facilities for it to be effective. Two of the three teachers were disadvantaged in terms of these resources and facilities. The excerpts below highlighted how insufficient resources and facilities influence teaching and learning negatively:

…I'm privileged, I can tell you my school is well equipped …when I got into this lab, it was fully equipped …if you check in the corner there, there are boxes, there are microscopes, light microscopes, electronic microscopes, all those models are there …yes, they have impacted positively… **AWQ18L05-61. Mr. Andile.**

…I believe if there are resources …I won't be able to struggle …I don't have, I think you have seen the science laboratory …I wanted to do the practical on DNA …so

we don't have those …if they were there, I was going to do that… **AWQ18L65-112. Mr. Bulunga.**

…like you saw my class, it was packed …it's a problem, inquiry-based learning, you need every learner to have an opportunity, they have to express whatever they know, but in a big class, it's one problem, you can't give each learner an opportunity, because the class is too big… **AWQ18L117-155. Mr. Chipo.**

Mr. Andile had a teacher-learner ratio of 1-26, he was privileged to have a well-equipped science laboratory with sufficient teaching and learning resources. He had the least challenges when compared to other teachers. He revealed the need for a training on how to effectively use the science laboratory. He confirmed that all the resources and facilities had impacted positively on teaching and learning, and had reflected in the pass rate of the learners. The availability of these resources and facilities made it easy to accommodate the learners' needs (Ragoonaden & Bordeleau, 2000).

Mr. Bulunga had a teacher-learner ratio of 1-87, the science laboratory is empty. Laboratory equipment is yet to be procured by the school management. He could not conduct any real practical experiments. He acknowledged that provision of these resources and science laboratory would have positively impacted on teaching and learning. He stressed that this inadequacy had denied his learners the opportunity to identify and effectively use laboratory apparatuses. He managed the large class size by separating learners into three groups.

Mr. Chipo had a teacher-learner ratio of 1-49, no science laboratory, there were insufficient teaching and learning resources. This had negatively impacted on teaching and learning. Due to the large size of class and limited resources, the teacher intermittently used a teacher-centred approach to teaching. He often samples a few learners' work and makes corrections on learners' common mistakes (Onwu & Stoffels, 2005).

Theme Seven

Applicability of IBL to Life Sciences curriculum and completion of the syllabus

Theme Seven emerged from the teacher's interview question 19. How applicable is the IBL approach or your preferred approach in completing the Life Sciences syllabus within the specified time-frame? The IBL approach is time consuming but very effective for teaching and learning. To complete the Life Sciences' syllabus using the approach is vital for examination success, although, it could be challenging for the subject teacher. The teachers adopted various strategies and ensured that an IBL approach was effectively combined with a teacher-centred approach to achieve efficiency. The excerpts below revealed strategies used by the teachers:

…more contact time is needed, especially when it comes to the IBL …you are not moving at the pace that you really want …content versus time allocated, you will need to move very fast …to complete the syllabus on time and then allow sufficient time for revision …IBL is still applicable because you cannot just cruise… **AWQ19L03-40. Mr. Andile.**

It doesn't allow me, because I have to keep on switching to …teacher-centred …you just teach and teach and assess them. …it doesn't at all, so you need to do like that …extra classes …during the holidays, you see after school …with Life Sciences, I do morning classes… **AWQ19L54-90. Mr. Bulunga.**

…okay with Matric where there is external examination, it doesn't work. You don't use a time-consuming method if you are having external examinations …if I don't give my learners time knowledge …because I'm going to use a lot of time inquiring …if I'm going to assess myself, it is better… **AWQ19L100-129. Mr. Chipo.**

In ensuring that the Life Sciences syllabus is completed within a specified period and to allow sufficient time for revision exercises before the final examinations, the teachers adopted the following strategies:

a) Increased the contact time of teaching and learning,
b) Engaged learners with teaching and learning activities before and after class (homework, assignment, research tasks etc.),
c) Conducted extra classes during weekdays, weekends, and holidays,
d) Prioritised Life Sciences and other science subjects,

e) Integrated a teacher-centred approach with an IBL approach during lessons,
f) Conducted a periodical analysis of learners’ performances to determine learners who are to be placed under supervised study, and
g) Used diverse methods of informal assessments to get immediate feedback and to ascertain learners’ understanding and preparedness for the successive topics.

Theme Eight

Remediation for ineffectiveness and challenges to IBL implementation

Theme Eight emerged from the combined teacher’s interview questions 8. How have you been able to manage or overcome the challenges mentioned in question 7 above? 11. How have you been able to prevent learners’ dropout and improve on their attendance and retention rate? and 14. What strategy or strategies have you put in place to avoid a decrease in the number of learners enrolling in Life Sciences and other science subjects? The excerpts below highlighted some of the interventions put in place to mitigate against the factors impeding the effective implementation of IBL approach.

…Yes, definitely. One on one sessions with weaker learners have helped to boost their confidence along the way. **AWQ08L05-07. Mr. Andile.**

…we are separating learners, giving the learners extra book …the ones that are underperforming …you give them extra book, new book …give them extra class activity …give them tests separately …you can use it to remedy that situation. …reduce the learning objectives for them… **AWQ08L10-101. Mr. Bulunga.**

…In my class, I give every learner a chance to participate, then, you don't use only one teaching method …I need to go and mark myself …I don't feel individuals should dominate …I have to assess, different assessment methods …even the way your class is arranged, it's also very critical… **AWQ08L104-145. Mr. Chipo.**

The teachers put in place several measures to overcome some of the challenges and factors responsible for the ineffectiveness of the IBL approach to teaching and learning (Lai-Yeung, 2014). The excerpts above and their responses to some of the interview questions highlighted some of the interventions. These interventions include:

a) One on one sessions with struggling learners to build their confidence to participate in the teaching and learning process,
b) The use of incentives to motivate learners to learn meaningfully,

c) Recognition of learners for the contributions they have made, and make them have a sense of belonging,
d) Separating learners into groups according to their cognitive capabilities,
e) Provision of extra learning resources for underperforming learners for assistance,
f) Reduction of learning objectives of each lesson by increasing the periods for the same lesson for underperforming learners,
g) Assigning additional inquiry tasks to the high performing learners to allow sufficient time for learners with learning needs or challenges,
h) Engage parents to check on and monitor learners' progress,
i) Encourage and give every learner the opportunity to participate by limiting and controlling the dominance of high performing learners,
j) More contact time for teaching and learning to be able to complete the syllabus and have sufficient time for revision exercises before final examinations,
k) Prioritise Life Sciences and other science subjects to reduce or prevent dropout among science learners,
l) Being dynamic, the use of different teaching methods and the use of different assessment methods to ensure that learners are not left behind, and
m) Allow a seating arrangement where weak learners are positioned to be assisted in group task by high performing learners.

I spoke about the pride in the subject …starting with us as the educators …you need to show the love for the subject as an educator before it even spreads to the learners. …we show the knowledge also you need to be confident …so that the learners have that trust in you …we have inculcated that culture into our learners… **AWQ11L09-28. Mr. Andile.**

Most of the learners who are dropping out are …those that are underperforming …one on one sessions, we call the learner …you need to know the learner that you are teaching …where are they coming from …some of the learners underperform and dropout because of certain family problems …call their parents …So once you bring him closer, he will start loving even your subject …If you love him, he'll end up loving the subject… **AWQ11L37-110. Mr. Bulunga.**

…the first thing, you have to make the subject interesting, and you have to minimise to be predictable …The learners should not predict, like say okay, sir, is just going to give us notes, you have to use diversity in assessment strategies …so obviously, I must have different teaching strategies …by making the subject interesting. **AWQ11L114-122. Mr. Chipo.**

Prevention of learners' dropout implies high rate of learner retention. Dropout among Life Sciences' learners is one of the critical challenges mentioned in the statement of problems of this study (Dyomfana, 2022). Most of the intervention put in place by the teachers as highlighted above were coordinated to prevent dropout and to maintain a high rate of learners' retention.

Mr. Andile affirmed that he often exhibits pride and love for his subject, this by implication made his learners to love the subject as well (Ramnarain & Hlatswayo, 2018; Gholam, 2019). His learners have trust in him because of the confidence he displayed when teaching. He inculcated in the learners the belief that Life Sciences is one of the best subjects. He often counsels them on the various career choice opportunities for taking Life Sciences. He ensured that the learners were meaningfully engaged in learning activities, this encouraged the learners to develop interest in the subject which prevents dropout.

Mr. Bulunga indicated that learners tend to drop out, once they are encountering learning difficulties and failing examinations. They start staying away from school as they struggle to cope with learning. One on one with such learners enabled the teacher to understand the cause of their problems, he reckoned that some of them were having family problems, he sought parents' intervention. He often visits the homes of learners who stay away from classes. By regularly checking on them, showing care and interest, the learners would start reciprocating that interest. As the relationship got better, the learners started having interest in the subject as well (Yoshinobu, 2017; Bogler, 2018).

Mr. Chipo acknowledged that creating a good relationship with learners and being approachable enabled struggling learners to develop an interest in the teacher's subject (Yoshinobu, 2017; Bogler, 2018). Making the subject interesting, avoid being predicted by the learners and the use of different strategic ways of conducting assessments had helped him to prevent dropout.

…we have maintained a very good work ethic standard, especially the science subjects… If we do that, then obviously the learners will have confidence in us …when it

comes to extra classes… more contact time for the science subjects… **AWQ14L05-17. Mr. Andile.**

…it is management, they look at the results of the learners, when they place them, it's just depended how many passed an S in Grade 10, so they place them like that accordingly …But it's going to keep on increasing, because the school is now growing… **AWQ14L26-44. Mr. Bulunga.**

…what we've done, we actually, like now, I'm actually overloaded with the number of learners, one thing that works is, know what learners want to do, are they career-oriented? If they are career-oriented, they will stick to the subject …tell them the opportunities in the subject, discuss with them, the targets, and share with them your previous achievements **AWQ14L47-55. Mr. Chipo.**

The teachers put in place the following strategies to avoid a decrease in the number of enrolments in Life Sciences and other science subjects:

a) Maintaining a very good standard of ethics,
b) Effective monitoring by the HOD to ensure that the expected pass rate is achieved or surpassed,
c) The learners tend to have confidence in the subject and enrol once (a.) and (b.) above are achieved,
d) HOD prioritised and allocated more contact time to science subjects,
e) The number of learners who passed science subjects in grades 10 and 11 dictated the number of Life Sciences and other science subjects' enrolment in Grade12,
f) Career guidance activities for the learners were conducted, especially to encourage learners who are career-oriented, and
g) Information on opportunities in the subject and previous achievement made in the subject were shared with the learners, it encourages learners at lower grades to enrol in Life Sciences and other science subjects.

Theme Nine

Recommendations for an increase in science learners' enrolment into secondary and university education

Theme Nine emerged from the combined teacher's interview questions 20. What would you recommend to improve teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education?

and 21. Do you have any suggestion or questions on the interview or the research topic? An IBL approach is perceived to be one of the teaching and learning approaches required to motivate learners to develop an interest for meaningful learning of science. It also prevents dropout and increases enrolment. Recommendations made by the teachers are in the excerpts below:

…there are basics that learners need to master …if we can do that …from elementary level …if we build that proper foundation, they are what we call biological skills …If you go down to NS, learners are taught the scientific method …learners would identify phenomena, question a phenomenon… **AWQ20L04-74. Mr. Andile.**

…you have to make Life Sciences practical …take learners outside …I believe that these learners like Life Sciences …now you explain everything when you are outside, not only, always in the class …don't bombard them with words… show them pictures, show them videos …take them to the laboratory… **AWQ20L78-175. Mr. Bulunga.**

…more practical activities …time for practicals, time for hands-on, demonstration methods …is something that you need to keep learners interested, because we do teaching, we do a lot of them …we need to, to use more ICT, we don't have lab, we don't have time, so what do we do? At least we have projectors, I can do that, I have it, I have videos… **AWQ20L182-205. Mr. Chipo.**

Increasing the number of enrolled science learners into secondary and university education remained one of the major objectives of the research study. To achieve this objective, the teachers highlighted the following recommendations:

a) Learners should be taught the basics of science at the elementary level to build their foundational knowledge in NS,
b) Development of learners' biological skills (investigative, identifying, researching, quantitative, analytical skills etc.) should commence from their early grades,
c) The teaching and learning of science should be made attractive, fun, and interesting to learners,
d) Opportunity for hands-on and practical activities to improve their SPS of observing, classifying, communicating, measuring, inferring, and predicting should be prioritised for all science subjects,
e) Integrate more scientific tasks which help to enhance their logical reasoning in dealing with scientific methods, use step by step strategies for asking logical and scientific questions about an observable phenomenon, formulating hypothesis, making predictions based on the formulated hypothesis, testing the hypothesis

through experimentation, analysing the results or the data collected from the experiment, making a conclusion and presenting the information through various possible forms, such as tables, line graphs, bar graphs, histogram, pie charts, also in the form of a paragraph,

f) Life Sciences curriculum should be made more practically implementable, should be more process-oriented,
g) More teaching and learning should be conducted outside the classroom for learners to relate what is being taught in the class with the natural world,
h) Integrate the use of pictures, videos, internet, information, and communication technology (ICT) in science to reinforce learners' interest in and passion for science, and
i) Plan lesson activities with the learners, allow peer teaching, class presentations, conduct science excursions.

The above recommendations were aimed at developing learners' interest for science, once they are motivated to do science, they will stay enrolled in science in secondary education and be encouraged to enrol in one of the science courses in the university (Bruder & Prescott, 2013).

4.3.2 Learner's interviews

Eight questions (Appendix X) were asked during the interview with a group of learners in each of the three schools, which lasted for approximately 60 minutes within the school premises. Data generated during the learner's interviews from the three schools were intended for comparison with the data collected during the teacher's interviews.

Theme One

Effectiveness of the IBL approach on teaching and learning

Theme One emerged from the learner's interview question 1. How effective is the teaching approach used by your Life Sciences teacher on your learning success? The excerpts below revealed the effectiveness of IBL approach on teaching and learning from the learners' perspectives.

…It is very effective …informs us about the topic beforehand …explain thoroughly while making examples …accommodates all learning style needed to learn …It helps me… **AYQ01L12-54. Mr. Andile's learners A and D**

…is quite interesting …he uses certain examples …very effective, because it helps in… It accommodates all types of learning styles… **AYQ01L69-92. Mr. Bulunga's learners A and B.**

…is very effective …engages with every single learner and helps …motivates us to interact with our friends if we are having trouble… learner has on one-to-one conversations …learners feel more comfortable… **AYQ01L104-146. Mr. Chipo's learners A, D and E.**

According to Mr. Andile's learners from the first school, the teaching approach used by their teacher was viewed as very effective because:

a) It allows them to prepare for the next lesson,
b) The teacher used examples effectively while teaching,
c) It accommodates all learning styles, provides a deeper understanding and helps memory recall,
d) It makes learning rewarding and it fosters curiosity which reinforces understanding,
e) Learners can take ownership and responsibility for their learning and it encourages them to love learning,
f) It gives them the opportunity to write lesson notes before detailed explanation during the lesson period which made it easier to understand,
g) Encourages them to engage in research activities, and
h) Learners can see their teacher after class for clarity.

According to Mr. Bulunga's learners from the second school, the teaching approach used by their teacher was viewed as very effective because:

a) It was quite interesting with examples effective for understanding,
b) It accommodates all types of learning styles,
c) The use of a projector enables learners to see what the teacher is discussing, it makes lesson better,
d) It enables the teacher to conduct several examples for better understanding,
e) Learners only need to be attentive to understand, and
f) The teacher re-explains if learners do not understand.

According to Mr. Chipo's learners from the third school, the teaching approach used by their teacher was viewed as very effective because:

a) It engages with every struggling learner to improve on their weakest point,

b) It enables learners to understand the topic before moving to the next topic,
c) They can develop alternative ways of answering examination questions,
d) Learners can get face-to-face learning through interaction to help one another,
e) The teacher steps in to give understandable explanation where learners find it difficult to comprehend,
f) The teacher motivates the learners to learn in groups and independently,
g) Shy and struggling learners feel more comfortable to approach the teacher or be approached by the teacher privately for assistance or approval of their work, and
h) Teacher simplifies difficult topics by starting off with simple examples and methods of approaching the topics or questions relating to the topics, which made it easier for learners.

The learners' views on the effectiveness IBL validated the data collection from their teachers. It was therefore evident that the level of learners' participation in teaching and learning through an IBL approach were encouraging and very effective (Lyngved et al., 2012).

Theme Two

Learners' attitudes and beliefs toward the IBL approach and interest to enrol in science courses in university.

Theme Two emerged from the combined learner's interview questions 2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities. and 6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences? The analysis of the excerpts below revealed how the teachers' positive attitude toward the IBL approach positively influenced the learners to embrace the teaching and learning approach.

…we are free to ask for re-explanation …helps improve my communication skills …motivates me to actively participate …illustrates the work with drawings, tables, and graphs …we research the topic before it is taught in class… **AYQ02L03-43. Mr. Andile's learners A and E.**

…motivates me knowing more …It motivates me in a way that it makes me inquisitive …do more research on the topic …to learn more …helps me to be more

devoted …I go to internet search about whatever we did in the class… **AYQ02L46-71. Mr. Bulunga's learners A, B, C and F.**

…I am a very shy person, but my teacher gave me the confidence to speak up… he motivates us to think outside the box …I believe it is an excellent approach because it allows us to think as many as possible …get more information about the topic …motivates me to do the research… **AYQ02L80-118. Mr. Chipo's learners A, B, C and D.**

The learners were motivated through the IBL approach used by their teachers. They mentioned some of the benefits derived from the IBL approach as follows:

a) The ability to participate in teaching and learning, team building (collaboration),
b) It necessitates the development of communication skills,
c) Understanding illustration with drawing, tables, and graphs,
d) They were motivated to grasp concepts and information,
e) They become more inquisitive and develop researching skills (curiosity),
f) They were able to concentrate (observe) more during teaching and learning,
g) Built up confidence to speak, learn, ask, and answer relevant scientific questions,
h) Motivated to think out of the box (critical thinking skills),
i) Engaging in assignment and school projects,
j) Ability to create new hypothesis (development of hypothetical skills), and
k) Does not necessary spoon-feed the learners (taking responsibility for own learning experience). (Crawford, 2000; Bhagat, 2017).

The learners took advantage of the positive attitudes toward the IBL approach to develop some scientific skills and derive some benefits. They were equipped with scientific skills to take up a more challenging tasks. Consequently, they developed the interest to enrol in some of the science courses in the university.

…Yes, I am inspired to enrol in Life sciences courses in university …strong enough to equip me for the lessons …I am more inspired to study to become a biochemist as my strongest suit is Chemistry… **AYQ06L04-57. Mr. Andile's learners A and D.**

…I know that I am inspired, but I want to pick from contrary field, but not in any science courses …Yes, I am feeling inspired to enrol in any science courses …I want to apply for a course that is MBChB in health sciences …I'm not inspired. **AYQ06L60-160. Mr. Bulunga's learners A and C.**

…Yes, I am inspired to enrol in Biology …Yes, I believe there's so much we can do …for me I wouldn't like to take Life Sciences as a major because …I'm not really interested in it …yes of course …science is really exhilarating… **AYQ06L168-267. Mr. Chipo's learners A, B, C and D.**

The table below showed learners who were inspired to enrol in science courses in the university and learners who were not inspired.

Table 4.2: Learner Participants Inspired to Enrol in Science Courses in University

Participants	**Mr. Andile (1st school)**	**Mr. Bulunga (2nd school)**	**Mr. Chipo (3rd school)**
Learner A	Inspired to enrol	Not inspired to enrol	Inspired to enrol
Learner B	Inspired to enrol	Not inspired to enrol	Inspired to enrol
Learner C	Inspired to enrol	Inspired to enrol	Not inspired to enrol
Learner D	Inspired to enrol	Not inspired to enrol	Inspired to enrol
Learner E	Inspired to enrol	Inspired to enrol	Not inspired to enrol
Learner F	Not inspired to enrol	Not inspired to enrol	Inspired to enrol
Learner G	Not Applicable	Not Applicable	Inspired to enrol
Inspired	**5 learners**	**2 learners**	**5 learners**
Not inspired	**1 learner**	**4 learners**	**2 learners**

Table 4.2 above revealed the number of learner participants (12 learners) who were inspired to enrol in one of the science courses in the university due to their developed scientific skills and increased interest in learning science. It also indicated the number of learner participants (7 learners) not inspired to enrol in any of the science courses.

Theme Three

Teaching and learning approaches used by teachers

Theme Three emerged from the learner's interview question 3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities? The excerpts below revealed the teaching and learning approach mainly used by their teachers.

…it does encourage scientific inquiry before classroom learning activities …it is easier when he is explaining in class …after classroom learning, we receive worksheets …we always discuss the work as if we are chatting …the more work you learn beyond the classroom learning activities …engage in group tasks… **AYQ03L04-40. Mr. Andile's learners A, B, D and E.**

…it encourages me to discuss the topic and do scientific inquiry …when you get home, you research more about the topic we are doing …it encourages me to engage in group tasks …we do …meet and talk about our work, sir tells us a topic before we leave… **AYQ03L60-116. Mr. Bulunga's learners A, B and F.**

…Yes, the teaching approach encourages me to engage in group tasks, before and after class activities. We have study groups that helps us to help each other …work together as learners... we are able to form study groups …we can meet up a certain times to go over what we do not understand …help each other …interact by sharing our understanding …instilled in us that we are a team… **AYQ03L122-205. Mr. Chipo's learners A, B, C and F.**

The learners confirmed that the teaching approach used by their teachers allowed them to conduct scientific inquiry before, during and after classroom teaching and learning activities (Lai-Yeung, 2014). Below are some of the highlighted IBL activities the learners participated in which indicated the teaching and learning approach mainly used by their teachers:

a) Learners were tasked beforehand to understand specific concepts on aspects of the textbooks before the classroom learning activities,
b) Worksheets were given to learners to enable them to continue learning after the classroom learning activities,
c) Learners were encouraged to discuss topics already covered by the teachers to understand them better and to improve their scientific skills,
d) Learners regularly ask questions, make use of their worksheets and were not afraid to be corrected as it formed an important part of learning,
e) More learning tasks (group tasks, homework, assignments etc.) beyond the classroom learning activities help to improve learners to succeed,
f) Learners were able to seek help and assistance from other learners,
g) It does encourage learners to conduct research and be prepared to answer questions asked randomly by teachers,
h) Learners formed study groups and regularly share ideas through WhatsApp groups when they are not converged in one place,

i) Learners also share learning materials such as textbooks and examination past question papers to assist other learners,
j) Learners who struggle with schoolwork and homework always seek help from other learners who understand the tasks better, and
k) IBL encourages teamwork amongst the learners as they constantly work together to learn.

It was evident from the above, that the teachers mostly used the IBL approach to actively engage the learners to interact and participate in the teaching and learning process before, during and after classroom activities. It also enabled the teachers to check their background knowledge and to get feedback from the learners on their learning progress.

Theme Four

Science laboratory, teaching and learning facilities or resources and challenges.

Theme Four emerged from the combined learner's interview questions 4. What are the challenges you are experiencing with the teaching approach used by your teacher? and 5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills? Effective implementation of the IBL approach requires sufficient resources or facilities like a science laboratory, without which proper facilitation of teaching and learning will be impeded (Onwu & Stoffels, 2005; Anderson, 2002). Some of these challenges were highlighted in the excerpts below:

…I am currently not facing any challenges with his teaching approach, in fact, I prefer it …the challenge that I am experiencing right now …I'm still adapting to the new learning technique …I don't feel like it's a big challenge that is going to interfere with my success in the subject …in the previous two years I've only been taught by one other teacher… **AYQ04L04-46. Mr. Andile's learners A and C.**

…there are no challenges that I'm experiencing in his teaching… The challenges I experience with the teaching approach is that sometimes Mr. is too fast …then when he changes the slides, like it gets confusing …sometimes we do our corrections orally, so sometimes I miss what he said… sometimes Mr. only teaches 10% so I'll have to revisit my book or textbooks… **AYQ04L51-137. Mr. Bulunga's learners A, C, D and E.**

…challenges I experienced with the teaching approach …he will take a lot of time on one topic explaining to other learners who are struggling …some of the topics need as many experimental investigations as we can possibly do …I believe in watching something to be able to get the idea …take up as many notes as we can, but like if we could possibly have the time to watch videos …the teacher is only one individual who is teaching a large magnitude of learners… **AYQ04L155-302. Mr. Chipo's learners A, B, C and E.**

Some of the learners highlighted a few of the challenges as:

a) The teacher is too fast for some of them, slides were moved very fast during teaching and learning while some learners struggle to understand,
b) Corrections are sometimes done orally, and learners may not have the opportunity to take notes during the correction exercise and as a result missed vital information,
c) Having to keep up with lesson as the teacher only teaches 10 percent, hence, the need to revisit lesson notes and textbooks,
d) The teacher spent more time explaining one concept or topic to other struggling learners,
e) Some topics require several experimental investigations for better understanding and preparation for examinations,
f) Taking too much or very little notes and having fewer visuals to elaborate on the topics and notes,
g) Not having enough homework or additional work to improve learners' understanding of the lessons being taught in the classroom,
h) The teacher being the only one teaching a very large class, and not having sufficient time to monitor the progress of individual learner's work or assist them where necessary, and
i) Having to explain practical experimentation during teaching and learning cannot substitute for the actual practical experimentation in the science laboratory.

Mr. Andile's learners were satisfied with the teaching and learning approach. They have sufficient teaching and learning resources, facilities, and a well-equipped science laboratory with a class size of 26 learners. They have sufficient resources and a science laboratory to facilitate an IBL approach. The teacher had sufficient time to guide and assist individual learners because of the moderate class size.

Mr. Bulunga's and Mr. Chipo's learners in the second and third schools respectively, highlighted the challenges as seen in their interview's excerpts above, their challenges were largely due to insufficient teaching and learning resources and facilities, lack of science laboratories, large class size (Onwu & Stoffels, 2005; Anderson, 2002).

Most learners were enthusiastic to learn science. They were desirous to have the challenges resolved. In the excerpts below, the learners highlighted the support that they received or did not receive from their classmates, teachers, and the school managements:

> *…Yes, I do get enough support from my Life Sciences teacher in interpreting important …like examinable questions …of freedom without judgement …enables me to communicate with my classmates… Definitely, the support is the best anyone can ask for as worksheets are handed out to be able to work on the topics covered in class …he sees the potential in me…* **AYQ05L04-35. Mr. Andile's learners A, D and E.**

> *…Yes, they are doing everything in their power and giving me the support that I need …whenever I need clarity on something, I go to them, and they help me …because Mr. Bulunga, when I don't understand …he revisits the topic again …doing extra classes in the morning …needs me to be in class after school.* **AYQ05L39-120. Mr. Bulunga's learners A, B, D, and F.**

> *…I do get enough support from my teacher and my classmates …pushes me to do well …motivates me …a lot of faith in me that also inspired me to do well …I love my classmates …But the school does not support Life Sciences learners enough …the issue of having a science lab was suggested …they haven't done anything yet …I feel as if I don't get enough support… there are no learning trips, excursions… the only lab we have is for IT …we don't have a lab…* **AYQ05L124-218. Mr. Chipo's learners A, C, D, F and G.**

When asked if they received enough support from the teacher, classmates, and the school management. Mr. Andile's learners at the first school confirmed that they received enough support from all stakeholders, and described how they were supported below:

a) Interpreting important examination questions and creating a conductive learning environment of freedom that is devoid of judgment,
b) Everyone having equal opportunity and a chance to communicate and make predictions,
c) Having the opportunity to learn more and become better,

d) Worksheets are handed out to enable learners to improve on the lesson discussed in the classroom, and
e) The teacher reminds the learners of their potential which motivates them to become better by the day.

Mr. Bulunga’s learners in the second school responded to the questions as follows:

a) “They are doing everything in their power and giving me the support that I need…”,
b) Getting clarity from them when it is needed,
c) The teacher revisits a topic and re-explains when requested for better understanding,
d) Classmates are always available to assist with lesson tasks,
e) The teacher provides early morning classes to assist the learners, and
f) Conducting extra classes after school.

Mr. Chipo’s learners in the third school responded to the same questions as follows:

a) The teacher inspired the learners to do better, he motivated the learners and had faith in them,
b) The classmates showed love and supported other learners,
c) Learners got support from the teacher to improve communication skills,
d) There was not enough support for Life Sciences learners from the school, they have failed in providing a science laboratory to facilitate teaching and learning,
e) No support for learners to attend science excursions or organised learning trips to places like hospitals, science exhibitions, research centres etc. to motivate them towards their career choice, and
f) Learners were requesting support from the school to organise a motivational program to invite scientists or specialists to counsel and mentor them in their career choice.

Effective implementation of an IBL approach requires several learning supports for the learners to reach their full potential (Ramnarain, 2014).

Theme Five

Suggestions for improved teaching and learning of science subjects.

Theme Five emerged from the combined learner’s interview questions 7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects? and 8. Any suggestion or questions on the interview or the research topic? There is always room for improvement, sometimes, it requires suggestions from persons who make use of the services. The importance of seeking suggestions from the learners for improved teaching and learning of science subjects cannot be overemphasised. They are the most important stakeholders in the institute of learning. Suggestions made by the learners in the excerpts below.

…advise my school to include active recall in their lessons… the teaching method that my teacher uses works for me …to my school is that, regarding science subjects, to use the same teaching methods, with all grades and all teachers **AYQ07L03-66. Mr. Andile's learners A, B and C.**

…keep on using the teaching and learning approaches or methods, because it's working …Mr. Bulunga to show us videos instead of slides …but he must be slower …advise my school to buy us science equipment …we can use our science lab… **AYQ07L70-159. Mr. Bulunga's learners A, B, C and D.**

…advise him not to spend a lot of time on one topic …suggest to the school that we do need a lot of excursions… **AYQ07L17-222. Mr. Chipo's learners A and D.**

No. No. No. No. No. No. **AYQ08L09-44. Mr. Andile's learners A to F.**

…enlighten me about your journey to Unisa or the career route around it. …I will like to know more about Unisa. **AYQ08L50-186. Mr. Bulunga's learners B and F.**

…like those who want to focus on Biology …would you advise the school to like to divide the Life Sciences topic… **AYQ08L187-225. Mr. Chipo's learner B.**

The suggestions made by the learners for improved teaching and learning of Life Sciences and other science subjects are as follows:

a) School and teachers should include an active recall program to enable learners to constantly evaluate themselves on their understanding of scientific concepts,
b) The IBL teaching approach is very effective, it should be continued and be introduced at lower grades and in all subjects,
c) Although the teaching approach is good, the teacher must ensure that everyone is carried along,
d) More group tasks, experiments and practical work should be given to learners in science classes,

e) Introduce alternative ways of answering examination questions and more examination-based questions or activities,
f) Excursions and learning trips should be included in the curriculum,
g) The school should maintain the same science teacher from Grade 10 to Grade 12,
h) Integrate more videos than slides and the use of a projector in the teaching and learning process,
i) The school management should build a science laboratory and procure laboratory equipment and ensure that the science laboratory is being utilised for teaching and learning,
j) The teacher should not spend much time on one topic, he should instead organise extra classes for slow learners,
k) The school management needs to provide more learning resources (Textbooks) and equip the library to have access to more information,
l) The school should support teachers and prioritise science subjects and not only Life Sciences, to develop science learners to continue science outside school premises, and
m) Science learners should be grouped and assisted according to their preferences in science or aspects where they wish to specialise in the university.

The above suggestions by the learners were aimed at improving the teaching and learning of Life Sciences and other science subjects. Their suggestions were intended to address most of the challenges previously highlighted. The learners repeatedly mentioned the need for a science laboratory, it showed the important role the science laboratory played in the acquisition of scientific knowledge. The learners need to stay enrolled in studying science subjects and courses in secondary and university education. The suggestions made should therefore be considered and implemented where applicable.

4.4 CLASSROOM LESSON OBSERVATION

Classroom lesson observations were conducted in the three schools as a vital data collection of classroom reality. The data collected in these natural phenomena reinforced the data collected during the interviews. Participants' attitudes, participation, understanding of IBL, its benefits or advantages, the challenges encountered using the approach for teaching and learning, were all revealed during the classroom lesson observations.

The use of Appendix Z enabled the researcher to effectively collect necessary data during the classroom lesson observations.

Table 4.3: Mr. Andile's Classroom Lesson Observation Activities

Date of Lesson Observation	: 26th of February 2022
Observation's Venue	: Classroom, in the school premises
Observer (Researcher)	: Naiye Olufemi David
Teacher Observed	: Mr. Andile **(Pseudonym)**
Level of Learners Observed	: Grade 12 Life Sciences learners
Level and Name of Subject	: Grade 12 Life Sciences
Topic of the Lesson	: Reproduction (Continuation)
Lesson Plan and Objectives	: Understanding the biological terms used in Reproduction. The roles of haploid cell, sperm, ovum, acrosome, diploid cells, and differentiation in the developmental processes. Developmental processes through mitosis in zygote, morula, blastula, blastocyst, embryo, and implantation in the endometrium wall Use of worksheets for classroom tasks Group tasks to encourage learners' interaction and collaboration, Use of slides and projector to aid teaching and learning, Use of video clips to enhance teaching and learning.
Lesson Duration	: 1hour 53minutes 34seconds
Teaching & Learning Resources	: Sufficient, Includes science laboratory facilities, textbooks, workbook, projector/slides etc.
Teaching & Learning Approach	: Highly interactive and participatory, (IBL) combined with a minimal teacher-centred approach where applicable. SCK and Pedagogical skills were sufficiently and evidently displayed to facilitate teaching and learning
Learners' Interaction & Participation	: Sufficient evidence of learners' participation in the teaching and learning process. Learners asked various questions for clarity and responded to teacher questions as expected, Learners were engaged in group tasks, Teacher engaged learners to relate previously learnt scientific concepts or skills with scientific concepts he intends them to learn, Lesson activities given to learners to engage them and to ascertain their understanding of concepts being discussed in class.
Classroom Management	: Well organised classroom setting, effective for teaching and learning. Teacher asked a learner who was distracting the learning process to go outside of the classroom for few minutes to get "fresh air and dress properly" before returning to the classroom. Classroom setting was very impressive with sufficient subject charts strategically displayed on the walls to facilitate and reinforce learning,

	Seating arrangement was accommodating and spacious enough for 25 learners in attendance. Classroom is connected and opened to science laboratories with sufficient and visible laboratory equipment. He encouraged learners to stand upright or quietly walk around the classroom to eliminate boredom and get active again, Learners normally raise their hands to get permission to answer or ask questions and to maintain a disciplined classroom atmosphere.
General Observable Activities	a. The teacher started by asking the learners to project a target for the subject so that he can jointly monitor progress of work towards the targets set by each learner, b. He handed out copies of a few pages from the G12LS learner's workbook to attempt questions on biological terms in Reproduction, c. He briefly discussed with the learners on previous lessons on Ovulation and Menstruation and asked relevant questions to ascertain if learners remembered vital concepts, d. He therefore proceeded with the day's topic on Reproduction (A continuation) from the released of the egg cell, fertilisation to the development of the zygote into a foetus, e. He quickly and mildly rebuked a learner who just arrived without unnecessarily interrupting the smooth flow of teaching and learning, f. He spoke about two options that could occur in the process i.e., if fertilisation did not take place and if fertilisation occurs, the roles of certain hormones in the two possible occurrences, g. He advised learners to always try to avoid taking medication that would interrupt menstruation and its pain, h. He also cleared the misconception learners brought to class by explaining hormonal imbalance, i. The teacher jokingly requested that they should be addressing typical examination questions instead of concentrating on personal questions, j. He reminded the learners of the roles of a haploid cell, sperm, ovum, acrosome at the tip of the sperm cell and diploid cells in the development processes, k. He stressed the point that only the male sperm nucleus enters the ovum during fusion (fertilisation), l. He explained developmental stages (mitosis) starting from zygote, morula, blastula, blastocyst, embryo to the point of implantation in the endometrium wall, m. He explained the impact of differentiation in the division of distinctive cells in forming human body parts, n. The roles of the placenta in the nourishment of the foetus were explained, o. He further explained reasons for change of names based on the level of development, p. Praised learners for accurate responses to questions asked, q. He used examples and analogies to explain some scientific concepts for better understanding, r. He intentionally gave a wrong answer to verify if learners understood a certain concept correctly, and s. He made many references to other Life Sciences topics in

	explaining scientific concepts.
Reflection	: The teacher played two different video clips on reproduction to reinforce and substantiate the teaching and learning on Reproduction, He recalled learners' memory of previous lesson activities and concepts, He gave out worksheets to learners to be completed and returned during the next lesson, and He briefly explained what is expected in their next lesson.

Table 4.4: Mr. Bulunga's Classroom Lesson Observation Activities

Date of Lesson Observation	: 23rd of April 2022.
Observation's Venue	: Classroom, in the school premises
Observer (Researcher)	: Naiye Olufemi David
Teacher Observed	: Mr. Bulunga **(Pseudonym)**
Level of Learners Observed	: Grade 12 Life Sciences learners
Level and Name of Subject	: Grade 12 Life Sciences
Topic of the Lesson	: Cloning (Continuation), New Topic: Division of the Nervous System
Lesson Plan and Objectives	: Use of practical demonstration to explain concepts in cloning, Understanding the central nervous system, peripheral nervous system, somatic and autonomic nervous system, sympathetic and parasympathetic nervous system etc., Use of worksheets for classroom tasks, Group tasks to encourage learners' interaction and collaboration, and Use of slides and projector to aid teaching and learning.
Lesson Duration	: 45minutes 22seconds
Teaching & Learning Resources	: Insufficient because the science laboratory is still being worked upon and it was not ready for practical and experimental activities, Textbooks are given to all learners and additional textbooks are given to underperforming learners to assist them with studying, and Workbook, projector/slides etc. were also provided to aid teaching and learning.
Teaching & Learning Approach	: Highly interactive and participatory, (IBL) combined with a minimal teacher-centred approach where applicable, and SCK and Pedagogical skills were sufficiently and evidently displayed to facilitate teaching and learning.
Learners' Interaction & Participation	: Sufficient evidence of learners' participation in the teaching and learning process, Learners asked various questions for clarity and responded to teacher questions as expected, Learners engaged in group tasks, Teacher used demonstration methods to explain concepts of cloning, and Lesson activities given to learners to engage them and to ascertain their understanding of concepts being discussed in class.

Classroom Management	: Well organised classroom setting, effective for teaching and learning, Few subject charts were displayed on the walls of the two classrooms used for G12LS lessons, Seating arrangement was accommodating and spacious enough for the first and third groups of 21 learners and 23 learners respectively, A different classroom that is more spacious and accommodating was used for the second and the largest group of 43 learners, Learners were grouped according to their cognitive capabilities, Learners coordinated themselves appropriately when given group tasks to work upon, Classroom is separate and not connected to the uncompleted science laboratory, and Learners normally raise their hands to get permission to answer or ask questions and to maintain a disciplined classroom atmosphere.
General Observable Activities	a. The teacher briefly discussed the last lesson with learners by asking a few questions on the previous lesson to ascertain if they remembered vital concepts, b. He then proceeded with the day's lesson by using 4 learners in front of the classroom to demonstrate the concepts of cloning, c. A learner answered correctly after the demonstration on cloning, whose characteristics the offspring will inherit. Not that of the surrogate mother, d. He gave the learners class activities on the worksheets that he handed to them, which enabled them to work in groups of 3 or 4, for 5 minutes, e. Learners had the opportunity to collaborate, discuss and a representative of each group was tasked with answering the questions, f. The teacher moved around to observe and monitor group activities and ensured that all learners were participating, g. He praised learners for accurate responses to questions asked, h. He used examples and demonstrations to explain some scientific concepts for better understanding, i. After 25 minutes into the lesson, he started with the topic on the Nervous System, j. He explained actions that are voluntary and involuntary and requested the learners to give examples as well as to allow them to participate in the discussion, k. He further explained the sympathetic and parasympathetic nervous system by giving an example of a drowning sibling and the reactions of family members, l. He also went ahead to explain concepts regarding the parts of the brain and their functions, m. He gave sufficient information on CNS, the brain, and the spinal cord and the PNS, somatic and autonomic nervous system, n. After giving sufficient information using examples to aid understanding of the concepts, he allowed learners' participation through question and answer, o. He used past events and analogies to facilitate teaching and learning, and

	p. Responses from learners were very positive and encouraging.
Reflection	: The teacher used learners to demonstrate the concepts of cloning in front of the classroom, He recalled learners' memory of previous lesson activities and concepts, He gave out worksheets to learners for classroom activities, The teacher started another topic on "The division of Nervous System" at the end of Cloning, He took and marked the class register at the end of the lesson with the first group of 21 learners, and The second group of 43 learners were the next to have the day's lesson while the teacher gave the third group of 23 learner class activities while attending to the second group of 43 learners.

Table 4.5: Mr. Chipo's Classroom Lesson Observation Activities

Date of Lesson Observation	: 9^{th} of April 2022.
Observation's Venue	: Classroom, in the school premises
Observer (Researcher)	: Naiye Olufemi David
Teacher Observed	: Mr. Chipo **(Pseudonym)**
Level of Learners Observed	: Grade 12 Life Sciences learners
Level and Name of Subject	: Grade 12 Life Sciences
Topic of the Lesson	: Genetics (Continuation)
Lesson Plan and Objectives	: Genetic crosses, sex-link, alleles, and dihybrid. Use of worksheets for classroom tasks Learners to solve questions in front of the classroom Use of slides and projector to aid teaching and learning.
Lesson Duration	: 40minutes 55seconds
Teaching & Learning Resources	: Insufficient due to lack of a science laboratory, However, there are slides with a projector to aid teaching and learning, no hard copy textbooks for learners, eBooks and other learning resources were installed on an iPad (tablets, the electronic devise) for learners, not all learners have received an iPad, workbook for learners were used.
Teaching & Learning Approach	: Highly interactive and participatory, (IBL) combined with a teacher-centred approach where applicable, SCK and Pedagogical skills were sufficiently and evidently displayed to facilitate teaching and learning.
Learners' Interaction & Participation	: Sufficient evidence of learners' participation in the teaching and learning process, Learners asked various questions for clarity and responded to teacher's questions as expected, a few learners volunteered to answer questions on the white board in front of the class, A learner requested the teacher to come and read out her answer to the question asked, and Lesson activities were given to learners to engage them and to ascertain their understanding of the concepts being discussed in

	class.
Classroom Management	: Classroom setting was effective for teaching and learning, Few subject charts were displayed on the walls, Seating arrangement was accommodating and spacious enough for 48 learners that were present for lesson out of a total of 49 learners expected, Learners coordinated themselves appropriately when given group tasks to work upon, and Learners normally raise their hands to get permission to answer or ask questions and to maintain a disciplined classroom atmosphere
General Observable Activities	a. The teacher started by taking the day’s learners’ attendance register, b. He combined two groups of G12LSLs during the lesson (total of 48 learners in attendance out of a total of 49 expected learners), c. The day’s topic on Genetics was a continuation from the previous lesson, he asked a few questions from the last lesson on Genetics and then continued with the teaching from Genetic crosses, and sex-linked diseases using slides to aid teaching and learning, d. He gave each learner worksheets of 4 pages, e. Learners were asked to go through and attempt some specific questions on the worksheets, f. Three learners volunteered to answer some of the questions on the board in front of the class, g. A learner requested that her answer be read out by the teacher, h. The teacher moved around the classroom to inspect the progress made by other learners, i. He observed common mistakes by learners who requested assistance, j. He went to the board to address the common mistakes that he observed during inspection of learners’ activities, k. He indicated that learners must compulsorily mention the gender when addressing questions on sex-link, l. The teacher also returned to struggling learners for assistance before moving to the 5th slide, m. He explained monohybrid and dihybrid, and n. He gave another class activity on dihybrid crosses and moved around the classroom to monitor the progress of learners’ work on the task that he gave them.
Reflection	: The teacher used slides and a projector to aid teaching and learning, He took and marked the class attendance register at the beginning of the lesson, He recalled learners’ memory of previous lesson activities and concepts, He gave out worksheets to learners to attempt some specific questions, and A total of 48 learners from two groups in attendance out of a total of 49 expected learners.

The data collected during the classroom lesson observations of the teacher participants in their individual school premises, validated the data collected from both the teacher's and learner's interviews. It also revealed to a large extent the effectiveness of IBL, and the benefits of using the approach.

Effective implementation of the IBL approach depends on availability of sufficient teaching and learning resources, facilities, well-equipped science laboratory and library. In addition, a qualified Life Sciences teacher and a moderate class size in a conducive teaching and learning environment.

4.5 DOCUMENT REVIEW

Document review was the only secondary data source collected from the participants by the researcher. It enabled the examination of some relevant documents already existing before the data collection process commenced. These hard copy and electronic documents that are related to teacher and learner participants, include the teacher's guide and lesson plans prepared by the teachers, Life Sciences' curriculum and syllabus, the textbooks and workbook for learners, electronic tablets, internet sources, attendance registers, and a projector.

The teacher participants used some of these documents to plan and prepare lesson activities and facilitate teaching and learning progress *"…I've been trained on each and every curriculum…"* **AWQ15L16-16. Mr. Andile.** Learners used a few of the documents to facilitate learning *"…we have a list of learners who are underperforming, and we give them extra book…"* **AWQ04L68-69. Mr. Bulunga.** Document review strengthened the findings derived through interviews and classroom lesson observations.

4.6 CHAPTER SUMMARY

The data collected, analysed, organised, and presented in this chapter was based on interviews conducted on G12LSTs and their learners, classroom lesson observations, and document review. The predominant teaching approach used by teachers, its effectiveness, derived benefits, as well as the challenges encountered when using the approach. The data collected from the interviews was consistent with the data collected from classroom lesson observations. The effective presentation of data collected in this chapter was essential for the findings and recommendations in the last chapter of this study.

4.7 CHAPTER CONCLUDING REMARKS

The teacher participants integrated constructivist orientation in their teaching approach. The learners were actively engaged to construct new scientific knowledge. Scientific tasks given to learners, kept them within the zone which allows learning to progress, neither too difficult nor too simple to enable meaningful acquisition of scientific knowledge (Rutten et al., 2015). The classroom lesson observation revealed how learners were given scientific tasks that challenge them to rely on their prior scientific knowledge. Learners' construction of scientific knowledge was multi-directional. They took responsibility for their own learning experience and did not exclusively rely on their teachers for knowledge acquisition. The teachers' constructivism theory's view put them in the position of facilitators and made their learners constructors of scientific knowledge.

The IBL approach used by the teachers enabled their learners to construct their own knowledge of a phenomenon through experiences and reflections (Adom et al., 2016). The teachers' constructivist philosophy of teaching and learning allowed the engagement of learners to strengthen their essential learning skills, and critical thinking skills (Eltanahy & Forawi, 2019). This was a clear indication that an IBL approach is supported by a constructivist approach, and that the various learner-centred activities made an IBL approach best suited for a constructivist classroom.

The learners were not confined to a single reality of scientific knowledge acquisition. Teachers adopted the concept of epistemology to understand the way different learners construct scientific knowledge, and the importance they attach to how they understand scientific concepts (Lederman et al., 2013). Scientific tasks allow learners to develop their SPS (Kurniawan et al., 2019).

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

IBL is regarded as one of the constructivist approaches, it enables Life Sciences teachers to effectively facilitate teaching and learning (Crawford, 2000). The understanding of IBL amongst G12LSTs, its effect on the teaching and learning of G12LS's topics, and the factors responsible for ineffective implementation of IBL to a considerable extent have been addressed in Chapter Four. It provided an analysis and presentation based on the data sourced from the interviews, classroom lesson observations and document review.

This chapter gave the findings, conclusions and limitations based on the analysis and presentation in Chapter Four. The researcher also includes recommendations from the study and for further research study.

5.2 SUMMARY OF THE RESEARCH FINDINGS

The empirical evidence reinforced the view of an IBL approach being effective for the teaching and learning of G12LS's topics. The commitments of learners were revealed in how they work collaboratively with their teachers and develop the ability to construct new scientific knowledge and gain a deeper understanding of science (Coffman, 2009). Teacher participants combined teacher-centred and IBL approaches during teaching and learning due to time constraints to cover the science syllabus (Siahaan et al., 2017). Certain factors were responsible for the ineffective implementation of IBL, which could be frustrating for G12LSTs and their learners (Anderson, 2002).

The findings of the study were guided by the research objective of determining G12LSTs' understanding of IBL and the research questions on the implementation of IBL in teaching G12LS's topics. Furthermore, the findings emerged from the responses to the interview questions. The interview questions were generated from the research questions and supported by data derived from classroom lesson observation and document review. The literature review and research methodology also played a critical role in arriving at the research findings.

Table 5.1: Summary of Findings from the Main and Sub-Research Question One

Research Questions	Teacher's Interview Questions	Themes	Findings
Main Research question What is the Grade 12 Life Sciences teachers' understanding of IBL approach in attaining the objectives of teaching and learning of Grade 12 Life Sciences? **Sub-Research question 1** How do G12LSTs perceive IBL approach to teaching Life Sciences' topics?	1. What does the term *Inquiry-Based Learning (IBL) approach* mean to you? 15. Have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it? 16. Do you think you need more training on IBL or your preferred approach to improve classroom management? 17. In which areas do you need more training and why?	1. Teachers' Understanding and Perceptions on the Use of an IBL Approach. 2. Teachers' Attitudes, Beliefs and Formal Training on the Use of an IBL Approach.	G12LSTs had adequate knowledge and understanding of the IBL approach to teaching and learning. G12LSTs developed positive attitudes for more training on the IBL approach. Periodic training assisted in keeping the G12LSTs abreast with the dynamic nature of the IBL approach.

Table 5.1 gave the summary of findings which emerged from the main research question and sub-research question 1, teacher's interview questions 1, 15, 16 and 17 and Themes One and Two.

Theme One revealed that the G12LSTs had adequate understanding of the IBL approach to teaching and learning. It was not surprising that the three teacher participants were equipped with sufficient pedagogical skills required to facilitate teaching and learning using an IBL approach. They all had more than ten years of teaching experience as indicated in Table 3.1 of Chapter Three and had enough training on IBL. Guerriero (2017) underscored the importance of teachers engaging in regular professional training to update themselves and be dynamic to remain relevant. Lyngved et al. (2012) maintained that organised training and developmental programmes help teachers overcome challenges associated with teaching and learning.

G12LSTs' understanding of the concepts of IBL formed the bases and relevance for the sub-research research questions. Teachers who lack understanding of the concept of

IBL will not be able to give relevant information on IBL’s effectiveness, challenges, or ineffectiveness to teaching and learning of G12LS’s topics. Neither will they be able to come up with any remedial actions to mitigate the challenges nor make any insightful recommendations to improve on the use of the IBL approach to teaching and learning.

The importance of having adequate understanding of the concept of the IBL approach cannot be overemphasised. G12LSTs’ adequate understanding of IBL was significant for the research study. Bhagat (2017) argues that science teachers need to acquire adequate skills to effectively implement the IBL approach. Inadequate understanding of the concept of IBL would have hindered the progress of data collection and affected the credibility of the overall findings. Training and developmental programmes are necessary for science teachers to enhance their SCK and PK in facilitating inquiry activities (Holmqvist, 2019).

The findings which emerged from Theme Two showed that G12LSTs developed positive attitudes towards an IBL approach. It was evident in their desire and request for more training on the use of IBL. They also mentioned aspects where they needed more training to improve their pedagogical skills. Furthermore, it was revealed that most of the trainings they had, helped to keep them informed with the dynamic nature of the IBL approach. The teachers viewed an IBL approach as an important part of learning success, hence, the need for more training to improve teaching and learning. Teachers’ educational qualifications and competence become irrelevant in an IBL classroom, if their beliefs conflict with IBL practices (Ramnarain & Hlatswayo, 2018).

The findings which emerged from Theme Two of learner’s interview questions 2 and 6, revealed that the G12LSTs’ positive attitudes influenced the G12LSLs to embrace the IBL approach to teaching and learning. Consequently, most learners were desirous of enrolling in science courses at the university. Lederman et al. (2013) assert that teachers’ perceptions and attitudes towards the IBL approach is indicative of how learners develop an interest in learning and acquiring scientific knowledge.

Learners' positive attitudes preceded the development of some scientific skills. G12LSLs were able to collaborate, work as a team, communicate skilfully, understand scientific illustrations of drawings, graphs, and tables (Yoshinobu, 2017; Bogler, 2018). Learners became inquisitive and curious to conduct research, concentrate and make meaningful observations. They were confident to ask and/or answer relevant scientific questions. Their positive attitudes toward IBL, helped them to develop hypothetical and critically thinking skills. They took responsibility for their own learning experience. The data and findings derived from the learners' perspectives validated data and findings derived from the teachers' perspectives.

The development of scientific skills were significant to learners' increased interest in the learning of science. These scientific skills form part of the foundational knowledge required to succeed in science courses in the university education (Coil, Wenderoth, Cunningham, & Dirks, 2010).

Table 5.2: Summary of Findings from the Main and Sub-Research Question Two

Research Questions	**Teacher's Interview Questions**	**Themes**	**Findings**
Main Research question What is the Grade 12 Life Sciences teachers' understanding of IBL approach in attaining the objectives of teaching and learning of Grade 12 Life Sciences? **Sub-Research question 2** How does the implementation of IBL impact on G12LSLs' academic achievement?	2. What teaching and learning approach do you frequently use and why do you prefer the approach to others? 3. Describe other approaches besides your preferred approach that you believe can be equally effective. 4. In your opinion, do you think an IBL approach can be effective in facilitating all Life Sciences topics and other science subjects? 9. What learning opportunities or benefits does IBL, or your preferred approach, provide for you and your learners from your own assessment of their learning progress? 10. Do you think that one or more of the learning	3. IBL and Teacher-Centred Approaches to Teaching and Learning. 4. Benefits or Opportunities of the IBL Approach to Teaching and Learning.	IBL has positive effects on the teaching and learning of G12LS's topics. Effective Implementation of IBL regarding effective time management requires the integration of some characteristics of the teacher-centred approach. Not all G12LS's topics and other science subjects' topics can be facilitated exclusively with an IBL approach. IBL provides several benefits for the teacher and the learners and

	opportunities listed in question 9 above will help to retain learners and minimise dropout among Life Sciences learners?		has helped to retain and prevent dropout amongst G12LSLs.

Table 5.2 highlighted the findings which emerged from the main research question and sub-research question 2, teacher's interview questions 2, 3, 4, 9 and 10, and Themes Three and Four.

It was found in Themes Three and Four, that the IBL approach enabled the G12LSLs to be actively engaged in the teaching and learning process (Ali, 2014). Learner-centred activities were applied to allow learners to inquire scientifically, discuss and collaborate in groups and come up with their findings (Coffman, 2009). The IBL approach enabled learners' active engagement and continuous learning before, during and after classroom lesson activities.

The findings from Theme Three of the learner's interview question 3 complemented the use of IBL approach revealed by their teachers. The IBL approach was found to be interactive, participative, and engaging. It allows G12LSTs to facilitate, obtain feedback on learning progress, and guide the learners towards achieving lesson objectives and academic success. The findings revealed that IBL has a positive effect on the teaching and learning of G12LS's topics. Crawford (2000) describes the teacher as a motivator in an IBL classroom, whose motivational role encourages learners to reflect on their learning experience in the form of feedback, and it allows the teacher to identify their strengths and learning difficulties. It enables learners to collaborate, share ideas, and build teamwork and trust (Crawford, 2000; Franklin, 2019).

Theme One from the learner's interview question 1, reaffirm the IBL as an effective approach to teaching and learning. It allows the learners to prepare in advance for the next lesson or topic (Murray, 2013). The face-to-face learning through interaction assisted learners in need. Shy and struggling learners participated and freely sought learning support from high-performing learners and the teacher. The G12LST as a diagnostician in an IBL classroom, enabled the learners to gain continued learning support (Galloway & Lesaux, 2014; Guerra et al., 2017).

G12LSLs developed alternative ways of solving scientific problems and examination questions. They learnt in groups and were less dependent on their teacher. The teacher re-explain or simplify difficult concepts or topics using examples or analogies for better understanding. IBL is flexible and it accommodates all learning styles; it fosters curiosity, enables learners to recall memory, and engage them in research activities (Murray, 2013; Bogler, 2018; Weimer, 2017). These findings were sufficient evidence of the positive impact of IBL approach on learners' learning progress.

Themes Three and Four from the teacher's interview revealed that effective time management in IBL approach requires the integration of some characteristics of the teacher-centred approach. G12LSTs integrated the teacher-centred approach due to time constraints to cover the syllabus (Siahaan et al., 2017). The combination of both an IBL and a teacher-centred approaches became necessary to transfer scientific knowledge and complete the Life Sciences syllabus within a specified period (Bruder & Prescott, 2013). The school authorities often put pressure on G12LSTs to meet deadline for completing the syllabus (Anderson, 2002). G12LSTs made an enormous effort to complete the syllabus and had sufficient time for preparatory examinations and revisions before the final examinations.

G12LSTs minimally integrated the teacher-centred approach to the IBL approach in teaching and learning aspects affected by insufficient teaching and learning resources. They resorted to giving learners information, and playing video clips on laboratory experiments. However, they maximally implemented the IBL approach due to its many advantages and benefits. Weimer (2013) maintained that a teacher-centred approach deprives learners of meaningful learning and makes them to become passive participants in the teaching and learning process. Bruder and Prescott (2013), and Duckworth (2009) agree with Weimer, that learners will be deprived of adequate collaborative learning, and this will impede the development of their scientific skills.

Findings showed that not all G12LS's topics and other science subjects' topics can be facilitated exclusively with an IBL approach. Some topics in Life Sciences and other science subjects are analytical in nature and have more theories and terminologies. G12LSTs introduced and explained these theories and terminologies at the beginning of the lessons. This allowed the learners to effectively comprehend the underlying scientific concepts associated with such topics. A teacher-centred approach should be balanced with learner-centred approach to increase interest and motivation to achieve learning objectives (Vani, 2010).

Genetics and Evolution are two of the few topics that require a compulsory integration of a teacher-centred approach. G12LSTs used analogies to give detailed explanations of theories, terminologies and concepts. Subsequently, the G12LSLs were allowed to participate through the IBL approach. They were presented with the opportunity to make their own contributions by relating the teacher's explanations of theories, terminologies, and concepts to previously learnt scientific concepts. Furthermore, they conducted their own inquiries for a better understanding of the topics.

It was revealed that an IBL approach provided several teaching and learning benefits to both the teacher and the learners. It helped to retain learners, prevented dropout, and ensured acquisition of scientific skills (Bhagat, 2017; Bruder & Prescott, 2013). Theme Four of the teacher's interview showed that IBL proved to be a motivational approach for learners to participate actively. It enabled the teacher to effectively follow-up on learners' learning progress and the development of various scientific skills. G12LSTs used it to identify learners' mistakes and apply corrective measures. It helped in identifying what the learners already know, what they do not but need to know and how they can be guided to achieve the lesson objectives. The dynamic nature of the IBL approach encouraged the teacher to develop several informal assessment strategies to regularly assess the learners (Kishwar, 2016). Consequently, the G12LSTs were able to improve on their pedagogical skills (Kishwar, 2016; Sonmark et al., 2017). The benefits derived from IBL approach, enabled the G12LSTs to effectively facilitate the teaching and learning of G12LS's topics, helped to retain learners and prevent dropout as the level of learners' participation increases (Coffman, 2009; Bhagat, 2017).

Theme Two of the learner's interview found that the G12LSLs became motivated and actively participated in lesson activities due to the IBL approach used by their teachers. IBL enabled learners to acquire scientific knowledge, irrespective of their cognitive capabilities (Guido, 2017). These benefits were also regarded by the learners as reasons for considering IBL as an effective teaching and learning approach. It enabled them to develop communication, critical thinking, researching and hypothetical skills. They were able to observe a phenomenon, ask and answer relevant scientific questions, collaborate, work as a team and inquire independently (Coffman, 2009; Bhagat, 2017). G12LSLs developed the interest for learning science meaningfully, and subsequently improve in their academic performance, and were inspired to enrol in some of the science courses in the university. The findings derived from the learners' perspectives complemented the findings derived from the teachers' perspectives.

Table 5.3: Summary of Findings from the Main and Sub-Research Question Three

Research Questions	Teacher's Interview Questions	Themes	Findings
Main Research question What is the Grade 12 Life Sciences teachers' understanding of IBL approach in attaining the objectives of teaching and learning of Grade 12 Life Sciences? **Sub-Research question 3** Why is IBL implementable or impracticable in teaching the Grade 12 Life Sciences' topics?	5. How would you describe the level of your learners' participation, motivation, and performance when using an IBL approach or your preferred approach to teaching Life Sciences? 6. How does the IBL approach or your preferred approach allow your learners to construct new scientific knowledge from their prior scientific knowledge? 12. How would you describe your learners' examination success or pass rate in the past three years? 13. Has there been an increase in the number of learners enrolling in Life Sciences and other science subject in the past	5. Effectiveness and Ineffectiveness of an IBL Approach on Teaching and Learning. 6. Science Laboratory, Teaching and Learning Facilities or Resources and Class Size. 7. Applicability of IBL to the Life Sciences Curriculum and Completion of the Syllabus.	IBL is effective for teaching G12LS's topics because it motivates G12LSLs to become active participants in the teaching and learning process and developed their scientific skills and interest for learning science. IBL had potentially improved examination pass rates and consequentially prevented dropout among science learners. It also

	three years? 7. How would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any? 18. How would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class? 19. How applicable is the IBL approach or your preferred approach in completing the Life Sciences syllabus within the specified timeframe?		increased enrolment and retention rates of G12LSLs. Insufficient or lack of teaching and learning resources and facilities like a science laboratory impedes the effectiveness of IBL to the teaching and learning of G12LS's topics. The large class size of G12LS was one of the major factors affecting effective implementation of IBL. G12LSTs increased teaching and learning contact time, engaged G12LSLs with learning activities before and after classroom lesson activities, and minimally integrated some characteristics of teacher-centred to the IBL approach to ensure timely completion of the syllabus.

Table 5.3 gave the summary of findings which emerged from the main research question and sub-research question 3, teacher's interview questions 5, 6, 12, 13, 7, 18 and 19, and Themes Five, Six and Seven.

Theme Five and teacher's interview questions 5, 6, 12 and 13 found that the overall objectives for using an IBL approach to teaching and learning of G12LS were achieved.

Several reasons for the effectiveness of IBL were highlighted in the Summary of Findings under Tables 5.1 and 5.2. G12LSTs used the IBL approach because of the benefits the teacher and the learners derive from it. The IBL was effective because the G12LSTs had adequate understanding of the approach. They possessed the SCK and the pedagogical skills required to facilitate using the approach (Shulman, 1986). In addition, they had positive attitudes towards the IBL approach to teaching G12LS. Effectiveness would not have been achieved if the G12LSTs were lacking in any of the above-mentioned qualities.

G12LSTs' perceptions of IBL were indicative of their positive attitudes towards the use of the approach. Consequently, the G12LSLs developed positive attitudes toward the IBL approach. It was found to be effective because it motivated G12LSLs to develop the interest to be active participants before, during and after classroom lesson activities (Ramnarain & Hlatswayo, 2018; Lyngved et al., 2012). Learners' constant engagement in inquiry tasks ensured continuous development of scientific skills. It was evident that this development increased enrolment and retention rates, prevented dropout and improved G12LSLs' examination pass rates. It eliminates rote-learning and encourages recall of memory, while an exclusive teacher-centred approach encourages rote-learning and thereby deprives learners of developing scientific skills (Duran & Dökme, 2016).

Learners become passive and dormant participants in the teacher-centred classroom, contrasted with an IBL classroom, where learners ceased to be passive and dormant participants (Ahmed, 2013; Duran & Dökme, 2016; Lyngved et al., 2012). The teacher as a mentor in an IBL classroom enabled the learners to develop collaborative relationship amongst themselves and their teachers. Consequently, improved their confidence and communication skills and were able to engage in scientific inquiry either in groups or independently (Crawford, 2000; Zachary, 2002).

The objectives of increasing the enrolment and retention rates while preventing dropout, and improving examination pass rate, were considerably achieved due to effective use of the IBL approach (Bhagat, 2017).

Themes Five and Six and the teacher's interview questions 7 and 18, found that effective implementation of the IBL approach was impeded due to insufficient or lack of teaching and learning resources and facilities. Some lessons in science require a well-equipped science laboratory for effective teaching and learning (Anderson, 2002; The PRIMAS project, 2013). In recognition of the fact that the IBL approach consumes much time, it also requires adequate teaching and learning resources and facilities to attain effectiveness.

The problem of insufficiency was further exacerbated, as two of the G12LSTs had to accommodate large class sizes and they resorted to integrating a teacher-centred approach and demonstration method (Onwu & Stoffels, 2005). As the number of Life Sciences learners' enrolment increases in the first school, the school management employed additional Life sciences' teacher to augment for the increase, but this was not the case with the second and third schools with large class sizes.

It was found that large class size negatively influenced the implementation of an IBL approach. Two out of three teacher participants who had large number of G12LSLs, resorted to separating the learners into groups for lesson purposes, they repeated the same lesson multiple times to accommodate the number of groups they had. It was necessary to reduce the large class sizes into smaller groups to effectively use an IBL approach. Identifying and supporting learners with learning difficulties in an IBL classroom with large class size is burdensome for the teachers (Ramnarain, 2014).

Findings showed that effective implementation of IBL was further impeded by underperforming learners who felt intimidated by the active participation of high performing learners. Struggling learners became reticent and were not intrinsically motivated to participate. Guerra et al. (2017) stress the need for teachers not to withdraw learning support from learners with learning difficulties and to constantly identify such weaknesses and apply corrective measures.

The classroom with diverse learners in terms of cognitive capabilities and different learning difficulties, posed another challenge to the effective implementation of IBL.

Discovering Science through Inquiry (2009) recommends that teachers should adopt differentiated types of inquiry to form demarcations for learners to develop scientific skills, irrespective of their cognitive capabilities. Learners with lower cognitive capabilities should be engaged with less advanced differentiated types of inquiry and vice versa. Similarly, differentiated instruction is another IBL teaching model the science teacher can adopt to ensure that no learner is deprived of doing science due to their learning difficulties. Scientific knowledge can be transferred despite learners' distinctive learning needs (Guido, 2017; Layton, 2016; National Research Council, 1996; Eltanahy & Forawi, 2019). If applied appropriately, the IBL approach can eliminate learners' negative attitudes and learning difficulties that impede learning of science, in addition, promote an all-inclusive science education (The PRIMAS project, 2013; Bruder & Prescott, 2013).

Inadequate support from some parents and the school management in the third school impeded effective implementation of IBL. Poorly organised stream subjects' combination in the third school made G12LSLs to be maximally engaged with social science subjects, while they had little time for their core science subjects. It became difficult for learners to focus on aspects of science they wish to specialise in.

Theme Four and learner's interview questions 4 and 5, found that G12LSTs spent much time trying to make underperforming learners understand scientific concepts. The teacher was too fast for some of the learners and corrections were sometimes done orally while slow learners struggled to keep up with the pace. The teacher was the only one teaching a very large class and does not have sufficient time to monitor or inspect all learners' work during classroom lesson activities. Explaining practical and experimental tasks without a science laboratory makes the learning of science uninteresting and irrelevant as some topics require several experimental investigations (The PRIMAS project, 2013). The findings derived from the learners' perspectives complemented and validated the findings derived from the teachers' perspectives.

Theme Seven and teacher's interview question 19, found that several interventions were put in place by the G12LSTs. These were done to ensure the completion of

G12LS's syllabus and to have sufficient time for preparatory examinations and revision before final examinations. It was revealed the IBL was effective but time consuming. In order to attain effectiveness and complete the G12LS's syllabus within the specified period, the G12LSTs increased teaching and learning contact time during weekdays and conducted extra classes during weekends and holidays. They prioritised Life Sciences, Mathematics, and other science subjects, they minimally integrated the time efficient teacher-centred characteristics with the IBL approach where applicable (Hotchkiss & Fleron, 2014; Coe et al., 2014; Ramnarain & Hlatswayo, 2018).

The G12LSTs engaged the learners with learning activities and inquiry tasks in the form of homework, assignments, and research tasks, before and after classroom lesson activities. Periodic analysis of the learners' performance was conducted to identify learners who need to be placed under supervised study. They used several informal assessment strategies to acquire frequent feedback. They monitor learners' learning progress and their level of preparedness for the successive topics; such assessment formed an integral aspect of teaching and learners' development (Kishwar, 2016).

Table 5.4: Summary of Findings Related to Research Problem Statement

Research Statement of the Problem	**Teacher's Interview Questions**	**Themes**	**Findings**
A relatively low rate of enrolment in university science courses. Increase in the rate of dropout among science learners in both secondary and university education. Poor performance leading to a poor percentage of learners graduating within the minimum	8. How have you been able to manage or overcome the challenges mentioned in question 7 above? 11. How have you been able to prevent learners' dropout and improve on learners' attendance and retention rate? 14. What strategy or strategies have you put in place to avoid a decrease in the number of learners enrolling in Life Sciences and other science subjects? 20. What would you recommend to improve the	8. Remediation for Ineffectiveness and Challenges to IBL Implementation. 9. Recommendations for an increase in Science Learners' Enrolment into Secondary and University Education	G12LSTs spent more time and resources on underperforming learners while high performing learners were engaged with more inquiry tasks. G12LSTs used different informal assessment methods that were engaging to get feedback on learning progress and to identify what learning objectives had been achieved or

required time in both secondary and university education.	teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education? 21. Do you have any suggestions or questions on the interview or the research topic?		not achieved and responded appropriately. Parents' engagement on following up on learners' homework activities and academic support. Motivation and recognition of learners' learning achievement Classroom seating plan that encourages weak learners to get assistance and support from high-performing learners. Implementation of different strategic plans to retain learners and prevent dropout. G12LSTs gave several recommendations to increase science learners' enrolment into secondary and university education.

Table 5.4 revealed the findings that emerged from the teacher's interview questions 8, 11, 14, 20 and 21 and Themes Eight and Nine, and how these findings addressed the statement of the problem of the research through various remedial actions and recommendations from the G12LSTs.

Theme Eight and the teacher's interview questions 8, 11 and 14, found that the G12LSTs put in place several remedial actions to improve G12LSLs' academic performance, increase science learners' enrolment and retention rates, and prevent dropout amongst G12LSLs. The interventions put in place under Theme Eight of Table 5.4, were to reinforce the remedial actions mentioned under table 5.3.

The G12LSTs spent more contact time and provided extra learning resources to assist underperforming learners, while high performing learners were kept engaged with more inquiry tasks or research activities. This strategy allowed the teacher to spend more time addressing the learning needs of underperforming learners. Struggling learners were encouraged to participate and make contributions, they were shown great care by the teacher and other learners. This was done to encourage and motivate them not to give up on learning science and to prevent dropout. Underperforming learners can improve as teachers develop learning resources that accommodate their learning need and show sufficient care for such learners (The PRIMAS project, 2013; Szydlo, 2014).

G12LSTs were dynamic in the way they facilitated the teaching and learning of G12LS's topics. They used different and frequent informal assessment methods to increase learners' involvement and participation in the teaching and learning process (Nusche et al., 2012). They monitored learners' learning progress and identified the learning objectives that were achieved and the ones that were not, and applied corrective measures where applicable before moving to a successive lesson task. The use of numerous assessments necessitated learners' development of scientific skills and acquisition of knowledge (Kishwar, 2016). They conducted informal assessments in the form of questioning, scaffolding, and open-ended questions, however, these activities reflected an excellent IBL classroom (Coe et al., 2014; Duckworth, 2009; DoBE, 2011). These remedial actions were necessary to ensure that no learner was left behind and prevented dropout.

The G12LSTs supervised and minimised the dominance of high-performing learners, which seemed intimidating to underperforming learners. Struggling learners' contributions were reciprocated with praise and recognition for their participation in the teaching and learning process. This was to encourage underperforming learners' continued participation. These interventions were necessary to motivate weak learners, increase their interest in learning science, retain them and prevent dropout. The IBL approach encouraged learners to ask and answer questions, to be inspired to participate in learning, and to develop alternative ways of solving scientific tasks, while maintaining classroom discipline (Yoshinobu, 2017; Bogler, 2018; Murray, 2013).

The G12LSTs used several forms of incentives, which included recognition of learners' achievement, praise for good performance, and gift items to motivate the learners to develop the interest in learning Life Sciences (Szydlo, 2014). This initiative motivated their learners to actively participate and helped to improve learning, retain learners, prevent dropout, and improve the examination pass rate.

The G12LSTs sought parents' involvement in monitoring the academic progress of the learners. Some of the parents were not involved in supervising and following up on learners' homework activities. The provision of informed feedback to the school by parents and rendering of academic support, were solicited by the G12LSTs. This strategy enabled the teachers, parents and school management to share relevant information that were helpful for G12LSLs' academic success. The intervention helped to improve learning support programmes, through joint efforts by the school management, teachers, and parents.

The G12LST in the second school, reduced the lesson objectives for each lesson and increased the number of times the same lesson was conducted to accommodate struggling learners. This was to avoid having too many objectives that the weak learners needed to achieve at a single class meeting. Learners were separated into different groups according to their cognitive capabilities. This strategy helped to accommodate high-performing learners who felt that the teacher was spending too much time on a few scientific concepts or topics, while they were eager to move to the next topic.

The G12LST in the third school, organised a seating plan which allowed weak learners to be assisted collaboratively when seated next to top achievers during group tasks or class activities. Learners of G12LST in the second school were separated into different groups, depending on their cognitive capabilities and were taught separately to maintain a learning pace appropriate to their learning ability. This idea contradicted the strategic seating plan in which weak learners were assisted when seated next to high-performing learners. However, each remediation has its own advantages.

The strategy of creating separate groups to engage learners according to their cognitive capabilities is only applicable in large class sizes. This idea enabled the teacher to spend more time rendering learning support to learners in the struggling group. The top achievers' group requires little supervision from the teacher, they are capable of handling a more advanced inquiry task. The strategic seating plan, works perfectly for a moderate class size of thirty or fewer learners to a teacher, where the teacher has sufficient time to supervise and monitor the work of all the learners in the class during a single lesson. The IBL approach in a large class size requires more time and resources to complete a single lesson.

Findings showed that G12LSTs created a warm and friendly teaching and learning atmosphere, to accommodate very active and struggling learners. Learners were free to approach their teachers privately at their free period for learning guidance or assistance (Lai-Yeung, 2014). This idea enabled shy and struggling learners to build their confidence to participate actively in classroom learning activities. The teacher as a mentor and guide, should be accessible to the learners, especially learners requiring learning guidance and support.

The school management prioritised Life Sciences, Mathematics, and other science subjects, when the DoBE introduced holiday classes. This initiative was a boost to the weekdays and weekend extra classes organised by G12LSTs. This intervention was particularly important for the completion of the Life Sciences syllabus. It ensured more contact time for teaching and learning activities. The opportunity enabled sufficient time for preparatory examinations and revisions before final examinations. It also enabled improved pass rates and prevented dropout.

Findings showed that G12LSTs exhibited pride and passion for the subject and impressed those feelings on the learners. G12LSLs reciprocated the gesture and regarded Life Sciences as one of the best subjects. They also counsel their learners on career opportunities that are open to them if they aspire to attain any career that are related to Life Sciences. They checked up and followed up on learners who started showing signs of dropping out from school. They created a friendly relationship with learners who were losing interest to learn. Teachers went the extra mile to make Life Sciences very interesting to their learners. Consequently, such learners started to take their subject more seriously.

Theme Nine and the teacher's interview questions 20 and 21, highlighted some of the recommendations made by G12LSTs to improve the teaching and learning of Life Sciences, and to increase the number of science learners enrolling at secondary and university education.

Increasing the number of enrolled science learners into secondary and university education remained one of the critical aspects of the research problem statement. To address this problem, the teachers gave the following recommendations:

a) Learners should be taught the basics of science at the elementary level to build their foundational knowledge in NS,
b) Development of learners' biological skills (investigative, identifying, researching, quantitative, analytical skills etc.) should commence from their early grades,
c) The teaching and learning of science should be made attractive, fun, and interesting to learners,
d) Opportunity for hands-on and practical activities to improve their SPS of observing, classifying, communicating, measuring, inferring, and predicting should be prioritised for all science subjects,
e) Integrate more scientific tasks which help to enhance their logical reasoning in dealing with scientific methods, use step by step strategies for asking logical and scientific questions about an observable phenomenon, formulating hypothesis, making predictions based on the formulated hypothesis, testing the hypothesis through experimentation, analysing the results or the data collected from the experiment, making a conclusion and presenting the information through various possible forms, such as tables, line graphs, bar graphs, histogram, pie charts, also in the form of a paragraph,
f) Life Sciences curriculum should be made more practically implementable, should be more process-oriented,
g) More teaching and learning should be conducted outside the classroom for learners to relate what is being taught in the class with the natural world,

h) Integrate the use of pictures, videos, internet, information, and communication technology (ICT) in science to reinforce learners' interest in and passion for science, and
i) Plan lesson activities with the learners, allow peer teaching, class presentations, conduct science excursions.

The implementation of these recommendations is envisaged to equip science learners from their foundational level of education to the university educational level. It will simplify science, and develop learners' positive attitudes toward doing science. Consequently, learners will have interest to learn scientific concepts and solve scientific problems. Their excitement and motivation to learn science, will keep them enrolled in Life Sciences and science courses in secondary and university education respectively.

In Theme Five and Learner's interview questions 7 and 8, the learners gave certain suggestions on how to improve the teaching and learning of Life Sciences and other science subjects. Their suggestions are as follows:

a) School and teachers should include active recall programs to enable learners to constantly evaluate themselves on their understanding of scientific concepts,
b) IBL teaching approach is very effective, it should be continued and introduced at lower grades and in all subjects,
c) Although the teaching approach is good, the teacher must ensure to carry everyone along,
d) More group tasks, experiments and practical work should be given to learners in science classes,
e) Introduce alternative ways of answering examination questions and more examination-based questions or activities,
f) Excursions and learning trips should be included in the science curriculum,
g) The school should maintain the same science teacher from Grade 10 to Grade 12,
h) Integrate more videos than slides in the teaching and learning process, also include a projector in the teaching and learning,
i) The school management should build a science laboratory and procure laboratory equipment and ensure that the science laboratory is utilised for teaching and learning,
j) The teacher should not spend so much time on one topic, he should instead organise extra classes for slow learners,

k) The school management needs to provide more learning resources (textbooks) and equip the library to have access to more information,
l) The school should support teachers and prioritise science subjects and not only Life Sciences, to develop science learners to continue science outside school premises, and
m) Science learners should be grouped and assisted according to their preferences in science or aspects they wish to specialise in, in the university.

The findings derived from Themes Eight and Nine and the teacher's interview questions 8, 11, 14, 20 and 21, further addressed the problem statement of the research.

5.3 RESEARCH CONCLUSIONS

The main research question formed the bases for the sub-research questions. It would have been very challenging to proceed with the sub-research questions, if the teacher participants did not have sufficient knowledge or understanding of the IBL approach. Poor perceptions or lack of understanding of the concepts of IBL would have impeded the progress of data collection. The three teacher participants showed sufficient evidence of their understanding, positive attitudes and amount of formal training acquired on the use of the IBL approach. They also have several years of teaching experience that were adequate for reliance on data collection.

The first sub-research question, "How do G12LSTs perceive IBL approach to teaching Life Sciences' topics?"

The findings derived from answering this question and the main research question revealed that G12LSTs clearly understood the concepts of IBL and were desirous for more training on IBL. They also developed positive attitudes towards an IBL approach to teaching and learning of Life Sciences, and as a result, it was not burdensome for them to effectively implement the approach. Their understanding of the IBL approach positively impacted on their learners' positive attitudes towards the approach. Impartation of scientific skills or knowledge on the learners also became possible and necessary for G12LSLs' motivation and interest to enrol in some of the science courses in the university.

The second sub-research question "How does the implementation of IBL impact on G12LSLs' academic achievement?"

In addressing this sub-research question and the main research question, the findings revealed several benefits of IBL to both the teacher and learner, which contributed to academic success. The academic success were indicative of the positive effect of IBL on teaching and learning of G12LS's topics. It was found that to attain effective time management while using a time-consuming IBL approach, the integration of minimal characteristics of the traditional but efficient teacher-centred approach was necessary. It was also revealed that not all G12LS's topics and other science subjects' topics can be facilitated exclusively with an IBL approach, hence, the need to integrate minimally the teacher-centred approach where applicable.

The third sub-research question "Why is IBL implementable or impracticable in teaching the Grade 12 Life Sciences' topics?"

In attempting to answer this sub-research question and the main research question, study revealed that IBL is effective for teaching G12LS's topics. It has positively influenced G12LSTs to develop and improve their pedagogical skills in facilitating teaching and learning. Similarly, it has motivated G12LSLs to become active participants in the teaching and learning process and enabled them to develop their scientific skills and interest for learning science. The objectives of increasing enrolment and retention rates, preventing dropout and attaining examination success were achieved and attributed to effective use of IBL approach. However, IBL becomes ineffective when impeded by some factors such as insufficient or lack of teaching and learning resources and facilities like a science laboratory. The large class size and other impeding factors as detailed in Themes Five and Six of the teacher's interview, made IBL impracticable. G12LSTs took advantage of IBL's flexibility to integrate some efficient strategies in order to complete the syllabus within the specified period and ensured that learners with learning difficulties were not left behind.

The G12LSTs adopted several remedial actions and gave recommendations for effective and efficient implementation of the IBL approach. The remedial actions and recommendations were aimed at developing learners' interest in learning science, and to enrol in some of the science courses at the university. They further recommend that science should be introduced to learners early, from the foundational stage of their formal education. This recommendation was intended for developing and improving learners' scientific skills, and eliminating most learning difficulties before they reach Grade 12.

There was sufficient evidence from the findings of the research study that it will provide support for Life Sciences teachers to be effective and efficient facilitators rather than instructors. It will motivate learners to learn Life Sciences and other Science, Technology, Engineering and Mathematics (STEM) subjects, and become critical thinkers, researchers, and lifelong learners. These will consequently increase the enrolment of science learners into both secondary and university education, prevent dropout, improve pass rates, and increase the number of employable graduates or scientists.

The findings of this research study were intended to make meaningful contributions to the already existing wealth of knowledge from the works of other researchers.

5.4 RECOMMENDATIONS FROM THE STUDY

In view of the summary of research findings outlined in this chapter, the researcher shall present the recommendations as they relate to different stakeholders in the educational sector. The stakeholders include teachers, learners, parents, school management, DoE and DoBE which are the government representatives in the educational sector.

5.4.1 Recommendations for teachers

5.4.1.1 Training and developmental programmes for teachers

Critical to the findings of this research study, are the teacher participants' sufficient understanding of the IBL approach, their SCK, pedagogical skills, positive attitudes towards the use of an IBL approach which was also evident in their desire for more training on some aspects of IBL. These qualities precede effective implementation of the IBL approach which resulted in several benefits derived by the teachers and learners.

These criteria formed the bases for quality science education, and it necessitated a recommendation for compulsory and continuous training and developmental programmes for all teachers. IBL is flexible and dynamic, it has various aspects in which teachers need to be trained, such as integration of Information and Communication Technology (ICT), classroom management, time management, implementation of formal and informal assessment, and handling indiscipline problems. The advantages of acquiring sufficient training in IBL to improve pedagogical skills and the benefits teachers stand to gain far outweighed the cost of engaging the teachers in periodic training and developmental programmes.

5.4.1.2 Acquiring the relevant professional teaching qualifications

Periodic training on the use of the IBL approach can be very helpful in developing and improving pedagogical skills, but it cannot improve the teachers' SCK. The IBL approach requires the teacher to have an in-depth knowledge of the subject matter, to guide, assist and provide the learners with relevant information that pertains to Life Sciences. The researcher recommends that teachers without appropriate teaching qualifications, should invest in a relevant professional teaching course in science or NS education to upgrade themselves.

Pedagogical skills become meaningless without SCK. Teachers can only impart into learners, SCK that they have acquired. Teaching and learning could be negatively affected by the teacher's insufficient or lack of SCK. It is recommended that teachers upgrade themselves through programmes that are subject-content enriching to meet their responsibilities as Life Sciences or science teachers.

5.4.1.3 Adopting an IBL approach for its effectiveness and benefits

There were substantial evidence from the findings, on the effectiveness of the IBL approach to teaching and learning. It was revealed that the teachers and learners acknowledged the effectiveness of IBL, with a learner suggesting that the approach should be replicated in the teaching and learning process of other subjects and through all grades, ***"****I would suggest my school to use the same teaching style for lower grades as well, not only Grade 12."* **AYQ07L56-57**. **Mr. Andile's learner C.**

Findings also showed that the teacher and learners derived much benefit from the IBL approach. In view of this, the researcher recommends adopting an IBL approach to the teaching and learning of Life Sciences and other science subjects, to engage learners meaningfully and actively, and to achieve the set objectives of teaching and learning.

5.4.1.4 Combining IBL and teacher-centred approaches for efficiency

The IBL approach is effective and flexible, but it is time consuming. Findings have shown that the teachers often feel the pressure of completing the syllabus within a specified timeframe. The teachers were often inclined to move at a pace which disadvantaged mostly the struggling learners. This move was considered as a serious learning challenge by some learners.

It was further revealed that, not all G12LS's topics and other science subjects' topics can be facilitated exclusively with an IBL approach. Some topics are analytical in nature, requiring in-depth explanation or definition of theories and terminologies. The teachers often integrate minimally, the characteristics of a traditional teacher-centred approach to an IBL approach for both effectiveness and efficiency. The researcher, therefore, recommends the integration of a minimal teacher-centred approach to the IBL approach. The combination of a time-efficient approach with a time-consuming approach will enable teachers to complete the syllabus within the specified period and allow learners to gain a deeper understanding of scientific theories, terminologies, and concepts.

5.4.1.5 Reinforcing IBL with differentiated instruction and differentiated types of inquiry

Implementing an IBL approach could be very challenging in a diverse class with learners at different levels of cognitive capabilities. According to the findings, high performing learners, with high cognitive capabilities, viewed the pace as being too slow, when the teacher spent time to help weak leaners to understand scientific concepts. Under such conditions, it is very unlikely that the teacher can facilitate effectively without integrating differentiated instruction and differentiated types of inquiry.

Differentiated instruction enables teachers to create demarcations among learners according to their different cognitive capabilities and learning needs; it allows teachers to prepare or develop learning resources and contents that are relevant to all groups of learners (Layton, 2016; Guido, 2017). Differentiated types of inquiry is used as a teaching model by teachers to create demarcations amongst learners, according to their cognitive capabilities (Eltanahy & Forawi, 2019). As learners improve and develop their scientific skills and ability to handle more challenging inquiry tasks, teachers introduce a more advanced type of inquiry task to the learners.

Learners bring into the classroom their different learning needs, individual talents, different cognitive capabilities, learning difficulties and learning styles (Llewellyn, 2011). The researcher, however, recommends the integration of differentiated instruction and differentiated types of inquiry due to their all-inclusiveness to accommodate all learners. The flexibility of the IBL approach enables effective integration of these models.

These models allow the transfer of scientific knowledge to learners despite their distinctive cognitive capabilities and learning needs or difficulties (Guido, 2017). The development of more learning materials or lesson activities to accommodate all learners' needs necessitate the improvement of their pedagogical skills (Layton, 2016). The formation of demarcations allows teachers to resolve the problem of a slow or a fast pace as viewed by high performing or struggling learners respectively, ensuring that no learner will be left behind in the teaching and learning process.

5.4.1.6 Educating and involving learners on the requirements of IBL

Some learners are yet to acquaint themselves with what an IBL approach requires of them in the teaching and learning process. A few of the learners expected the teacher to give them all the information they need on each of the scientific concepts. They were not prepared to source for information independently and to develop their scientific skills. Learners should not walk into an IBL classroom with the notion that the teacher is transferring his or her responsibilities to them, when engaged with inquiry tasks.

It was found, during one of the trainings, according to one of the teacher participants, *"when we got the training, they are saying, get the learner involved, the learner should be involved in everything that we do…"* **AWQ15L07-08. Mr. Andile.** All teacher participants, at one point or the other, stressed the need to always get learners involved.

The researcher recommends that teachers should educate their learners on what the IBL approach requires of them, and the need for them to be actively involved in the teaching and learning process. They should inculcate the culture of learners inquiring and searching for relevant information and independently resolving scientific problems.

Getting learners involved in the planning will enable them to adapt and be well informed of what an IBL approach entails. They will be encouraged to conduct scientific inquiries independently, regularly conduct self-assessment of their learning progress and will take responsibility for their own learning experience. Feedback from the learners will inform the teacher on how best to structure an IBL classroom's lesson activities.

5.4.1.7 Improvising to mitigate against lack of a science laboratory

As much as the IBL approach consumes more time during the learning process, it also requires sufficient teaching and learning resources and facilities like a science laboratory for effective implementation. Insufficient resources and lack of a science laboratory are some of the factors impeding the effective implementation of the IBL approach. Learners may not completely understand some topics in Life Sciences, without the use of a science laboratory facility to conduct certain practicals or experimental investigations.

The researcher recommends that teachers should endeavour to improvise and take advantage of their local circumstances, including the availability of resources (DoBE, 2011). They should ensure that videos on practicals or experimental investigations are played for learners to view them and these should be accompanied with detailed explanations from the teachers.

The alternative use of videos for practicals or experimental investigations may not be as effective as having the learners engaged in real hands-on activities. School managements are advised not to perceive teachers' remedial actions of temporary improvising as a permanent solution to the lack of a science laboratory. The act of Improvising by the teachers cannot replace a well-equipped science laboratory that is expected to serve practicals or experimental investigations of all the science subjects including Life Sciences.

5.4.1.8 Mitigating against the factors impeding effectiveness of IBL

Most of the recommendations for all the stakeholders were part of the remedial actions to ensure effectiveness of IBL. These interventions have also helped to address the statement of the problem of the research. The findings showed that the teacher participants employed several strategies to mitigate against factors impeding effective implementation of the IBL approach to attain set objectives.

The researcher recommends that teachers having related or similar kinds of challenges should adopt these remedial or strategic actions. When spending more time supporting underperforming learners, teachers should endeavour to engage learners with high cognitive capabilities with more inquiry tasks. They should adopt the use of different informal assessment methods to get relevant feedback, which informs the teacher of the next course of action. Engaging parents and soliciting academic support for learners at home and school. The use of incentives to motivate and encourage learners' continued participation, and a classroom seating plan that encourages weak learners to get support from top achievers.

5.4.2 Recommendations for learners

5.4.2.1 Getting acquainted with the roles IBL requires from learners

Learners need to understand that IBL demand more responsibility from them, and that they have some degree of control over the teaching and learning process. The scope of responsibilities enables learners to develop a good relationship with the teacher and among themselves. It encourages them to ask and answer scientific questions, think critically, and conjure alternative ways of solving scientific problems in an IBL classroom (Crawford, 2000).

These roles were intended to make learners understand what the IBL approach requires of them in the teaching and learning process. During learner's interviews, one of the learners said *"…challenges I came across is keeping up with lessons, because sometimes Mr. Bulunga only teaches 10% so I'll have to revisit my book or textbooks…"* **AYQ04L108-109. Mr. Bulunga's learner E.** Learners who are lacking in the understanding of their roles in an IBL approach are more inclined to believe that the teacher is relinquishing his or her responsibilities to them. This is often viewed as a burden or challenge, instead of regarding it as an opportunity to learn and acquire scientific knowledge.

The researcher recommends that learners acquaint themselves with the importance of their active roles or responsibilities in an IBL classroom (Mammino, 2010; Fisher et al., 2009). The roles include:

a) Actively participating in the teaching and learning process,
b) Asking questions and expressing their own ideas or understanding,
c) Applying prior knowledge or experience of the subject matter which will allow them to construct their own knowledge and use it where applicable,
d) Accepting the ever increasing and newly-emerging responsibilities of IBL,
e) Motivating oneself to always think innovatively, preparing themselves to learn more about new concepts or ideas generated,
f) Developing alternative ways of solving scientific problems,
g) Sourcing and gathering materials and information needed and ensuring that specimens or other relevant materials used are returned appropriately after use,
h) Making use of information or following the guide provided by the teacher,
i) Being safety-conscious for oneself and others during scientific inquiring practicals or experimental investigations and teaching and learning engagements, and
j) Cooperating with team members when conducting a scientific inquiry or engaged in any group tasks.

Collaborative efforts between the teacher and the learners toward achieving the objectives or attaining the benefits of the IBL approach is an indication of clear understanding of their roles and responsibilities. These learning achievements are part of the criteria by which the assessment or evaluation of teachers and IBL effectiveness are measured (Coe et al., 2014, Crawford, 2000).

5.4.3 Recommendations for parents

5.4.3.1 Getting involved in the academic commitments of learners

As learners seek teachers' guidance and assistance, parents are expected to give academic and moral supports to learners. It will develop learners' interest for learning Life Sciences and other science subjects. Teachers often rely on vital information in the form of feedback from parents. Information is necessary to understand real challenges that are affecting learners both at home and at the school. Being aware of these challenges will enable teachers to put in place corrective measures to mitigate against such challenges that impede learning progress.

It was revealed that the lack of parental involvement negatively influence the examination success of some learners. One of the teacher participants said *"…parents that just say, okay, I pay school fees that, the community, the parents are not much involved. Parents of the learners are not much involved…"* **AWQ12L164-165. Mr. Chipo.**

The researcher recommends that parents should be more involved in their children's academic commitments at home and at school. They are also advised to regularly follow up on their children's learning progress. This will enable teachers and parents to identify aspects requiring assistance, guidance, and counselling.

5.4.3.2 Participating in the Parent Teacher Association (PTA) and the School Governing Body (SGB)

Parental involvement extends beyond paying school fees, it includes moral and financial support for creating a conducive learning environment. Parents may not fully understand the challenges confronting the school management if they do not participate in the PTA and SGB. Their participation will grant them access to information on the challenges confronting the school.

In the best interest of learners, and other stakeholders, the researcher recommends that parents should join and actively participate in the voluntary activities of the PTA and SGB. They are also advised to volunteer where applicable and to render financial support to the school management in securing a science laboratory and library for the learners. The provision of teaching and learning resources and other facilities are necessary in ensuring an improved teaching and learning environment.

5.4.4 Recommendations for School Managements

5.4.4.1 Organising training and developmental programmes for teachers

The importance of integrating periodic training and developmental programmes into the school yearly academic calendar cannot be overemphasised. There is always room for improvement in ensuring continued and effective implementation of IBL. It is necessary to attain academic excellence *"…you can never say you are up to date …remember there are dynamics within subjects …training is always necessary.* **AWQ16L11-14. Mr. Andile.** *"…training is always necessary…"* **AWQ16L155-155. Mr. Chipo.** *"I need more"* **AWQ15L76-76. Mr. Bulunga.** The three teacher participants reiterated the importance of more training.

Findings showed that the teacher participants effectively implemented the IBL approach and were able to derive several teaching and learning benefits that comes with the approach. This was possible because they had sufficient understanding and several training sessions on the IBL approach. The trainings helped them to develop PK and positive attitude towards IBL approach.

In view of these improvement and benefits of IBL for the teachers and learners, the researcher recommends that the school management support G12LSTs and other teachers by planning and organising periodic training on the use of the IBL approach. They should also integrate other developmental programmes that will help to develop teachers’ PK and improve their SCK. These planned activities should be included in the annual academic calendar.

5.4.4.2 Prioritising Life Sciences and other STEM subjects

Findings showed that the school management prioritised Life Sciences and other STEM subjects. It allowed the teachers to have more contact time to engage their learners, and they were able to complete the syllabus within a specified period. Consequently, improving the examination pass rate, retention rate and preventing dropout. More contact time came with an increased workload, and the teachers often had to sacrifice their personal responsibilities and commitments to accommodate their learners. One of the G12LSTs said *“our normal teaching time is from seven until two o'clock, from two o'clock exactly, we proceed up to five o'clock. So, Monday and Wednesday, you cancel any other live events that you have.”* **AWQ19L27-29. Mr. Andile.**

The researcher recommends that the school managements prioritise Life Sciences and other STEM subjects and include incentives to motivate the teachers. One of the teachers said *“…if you can check some of those certificates there, there are incentives from the school, they gave us some vouchers, you see those”* **AWQ12L16-17. Mr. Andile.** The teachers should be encouraged as they go the extra mile in ensuring that learners reach their full potential. The researcher also recommends that the school managements prioritised acquiring well-equipped science laboratories to improve teaching and learning of Life Sciences and other STEM subjects. One of the learner participants said, *“I would advise my school to buy us science equipment …So that we can use our science lab.”* **AYQ07L111-113. Mr. Bulunga’s learner D.**

5.4.4.3 Organising stream subjects’ combinations for learners

Learners who are desirous of enrolling in one of the science courses in the university should not spend most of their study hours on social science subjects from grades 10 to 12. During the interview, two learner participants said, *“…would you advise the school to break …to divide the Life Sciences topics …like those who want to focus on Biology …would you advise their school to like divide their Life Sciences topics...”* **AYQ08L205-**

207. Mr. Chipo's learner B. *"...she enjoys Nervous System, and I enjoy Genetics …have Genetics and the Nervous System as two different links …you gain in one information that you will be taught in university"* **AYQ08L219-222. Mr. Chipo's learner A.**

The researcher recommends that a more organised subject stream be implemented at Grade 10 for science learners in preparation for Grade 12. This will allow sufficient time to prepare them for their preferred science courses before they gain admission into university education. A learner who has identified a specific science course should be assisted and mentored toward enrolling for his or her preferred science course. They should have more study hours for the core science subjects. *"Our subjects are mixed up. We don't have like science stream, commerce stream …that is one of the problems that we have …learners that are not science-oriented, but they take the subject…"* **AWQ12L167-171. Mr. Chipo.** The above problem highlighted by one of the teacher participants should be avoided. The system adopted by one of the schools as highlighted below should be emulated, *"…the system in our school is we work with what are known as links, from Grade 10, 11 and 12 …learners with common subjects are going to be placed in one class."* **AWQ13L49-54. Mr. Andile.**

5.4.4.4 Integrating career guidance and counselling into the school curriculum

Findings have shown that most learners were motivated to participate actively in the IBL approach used by their teachers. However, a few learners were not intrinsically motivated to participate for some reasons. Teachers used learner support programmes like career guidance and counselling to assist learners who were not motivated. Sharing vital information with learners, informing them of the career opportunities available to them when they enrol in science courses can be motivating, *"…when you share such information with the learners, they become interested in taking part in the subject and also inside the subjects where you indicate the career choices…"* **AWQ11L17-19. Mr. Andile.**

For this reason, the researcher recommends that school management should integrate career guidance and counselling programmes to prevent dropout and to support learners to reach their full potential. *"…know what learners want to do …If they are career-oriented, they will stick to the subject …tell them about the opportunities in the subject, discuss with them, the targets, and share with them your previous achievements."* **AWQ14L48-51. Mr. Chipo.** Provide relevant information on career opportunities to Life Sciences and other STEM subjects' learners, to motivate and encourage them to continue their commitment to learning of science.

5.4.4.5 Organising and hosting periodic meetings for the PTA and SGB on school affairs

One of the teacher participants revealed, *"The more the school is becoming bigger …the more challenges that we are getting, and to get hold of all the parents."* **AWQ13L179-181. Mr. Chipo.** As learners' enrolment at the school increases, classes became more diverse and larger in size. The need for more teaching and learning resources and facilities became necessary. Consequently, additional Life Sciences or STEM subjects' teachers would be required. If these new requirements are not met, there will be ineffective implementation of the IBL approach to teaching and learning, and learners will be denied meaningful learning.

The researcher recommends that school management plan and organise periodic PTA and SGB meetings. This should be communicated to parents in advance as these are the only formal avenues to regularly meet with the parents to discuss matters that affect the academic growth and development of the school. The invitation is aimed to serve the interests of the learners and all other stakeholders.

5.4.5 Recommendations for the Department of Education and DoBE

5.4.5.1 Adopting an all-inclusive and IBL oriented Life Sciences curriculum

Learner with learning difficulties or needs should not be denied the opportunities of becoming a scientist. Learners who showed interest and are inclined to do science should be supported to reach their full potentials. Although, there has been curricula reform over the years to make it more practically implementable and all-inclusive to accommodate all learners irrespective of their intellectual ability (DoBE, 2011). However, teacher participants still believe that the current CAPS curriculum does not sufficiently accommodate science learners with learning difficulties.

Findings showed that the teacher participants adopted different remedial actions to support learners with learning difficulties. The science curriculum should be more learner-centred to accommodate all learners and their different learning needs to conduct hands-on activities.

Another finding revealed that the science curriculum and syllabus are time constrained, content oriented, and have limited time for practical activities. Teacher participants acknowledged that, *"…our syllabus is so broad and diverse. We don't have a demonstration kind of syllabus where we do a lot of practicals"* **AWQ02L91-92. Mr. Chipo.** *"…but there are minimum practical aspects in the syllabus that we are given currently in South Africa"* **AWQ02L111-112. Mr. Chipo.** *"But remember also, the problem that we have, is that of time, the curriculum emphasises, and doesn't engage with practicals"* **AWQ17L82-83. Mr. Chipo.**

This study also found that not all Life Sciences topics in lower grades connect perfectly with topics in Grade 12. One of the teacher participants acknowledged that, *"…the curriculum is not continuous, you find that, Life Sciences Grade 10 …is like a different subject on its own …10, 11, 12 has different topics, so the topics that we are doing in Grade 12, very few things were done in the lower grades..."* **AWQ19L128-132. Mr. Chipo.**

The researcher recommends that the DoE and DoBE take advantage of the effectiveness and benefits of the IBL approach to develop robust policies that are aimed towards reviewing the science curriculum. Addressing shortcomings in the current CAPS curriculum will enable an improved science education and develop science and technology.

The review should integrate scientific activities or tasks that will develop learners' biological skills from their foundational phase of formal education. Should mitigate against learning difficulties being experienced at FET phase. Some aspects of the content should be replaced with hands-on activities, science excursions to specialised science fields. It should include experiential learning that is expected to practically engage learners outside the classroom. The topics, content, and hands-on aspects from Grade 10 to Grade 12 should be more coherent and allow learners to refer to previously learnt scientific concepts from lower grades. A more inquiry-based and process-oriented science curriculum that is all-inclusive, more practically implementable is needed.

5.4.5.2 Provisioning to mitigate against insufficient learning resources and lack of science laboratories and libraries in under-resourced schools

A more inquiry-based and process-oriented science curriculum that is all-inclusive requires sufficient teaching and learning resources and facilities such as well-equipped science laboratories, ICT laboratories and libraries. This becomes necessary to accommodate all learners with different learning needs and learning styles. Some of the teacher and learner participants acknowledged that insufficient teaching and learning resources and lack of science laboratories impacted negatively on teaching and learning.

Findings showed that two of the three schools were struggling to provide science laboratories for the science teachers and learners. They said, *"…another difficulty is …we don't have labs …if there was a laboratory, we were going to perform a lot of practicals, of which performance level…"* **AWQ07L98-102. Mr. Bulunga.** *"…we don't have a lab, we don't have time, so what do we do? At least we have projectors…"* **AWQ20L190-191. Mr. Chipo.** *"…because I think the issue of having a science lab was suggested, but they haven't done anything yet."* **AYQ05L128-129. Mr. Chipo's learner A.** *"…we don't have a lab …not given the opportunity to go to research centres and broaden our minds, so that really is disadvantaging us as science learners."* **AYQ05L219-221. Mr. Chipo's learner G.** *"...they should improve it so that we witness experiments instead of just talking about them."* **AYQ07L137-138. Mr. Bulunga's**

learner E. The lack of a science laboratory is one of the major factors impeding effective implementation of an IBL approach. It was responsible for learners' inability to acquire certain scientific skills, leading to a poor understanding of science.

The researcher recommends that the DoE and DoBE intervene to rescue under-resourced schools that are struggling to provide adequate resources and science laboratories. This is vital to enable effective teaching and learning of Life Sciences and other STEM subjects. Prompt intervention is advised as the learners will remain disadvantaged until such provisions are made. Provisioning will grant them access to meaningful learning and the opportunity to enrol in some of the science courses in the university.

5.4.5.3 Mitigating against the shortages of qualified Life Sciences and other STEM subjects' teachers

Large class size was another major factor impeding effective implementation of an IBL approach. Findings from this study showed that teacher participants could not conduct sufficient practical activities, they resorted to adopting a teacher-centred approach and separating learners into groups due to large class size. They acknowledged that, *"…the method that works best is …practical demonstrations, but I use that minimally, like you saw in my class, it was packed, how do I do practicals? …I resolve to a lecture method."* **AWQ02L94-97. Mr. Chipo.** *"…as you have seen in the other class, I cannot group that class with that other one, these ones are very, very fast, but the other ones…"* **AWQ04L42-44. Mr. Bulunga.** *"…teacher to a classroom ratio is making teaching difficult…"* **AWQ07L29-30. Mr. Bulunga.**

The researcher recommends that the DoE and DoBE should organise short-term, medium-term, and long-term training and developmental programmes. They should include incentives to attract prospective science teachers to participate in the programmes. It is envisaged that the developmental programmes will enable increase in the number of competent and qualified science teachers. Consequently, the increase will remediate the shortage of qualified science teachers in science education. The training and developmental programmes should be continuous. The number of enrolments in teachers' science education is declining, it remains one of the major challenges that requires government intervention (Holmqvist, 2019).

The learners are the most important stakeholders in the educational sector. The recommendations for all stakeholders are geared towards achieving a set objectives. The recommendations are aimed at motivating learners to increase their interest in learning Life Sciences and other science subjects, developing learners' scientific skills, increasing retention rates both in secondary and university education, preventing dropout, improving examination pass rate, inspiring learners to enrol in some of the science courses at university, and increasing the number of employable graduates in the field of science and technology.

5.5 RECOMMENDATIONS FOR FURTHER RESEARCH

a) Similar research studies should be conducted on the effectiveness of IBL for teaching grades 10, 11 and 12. The research questions and problem statements should be addressed from the point of view of other STEM subjects. The study should extend to other provinces and the number of teacher participants increased to include teachers with sufficient and insufficient SCK and PK in both under-resourced and well-equipped secondary schools.

b) Future research studies should consider how Life Sciences and other science subjects' learners with diverse cognitive capabilities can be effectively managed while using the IBL approach. Research on how STEM subjects' teachers can effectively and efficiently integrate differentiated instruction and or differentiated types of inquiry. Accommodating learners with different learning needs, difficulties, styles, and cognitive capabilities should be considered. Preparation of lesson resources, activities and or content that are applicable and all-inclusive should be included in the research studies.

c) A comparative perspective on similar research study is recommended. It is imperative to conduct research studies on countries that are excelling in IBL approach. Investigate how they used the approach to improve STEM education from its foundational level of formal education to university educational level, and their advancement in the field of science and technology.

The above recommendations for further research are envisaged to partly address some aspects of the limitations of the research study. It also aimed to improve science education and to develop science and technology by researching other countries' achievements of IBL implementation on STEM subjects.

5.6 LIMITATIONS OF THE STUDY

- The findings of the research study arose from data collected from three different schools in Bojanala district of the North-West province of South Africa. Twenty-two interview participants, classroom lesson observations and document reviews from the three schools represented a very small sample size of the entire population. However, all participants and other data collection instruments employed, satisfied the requirements described in the research design and approach in Chapter Three of this study.
- The teacher participants' SCK and PK, years of teaching experience and adequate understanding of the IBL approach are some of the integral aspects responsible for the credibility of the research findings. These qualities cannot be the exact replica in all G12LSTs of all schools in Bojanala district of North-West province of South Africa.
- The distribution of learners' cognitive capabilities, inclination to Life Sciences and other science subjects, and career aspirations in the field of science, played an important role in the findings of this research study. The distribution of these values and samples cannot be said to be the same with all G12LSLs of all schools in Bojanala district of North-West province of South Africa.
- G12LS is not the only subject requirement that G12LSLs need to pass to enrol in one of the science courses at university. Among other subject requirements are grade 12 Mathematics, Physical Sciences, Agricultural Sciences. However, the researcher focused mainly on G12LS to derive the findings of the research study without including other grade 12 science subjects. Life Sciences is not only

taught at Grade 12, but also in grades 10 and 11 where learners are expected to consolidate their scientific skills before they reached Grade 12.

5.7 CONCLUDING REMARKS

Writing this dissertation was so demanding and rewarding for me, it kept me awake most nights, and it could be very frustrating sometimes to realise that I have spent hours working without making any meaningful progress. It taught me how to focus on one aspect of the study at a time. The motivation and academic guidance from my supervisor encouraged me to develop my researching skills, I am more skilful and knowledgeable than I was before the commencement of this study.

The advent of the Covid-19 pandemic and multiple adjustments to the school calendar made it difficult to conduct interviews for a long period of time. It was really challenging for me, as the interview scheduled dates were postponed several times. However, the long break gave me the opportunity to interact more with my supervisor, this interaction resulted in improving my work while waiting frustratingly for the pandemic to subside and the resumption of school academic activities to be announced by the government.

As the lockdown introduced intensive online teaching and learning activities, the need to align with modern technology compatible with the IBL approach became inevitable. STEM education is developing faster around the world, learners showing an interest in STEM education should not be denied the opportunity to be self-actualised. Holding on to the primitive ways of transferring scientific knowledge will limit development in the field of science and technology. If learners with diverse learning needs must reach their full potential and become invaluable assets to themselves and the entire community, improving IBL and STEM education should be a priority for government.

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7.0 APPENDICES

Appendices in order of appearance:

Appendix A: Proof of Registration

1523 M1RST

NAIYE O D MR
228, PRETORIUS STREET, PRETO
METROPOLITAN BUILDING, CNR
PRETORIA
0002

STUDENT NUMBER : 5396-462-4

ENQUIRIES NAME : MOYO J T
ENQUIRIES TEL : (012) 441 5702

DATE : 2023-05-15

Dear Student

I wish to inform you that your registration has been accepted for the academic year indicated below. Kindly activate your Unisa mylife (https://myunisa.ac.za/portal) account for future communication purposes and access to research resources.

DEGREE :	MED NATURAL SC EDU (90063)
TITLE :	Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study
SUPERVISOR :	Prof HO MOKIWA (Mokiwho@unisa.ac.za)
ACADEMIC YEAR :	2023
TYPE:	DISSERTATION
SUBJECTS REGISTERED:	DFNSE96 MEd - Natural Science Education (Dissertation)

A statement of account will be sent to you shortly.

You must re-register online and pay every academic year until such time that you can submit your dissertation/thesis for examination.

Students registering for the first time for a dissertation or thesis must complete a research proposal in their first year of study. Guidelines will be provided by your supervisor/contact person.

If you intend submitting your dissertation/thesis for examination you have to submit an Intention to submit form (available on the website www.unisa.ac.za) at least two months before the date of submission. If submission takes place after 15 November, but before the end of January of the following year, you do need not to re-register and pay registration fees for the next academic year. Should you submit after the end of January, you must formally reregister online and pay the full fees.

Please access the information with regard to your personal librarian on the following link: https://bit.ly/3hxNqVr

Yours faithfully,

Prof M S Mothata
Registrar

UNIVERSITEIT VAN SUID-AFRIKA
PRETORIA
UNIVERSITY OF SOUTH AFRICA

University of South Africa
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PO Box 392 UNISA 0003 South Africa
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Appendix B: Request Letter to Department of Education North-West Province

UNISA | college of education

6th April 2021

The Head of Department
Department of Education
2nd Floor, Garona Building
Mmabatho (North-West Province)

Dear Ms. SM Semaswe,

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I, Naiye Olufemi David, I am currently conducting a research study titled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study" under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We humbly wish to request your permission to conduct the research study in some selected secondary schools in Bojanala District with the aims of determining Grade 12 Life Sciences' teachers' understanding of Inquiry Based Learning approach to teaching, and its effectiveness on their learners' motivation, retention and understanding of Life Sciences.

The province, district and as well as the selected schools for data collection will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both secondary and university education and increase in the number of competent and employable graduates or scientists. The final research work will be made available to the province, district and selected schools at request.

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research study. Confidentiality and anonymity will be guaranteed in ensuring that names and identity of all participants at the selected schools are not disclosed in reporting of data or in the final draft of the dissertation.

Data collection will only commence after your approval and the approval by the College of Education's Research Ethics Review Committee of University of South Africa.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Yours sincerely,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix C: Permission Letter from Department of Education North-West Province

education
Lefapha la Thuto la Bokone Bophirima
Noordwes Departement van Onderwys
North West Department of Education
NORTH WEST PROVINCE

Garona Building, Mmabatho
1st Floor, East Wing,
Private Bag X2044,
Mmabatho 2735
Tel.: (018) 388-3433
Fax.: 086-514-0126
e-mail: sgedu@nwpg.gov.za

OFFICE OF THE SUPERINTENDENT-GENERAL

Enq. : Dr T Phorabatho
Tel. : 018 388 3071/3433

To: Dr MM Chakane
University of South Africa
Faculty of Education

From: Mrs S M Semaswe
Superintendent-General

Date : 21 April 2021

PERMISSION TO CONDUCT RESEARCH: MR NAIYE O DAVID

Your letter received on the 21st of April 2021 bears reference.

Permission is hereby granted to you to conduct research in the department as requested, subject to the following conditions:

- You contact the relevant School Principals for your target schools about your request with this letter of permission;
- Considering that your research will involve both Educators and Learners, the general functionality of the school should not be compromised by the research process.
- The participation in your project will be voluntary.
- The principles of informed consent and confidentiality will be observed in strictest terms, and;
- The findings of your research should be made available to the North West Department of Education upon request.

Best wishes

Mrs S M Semaswe
Superintendent-General

21 | 04 | 2021
Date

COVID-19 (NOVEL CORONAVIRUS) | BE SAFE ACT RESPONSIBLY | WASH YOUR HANDS OFTEN | WEAR A MASK WHEN GOING OUTSIDE | MAINTAIN SOCIAL DISTANCING | 2030 NDP

Appendix D: Clearance Certificate from Unisa College of Education Ethics Review Committee

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2021/07/07

Dear Mr OD Naiye

Decision: Ethics Approval from 2021/07/07 to 2024/07/07

Ref: **2021/07/07/53964624/03/AM**
Name: Mr OD Naiye
Student No.:53964624

Researcher(s): Name: Mr OD Naiye
E-mail address: 53964624@mylife.ac.za
Telephone: 081 263 1881

Supervisor(s): Name: Dr MM Chakane
E-mail address: morechakane@yahoo.com
Telephone:083 925 5000

Title of research:

Effectiveness of inquiry-based learning in teaching grade 12 life sciences: A case of selected schools in Bojanala district

Qualification: MEd Natural Science Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2021/07/07 to 2024/07/07.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2021/07/07 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached.
2. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
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3. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
4. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
5. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
6. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
7. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
8. No field work activities may continue after the expiry date **2024/07/07.** Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2021/07/07/53964624/03/AM** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
motlhat@unisa.ac.za

Prof PM Sebate
EXECUTIVE DEAN
Sebatpm@unisa.ac.za

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

Appendix E: Request Letter to Principal of the First School

22nd July 2021

[redacted]

Dear [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH [redacted]

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

Your school is invited to participate in a study entitled “Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study”.

We humbly request your permission to conduct the research study with the aims of determining Grade 12 Life sciences' teachers' understanding of Inquiry Based Learning approach to teaching, and its effectiveness on their learners' motivation, retention and understanding of Life Sciences. Attached herewith is the letter of permission from the North West Department of Education and Research Ethics Clearance from Unisa College of Education Ethics Review Committee.

Your school and teachers will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

Feedback pertaining to the findings will be given to your school, the participants and the North West Department of Education upon request, and the dissertation will be made available at the University of South Africa library.

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research study. No reimbursement or any incentives for participation, although light refreshment will be provided

during the interview or data collection process which will last for approximately one hour session with the teacher and one hour session with a group of six learners. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

____

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix F: Request Letter to Life Sciences Teacher of the First School

22nd July 2021

[redacted]

Dear [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH [redacted]

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

You are invited to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study". Your permission will enable the collection of relevant information from you as the Grade 12 Life Sciences teacher, with the aims of determining your perceptions of Inquiry Based Learning approach to teaching Grade 12 Life Sciences, its effectiveness and contribution on your learners' motivation, retention and their understanding of Life Sciences. Attached herewith is the letter of permission from the North West Department of Education and Research Ethics Clearance from Unisa College of Education Ethics Review Committee.

You and your colleagues will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

Feedback pertaining to the findings will be given to your school, the participants and the North West Department of Education upon request, and the dissertation will be made available at the University of South Africa library.

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research study. No reimbursement or any incentives for participation, although light refreshment will be provided during the interview or data collection process which will last for approximately one hour session with

Reference No.: 2021/07/07/53964624/03/AM **1of1**

the teacher and one hour session with a group of six learners. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Reference No.: 2021/07/07/53964624/03/AM 1of2

Appendix G: Approval Letter from the First School

[redacted]

Date: 11 August 2021

To whom it may concern,

This letter provides permission for Naiye Olufemi David to conduct research at [redacted]

[redacted] will be in a supervisory position while this research is being conducted.

Permission has been received from the NW Department of Education and has been noted.

Yours in education,

[redacted]

PRINCIPAL

[redacted]

Appendix H: Letter of Request for Parent's Consent in the First School

UNISA college of education

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

[redacted]

Dear Parent,

LETTER OF CONSENT

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting your child to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that could help in determining the teachers' perceptions of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

Your child is invited because he/she is a Grade 12 Life Sciences learner, his/her participation will provide the research study with authentic required information to achieve optimal results in the final dissertation. The study requires a Life Sciences' teacher and six Grade 12 Life Sciences' learners in your child's school, your approval will make your child one of the six participating learners.

The study involves classroom lesson observations, note-taking and audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following questions will be asked, which is expected to last for approximately one hour session with a group of six learners within the school premises:

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.
3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?

Reference No.: 2021/07/07/53964624/03/AM **1of1**

4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?
8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and your child is under no obligation to assent to participation. If you approve of this request, you will be given this information sheet to keep and be asked to sign a written consent form. Your child is free to withdraw at any time and without giving a reason.

The school, teachers, and learners will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of your child's busy schedule for the interview period that will take place in the school premises.

Your child has the right to insist that his/her name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about his/her participation in this research and his/her name will not be recorded anywhere and no one will be able to connect him/her to the answers given by him/her. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

Hard copies of answers collected will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period

to prevent interruptions that could arise from boredom of having to sit for approximately one hour session with a group of six learners.

Data collection process will only commence after your consent, child's assent and approval by the school.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524, or email Mokiwho@unisa.ac.za.

Thank you for taking time to read this information.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix I: Letter of Request for Learner's Assent in the First School

UNISA college of education

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

Dear Learner,

LETTER OF ASSENT

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting you to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that will help in determining your teacher's perception of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

You are invited because you are a Grade 12 Life Sciences learner, your participation will provide the research study with authentic required information to achieve optimal results in the final dissertation. The study requires a Life Sciences' teachers and six Grade 12 Life Sciences learners in your school, your approval will make you one of the six participating learners.

The study involves classroom observations, audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following questions will be asked, the interview session is expected to last for approximately one hour with a group of six learners:

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.
3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?

Reference No.: 2021/07/07/53964624/03/AM **1of1**

4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?
8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and you are under no obligation to assent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written assent form. You are free to withdraw at any time and without giving a reason.

You and others will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of your busy schedule for the interview period that will take place in the school premises.

You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your participation in this research and your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation. I shall however, encourage you not to disclose personal and sensitive information of any participant to anyone.

Hard copies of your answers will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period to prevent interruptions that could arise from boredom of having to sit for approximately one hour session with a group of six learners.

Data collection process will only commence after your assent, the approval by your parents and the school management.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524 or email Mokiwho@unisa.ac.za

Thank you for taking time to read this information sheet and for participating in this study.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

____

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Reference No.: 2021/07/07/53964624/03/AM **1of3**

Appendix J: Request Letter to Principal of the Second School

UNISA college of education

22nd July 2021

[redacted]

Dear [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH [redacted] SCHOOL

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

Your school is invited to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

We humbly request your permission to conduct the research study with the aims of determining Grade 12 Life sciences' teachers' understanding of Inquiry Based Learning approach to teaching, and its effectiveness on their learners' motivation, retention and understanding of Life Sciences. Attached herewith is the letter of permission from the North West Department of Education and Research Ethics Clearance from Unisa College of Education Ethics Review Committee.

Your school and teachers will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

Feedback pertaining to the findings will be given to your school, the participants and the North West Department of Education upon request, and the dissertation will be made available at the University of South Africa library.

Reference No.: 2021/07/07/53964624/03/AM **1of1**

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research study. No reimbursement or any incentives for participation, although light refreshment will be provided during the interview or data collection process which will last for approximately one hour session with the teacher and one hour session with a group of six learners. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Reference No.: 2021/07/07/53964624/03/AM **1of2**

Appendix K: Request Letter to Life Sciences Teacher of the Second School

UNISA | college of education

22nd July 2021

[redacted]

Dear [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH [redacted] SCHOOL

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

You are invited to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study". Your permission will enable the collection of relevant information from you as the Grade 12 Life Sciences teacher, with the aims of determining your perceptions of Inquiry Based Learning approach to teaching Grade 12 Life Sciences, its effectiveness and contribution on your learners' motivation, retention and their understanding of Life Sciences. Attached herewith is the letter of permission from the North West Department of Education and Research Ethics Clearance from Unisa College of Education Ethics Review Committee.

You and your colleagues will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

Feedback pertaining to the findings will be given to your school, the participants and the North West Department of Education upon request, and the dissertation will be made available at the University of South Africa library.

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research

Reference No.: 2021/07/07/53964624/03/AM **1of1**

study. No reimbursement or any incentives for participation, although light refreshment will be provided during the interview or data collection process which will last for approximately one hour session with the teacher and one hour session with a group of six learners. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix L: Approval Letter from the Second School

[redacted]

13th October 2021.

Researcher: Mr. OD Naiye
[redacted]

The Principal,
[redacted]

RE: PERMISSION TO CONDUCT RESEARCH

We acknowledge receipt of your letter of request to conduct a research study in our school and the attached approval letters from the North-West Provincial Department of Education and Unisa Ethics Review Committee.

This letter therefore serves to confirm that permission has been granted to conduct your research study within the conditions set out in the attached approval letters.

The educator [redacted] has been assigned to coordinate the data collection process in the school premises.

We wish you well in your research.

Yours faithfully,

[redacted]
Principal.

Appendix M: Letter of Request for Parent's Consent in the Second School

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

[redacted]

Dear Parent,

LETTER OF CONSENT

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting your child to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that could help in determining the teachers' perceptions of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

Your child is invited because he/she is a Grade 12 Life Sciences learner, his/her participation will provide the research study with authentic required information to achieve optimal results in the final dissertation. The study requires a Life Sciences' teacher and six Grade 12 Life Sciences' learners in your child's school, your approval will make your child one of the six participating learners.

The study involves classroom lesson observations, note-taking and audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following questions will be asked, which is expected to last for approximately one hour session with a group of six learners within the school premises:

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.

Reference No.: 2021/07/07/53964624/03/AM **1of1**

3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?
4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?
8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and your child is under no obligation to assent to participation. If you approve of this request, you will be given this information sheet to keep and be asked to sign a written consent form. Your child is free to withdraw at any time and without giving a reason.

The school, teachers, and learners will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of your child's busy schedule for the interview period that will take place in the school premises.

Your child has the right to insist that his/her name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about his/her participation in this research and his/her name will not be recorded anywhere and no one will be able to connect him/her to the answers given by him/her. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

Hard copies of answers collected will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period

to prevent interruptions that could arise from boredom of having to sit for approximately one hour session with a group of six learners.

Data collection process will only commence after your consent, child's assent and approval by the school.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524, or email Mokiwho@unisa.ac.za.

Thank you for taking time to read this information.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix N: Letter of Request for Learner's Assent in the Second School

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

[redacted]

Dear Learner,

LETTER OF ASSENT

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting you to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that will help in determining your teacher's perception of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

You are invited because you are a Grade 12 Life Sciences learner, your participation will provide the research study with authentic required information to achieve optimal results in the final dissertation. The study requires a Life Sciences' teachers and six Grade 12 Life Sciences learners in your school, your approval will make you one of the six participating learners.

The study involves classroom observations, audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following questions will be asked, the interview session is expected to last for approximately one hour with a group of six learners:

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.

Reference No.: 2021/07/07/53964624/03/AM **1of1**

3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?
4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?
8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and you are under no obligation to assent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written assent form. You are free to withdraw at any time and without giving a reason.

You and others will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of your busy schedule for the interview period that will take place in the school premises.

You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your participation in this research and your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation. I shall however, encourage you not to disclose personal and sensitive information of any participant to anyone.

Hard copies of your answers will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period

to prevent interruptions that could arise from boredom of having to sit for approximately one hour session with a group of six learners.

Data collection process will only commence after your assent, the approval by your parents and the school management.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524 or email Mokiwho@unisa.ac.za

Thank you for taking time to read this information sheet and for participating in this study.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

____

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix O: Request Letter to Principal of the Third School

UNISA college of education

22nd July 2021

[redacted]

Dear [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH [redacted]

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

Your school is invited to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

We humbly request your permission to conduct the research study with the aims of determining Grade 12 Life sciences' teachers' understanding of Inquiry Based Learning approach to teaching, and its effectiveness on their learners' motivation, retention and understanding of Life Sciences. Attached herewith is the letter of permission from the North West Department of Education and Research Ethics Clearance from Unisa College of Education Ethics Review Committee.

Your school and teachers will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

Feedback pertaining to the findings will be given to your school, the participants and the North West Department of Education upon request, and the dissertation will be made available at the University of South Africa library.

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research study. No reimbursement or any incentives for participation, although light refreshment will be provided

Reference No.: 2021/07/07/53964624/03/AM **1of1**

during the interview or data collection process which will last for approximately one hour session with the teacher and one hour session with a group of six learners. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix P: Request Letter to Life Sciences Teacher of the Third School

22nd July 2021

[redacted]

Dear [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH [redacted]

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

You are invited to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study". Your permission will enable the collection of relevant information from you as the Grade 12 Life Sciences teacher, with the aims of determining your perceptions of Inquiry Based Learning approach to teaching Grade 12 Life Sciences, its effectiveness and contribution on your learners' motivation, retention and their understanding of Life Sciences. Attached herewith is the letter of permission from the North West Department of Education and Research Ethics Clearance from Unisa College of Education Ethics Review Committee.

You and your colleagues will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

Feedback pertaining to the findings will be given to your school, the participants and the North West Department of Education upon request, and the dissertation will be made available at the University of South Africa library.

The research study is devoid of any foreseeable risks, participation is voluntary and participants can withdraw their participation at any stage of the data collection and prior to the conclusion of the research study. No reimbursement or any incentives for participation, although light refreshment will be provided

Reference No.: 2021/07/07/53964624/03/AM **1of1**

during the interview or data collection process which will last for approximately one hour session with the teacher and one hour session with a group of six learners. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

Regarding further information or query about the research study, kindly contact me or my supervisor through the contact details below:

1. Mr. Naiye O. David (081 263 1881) 53964624@mylife.unisa.ac.za, dnaiye@gmail.com or
2. Prof. HO Mokiwa (066 082 1524) Mokiwho@unisa.ac.za

Thanking you in advance for your kind consideration and approval.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix Q: Approval Letter from the Third School

[redacted]

11 April 2022

To:
Researcher: Name: Mr. OD Naiye
E-mail address: 53964624@mylife.unisa.ac.za
Telephone: 081 263 1881

[redacted]

From:
The Principal,
[redacted]

RE: PERMISSION TO CONDUCT RESEARCH

This letter serves to confirm that permission has been granted as per your request to conduct research study at our school.

You are required to fully comply with the conditions as contained in the Ethics Review Committee approval letter with reference 2021/07/07/53964624/03/AM.

According to your request, [redacted] shall assist with the coordination during the period of your research study.

We wish you success in your study.

Yours in Education,

[redacted]

PRINCIPAL

[redacted]

[redacted]

[redacted]

Appendix R: Letter of Request for Parent's Consent in the Third School

UNISA college of education

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

[redacted]

Dear Parent,

LETTER OF CONSENT

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting your child to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that could help in determining the teachers' perceptions of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

Your child is invited because he/she is a Grade 12 Life Sciences learner, his/her participation will provide the research study with authentic required information to achieve optimal results in the final dissertation. The study requires a Life Sciences' teacher and six Grade 12 Life Sciences' learners in your child's school, your approval will make your child one of the six participating learners.

The study involves classroom lesson observations, note-taking and audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following questions will be asked, which is expected to last for approximately one hour session with a group of six learners within the school premises:

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.

Reference No.: 2021/07/07/53964624/03/AM **1of1**

3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?
4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?
8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and your child is under no obligation to assent to participation. If you approve of this request, you will be given this information sheet to keep and be asked to sign a written consent form. Your child is free to withdraw at any time and without giving a reason.

The school, teachers, and learners will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of your child's busy schedule for the interview period that will take place in the school premises.

Your child has the right to insist that his/her name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about his/her participation in this research and his/her name will not be recorded anywhere and no one will be able to connect him/her to the answers given by him/her. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation.

Hard copies of answers collected will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period

to prevent interruptions that could arise from boredom of having to sit for approximately one hour session with a group of six learners.

Data collection process will only commence after your consent, child's assent and approval by the school.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524, or email Mokiwho@unisa.ac.za.

Thank you for taking time to read this information.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

____

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix S: Letter of Request for Learner's Assent in the Third School

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

[redacted]

Dear Learner,

LETTER OF ASSENT

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting you to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that will help in determining your teacher's perception of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

You are invited because you are a Grade 12 Life Sciences learner, your participation will provide the research study with authentic required information to achieve optimal results in the final dissertation. The study requires a Life Sciences' teachers and six Grade 12 Life Sciences learners in your school, your approval will make you one of the six participating learners.

The study involves classroom observations, audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following questions will be asked, the interview session is expected to last for approximately one hour with a group of six learners:

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.

Reference No.: 2021/07/07/53964624/03/AM **1of1**

3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?
4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?
8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and you are under no obligation to assent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written assent form. You are free to withdraw at any time and without giving a reason.

You and others will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of your busy schedule for the interview period that will take place in the school premises.

You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your participation in this research and your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation. I shall however, encourage you not to disclose personal and sensitive information of any participant to anyone.

Hard copies of your answers will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period

to prevent interruptions that could arise from boredom of having to sit for approximately one hour session with a group of six learners.

Data collection process will only commence after your assent, the approval by your parents and the school management.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524 or email Mokiwho@unisa.ac.za

Thank you for taking time to read this information sheet and for participating in this study.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix T: Participant Information Sheet

22nd July 2021

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study.

Dear Prospective Participant,

Participant Information Sheet

I am Naiye Olufemi David, currently conducting a research study under the supervision of Prof. HO Mokiwa, a supervisor in the Department of Science and Technology Education towards a M. Ed in Natural Science Education at the University of South Africa.

We are inviting you to participate in a study entitled "Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study".

The study is expected to collect research data for information that will help in determining the teacher's perception of Inquiry Based Learning approach to teaching Grade 12 Life sciences and its effectiveness and contribution on learners' motivation, retention and their understanding of Life Sciences and other science subjects.

Your school is invited because it has Grade 12 Life Sciences teacher and learners and your approval will allow the participants to provide the research study with authentic required information to achieve optimal results in the final dissertation. I obtained your school contact details from the website which confirms that your school is highly reputable and well suited for the research study.

The study involves classroom lesson observations, audio-recording of a semi-structured interviews and exploring learning resources or facilities to ascertain the extent to which they apply to Inquiry Based Learning approach. The following interview questions will be asked, which is expected to last for approximately one hour session with the teacher and one hour session with a group of six learners:

Interview Questions for Teachers

1. What does the term *Inquiry-Based Learning (IBL) approach* mean to you?
2. What teaching and learning approach do you frequently use and why do you prefer the approach to others?
3. May you describe other approaches besides your preferred approach you believe can be equally effective
4. In your opinion, do you think IBL approach can be effective in facilitating all Life Sciences topics and other science subjects?
5. How would you describe the level of your learners' participation, motivation, and performance when using IBL approach or your preferred approach to teaching Life Sciences?

Reference No.: 2021/07/07/53964624/03/AM **1of1**

6. How does IBL approach or your preferred approach allow your learners to construct new scientific knowledge from their prior scientific knowledge?
7. How would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any?
8. How have you been able to manage or overcome the challenges mentioned in question 7 above?
9. What learning opportunities or benefits does IBL or your preferred approach provides for you and your learners from your own assessment of their learning progress?
10. Do you think that one or more of the learning opportunities listed in question 9 above will help to retain learners and minimise dropout among Life Sciences learners?
11. How have you been able to prevent learners' dropout and improve on their attendance and retention rate?
12. How would you describe your learners' examination success or pass rates in the past three years?
13. Has there been an increase in the number of learners enrolling in Life Sciences and other science subject in the past three years?
14. What strategy or strategies have you put in place to avoid decrease in the number of learners enrolling in Life Sciences and other science subjects?
15. Have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it?
16. Do you think you need more training on IBL or your preferred approach to improve classroom management?
17. In which areas do you need more training and why?
18. How would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class?
19. How applicable is IBL approach or your preferred approach in completing the Life Sciences syllabus within the specified time-frame?
20. What would you recommend to improve teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education?
21. Do you have any suggestion or questions on the interview or the research topic?

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?
2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.
3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?
4. What are the challenges you are experiencing with the teaching approach used by your teacher?
5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?
6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?
7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?

Reference No.: 2021/07/07/53964624/03/AM 1of2

8. Any suggestion or questions on the interview or the research topic?

Participating in this study is voluntary and participants are under no obligation to consent to participation. If participants decide to take part, they will be given this information sheet to keep and be asked to sign a written consent/assent form. They are free to withdraw at any time and without giving a reason.

The school, teachers and learners will benefit from this study as the research findings and recommendations are intended to provide support for Life Sciences teachers to become effective facilitators rather than instructors, improve the teaching and learning of Life Sciences and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into both the secondary and university education and increase in the number of competent and employable graduates or scientists.

The research study is devoid of any foreseeable risks, although it will require approximately one hour out of participants' busy schedule for the interview period that will take place in the school premises.

Participants have the right to insist that their names will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about their participation in this research and their names will not be recorded anywhere and no one will be able to connect them to the answers they will provide. Confidentiality and anonymity will be guaranteed in ensuring that names or identity of all participants are not disclosed in reporting of data or in the final draft of the dissertation. I shall however, encourage participants not to disclose personal and sensitive information to anyone.

Hard copies of their answers or response will be stored by the researcher for a period of five years in a locked filing cabinet for future research or academic purposes; electronic information will be stored on a password protected computer and external storage drive. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

No payments will be made for participation, except costs incurred by participants as a result of participation in the data collection process. Light refreshment will be provided during the interview period to prevent interruptions that could arise from boredom of having to sit for approximately one hour.

The research project shall adhere to the COVID-19 precautionary measures and other regulations put in place by your school and the guidelines set out in the Unisa Covid-19 policy statement on research ethics.

Data collection process will only commence after your approval.

If you would like to be informed of the final research findings, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com . The findings are accessible for a period of five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Naiye Olufemi David on 081 263 1881 or email 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. HO Mokiwa on 066 082 1524 or email Mokiwho@unisa.ac.za

Thank you for taking time to read this information sheet and for participating in this study.

Kind regards,

Naiye O. David,
Researcher (081 263 1881).

Prof. HO Mokiwa,
Supervisor (066 082 1524).

Appendix U: Consent and Assent Form

UNISA | college of education

CONSENT/ASSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I, ________________________________ (participant name), confirm that the person asking my consent/assent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and I am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agreed to the recording of the semi-structured interview during the research data collection process.

I have received a signed copy of the informed consent/assent agreement.

Participant Name & Surname (please print) ________________________________

________________________ ________________________

Participant Signature Date

Researcher's Name & Surname (please print) Mr. Olufemi David Naiye

________________________ 22nd July 2021

Researcher's signature Date

Reference No.: 2021/07/07/53964624/03/AM **1of1**

Appendix V: Teacher's Interview Guide

UNISA college of education

The Interview Guide (Teacher)

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

The Research Interview Guide

Presented to Unisa College of Education

Ethics Review Committee

for the Degree of

Master of Education

By

Olufemi David Naiye

Under the Supervision of

Prof. H. O. Mokiwa

November 2021

Reference No.: 2021/07/07/53964624/03/AM 1of1

Introduction

1. **Introducing myself**

I am Naiye Olufemi David, a Master of Education student in the Department of Science and Technology Education, from the University of South Africa, and doing research towards a M. Ed in Natural Science Education.

2. **Restating Purpose, Context, and Intended Use of the Interview**

The purpose of this interview is to find out your perception of Inquiry Based Learning approach in teaching Grade 12 Life Sciences, its effectiveness and the challenges encountered in using the approach. In addition, its contribution on your learners' motivation, retention and understanding of Life Sciences and other science subjects. I intend to use the information you provide me to validate data from literature review, lesson observation, document review and your learners' interview data. It is envisaged that the research findings will provide support for Life Sciences teachers to become effective facilitators, improve teaching and learning and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into university education and the number of competent and employable graduates and or scientists.

3. **Assuring Confidentiality**

I assure you of complete confidentiality of any information you share with me, and the use of pseudonyms instead of actual names in the transcript and the report

4. **Permission to Tape**

I would like to tape the conversion for recollection of our discussion. Can you give me the permission, if you agree, to tape this conversation, if the answer is yes, I set the tape on; if the answer is no, I take notes during the interview in the spaces I have left between the questions in this guide.

5. **Any Questions**

Before we start, first, do you have any questions about the purpose of the interview, confidentiality, tape recording, or any other thing you would like to ask me? Do you understand all the questions in the interview guide when you read them at home?

Interview Questions for Teachers

1. What does the term *Inquiry-Based Learning (IBL) approach* mean to you?

2. What teaching and learning approach do you frequently use and why do you prefer the approach to others?

3. May you describe other approaches besides your preferred approach you believe can be equally effective

4. In your opinion, do you think IBL approach can be effective in facilitating all Life Sciences topics and other science subjects?

5. How would you describe the level of your learners' participation, motivation, and performance when using IBL approach or your preferred approach to teaching Life Sciences?

6. How does IBL approach or your preferred approach allow your learners to construct new scientific knowledge from their prior scientific knowledge?

7. How would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any?

8. How have you been able to manage or overcome the challenges mentioned in question 7 above?

9. What learning opportunities or benefits does IBL or your preferred approach provides for you and your learners from your own assessment of their learning progress?

10. Do you think that one or more of the learning opportunities listed in question 9 above will help to retain learners and minimise dropout among Life Sciences learners?

11. How have you been able to prevent learners' dropout and improve on their attendance and retention rate?

12. How would you describe your learners' examination success or pass rates in the past three years?

13. Has there been an increase in the number of learners enrolling in Life Sciences and other science subject in the past three years?

14. What strategy or strategies have you put in place to avoid decrease in the number of learners enrolling in Life Sciences and other science subjects?

15. Have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it?

16. Do you think you need more training on IBL or your preferred approach to improve classroom management?

17. In which areas do you need more training and why?

18. How would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class?

19. How applicable is IBL approach or your preferred approach in completing the Life Sciences syllabus within the specified time-frame?

20. What would you recommend to improve teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education?

21. Do you have any suggestion or questions on the interview or the research topic

Conclusion

1. **Summary check**

Before we conclude, let me go through what you have shared with me:

1.1 Your understanding of the statement ______________________________ and position ______________________________ in question number ______________ is ____. Did I understand you correctly?

1.2 You believe that ______________________________ (one of the statements in the interview questions) because ______________________________ (reason for the statement in the interview question). Did I understand you correctly?

1.3 Have I left out something you feel is important in this discussion or I have misunderstood you? Please feel free to make corrections, delete statements or add anything.

2. **Closure**

Thank you very much for sharing with me, your perception of IBL approach to teaching and learning of Grade 12 Life Sciences, and its effectiveness and the challenges encountered in using the approach. In case you feel you still want to talk to me about anything you might think about after this discussion, kindly contact me through the details below:

081 263 1881, 53964624@mylife.unisa.ac.za, dnaiye@gmail.com

Appendix W: Teacher's Interview Transcripts

QN	Line	Mr. Andile, Mr. Chipo and Mr. Bulunga (Teacher's Interview Transcripts)
1.		**Researcher:** Good morning Mr. Andile, I hope you understand that for the purpose of this interview, you will be Mr. Andile. The purpose is to make sure that every participant is protected, it is not ethical for us to use your real name. So, I will take the first question of the interview, I believe that you have gone through the guide and that is why you gave me an approval to record this. I will take Question one, you will respond, then it will be recorded anyway. And at the same time, I may want to jot down some vital information from the interview. Okay. First question is, ***what does the term inquiry-based learning approach mean to you?*** **Mr. Andile:** Okay. Good morning, sir, **Researcher:** Good morning, **Mr. Andile:** The rules are understandable. Thank you so much for the opportunity. **Researcher:** you are welcome, sir. **Mr. Andile:** In terms of inquiry-based learning, basically, I believe, it is that kind of learning that involves a learner in the learning process. It is done by checking the background information from the learners, and then that concerns a particular topic before you proceed to deliver the information that they need. But background information is relevant, where you check what learners know first before you give them what you have. **Researcher:** Thank you very much, sir, I love the answer you gave in your response to that. And because I also have the perception that before a learner move, you will start a class, you will need to know what the learner lot understand about the scientific concept that you want them to achieve in that lesson. Because there are certain things that if the learner doesn't have them, when you give them, they tend to want to struggle. Yeah, so thanks. And I got exactly what I wanted from that response. Now, let me move to the next question. **(IBL simply means the teacher/educator constantly involves the learners in the learning process. This is done by checking the background information that the learners have concerning a particular concept before it's explained).** **Researcher:** Thank you for the permission to have this interview and to be able to audio record this interview, please sir, um, we, because of our time, like I've explained earlier, we are not allowed to use names, real names of our participants. So that is why we are using pseudonyms instead of their real names. So, the first, we'll pick the question first, then we'll move in that manner until we are done. You have your paper. **Mr. Bulunga:** I think I left it here. I left it in the car. **Researcher:** I saw some, a paper there written **Mr. Bulunga:** No, it's here. **Researcher:** Okay, you've seen it **Mr. Bulunga:** Yes **Researcher:** Okay sir, can we go ahead sir? Okay, the first question is, ***what does the term inquiry-based learning approach mean to you?*** **Mr. Bulunga:** I was thinking maybe it's talk about cooperative learning, while the learners learn in group, they assist each other, you know, when you teach, when you teach them, they also have that chance to assist each other, like you give them activity, and they discuss it together as a group, which means, that the learners will be able to, even if they didn't hear you, both of them, they can be able to assist each other. **Researcher:** Okay, collaborative? **Mr. Bulunga:** Um **Researcher:** Collaboratively? **Mr. Bulunga:** Um **Researcher:** Thank you, sir. Alright, then let's move to the second question.

Mr. Chipo: You were recording also?

Researcher: Yeah, I took their permission too, I told them the same thing you know, you have to get permission before you. If they say no, I don't want, then, you don't have to. But if the learner, because it is not ethical for you to do it without them knowing that this is what you are doing.

Mr. Chipo: Yeah, No I actually, I prepared the letter, but we didn't get electricity yesterday. y is that is okay.

Researcher: Oh, okay, it's not a problem that we can always do that later.

Researcher: Okay, thank you, sir. Then, thank you for giving me your time, sir. And before we start, I just want to highlight a few things that I have put in the introduction I've introduced myself, then the purpose is, the main, main point out of the purpose is towards the last three-four lines, where it talks about increase the number of science learners enrolling into university education and the number of competent and employable graduates or scientists, then, thank you for giving me the permission to tape-record this interview, then we can now go ahead with the first question, sir,

Mr. Chipo: Yes.

Researcher: For the purpose, you are Mr. Chipo, it is also not ethical for us to use the real names of our participants. That is why we are using pseudonyms. So, the first question is, ***what does the term inquiry-based learning approach mean to you?***

Mr. Chipo: To me, I would say inquiry based, I'm looking at a scenario whereby I don't, I don't give learners, spoon-feed them. I don't give them information. But I have to, to locate, but to start with basement assessment, to know what learners know through asking questions, right? To have to know what learners already know and start scaffolding from there, not just dishing out information.

Researcher: Thank you sir, that's good.

2.

Researcher: The next question is, ***what teaching and learning approach do you frequently use and why do you prefer that approach to others?*** Now, the first one, sorry, let me put clarity so that you can respond. You know, we have inquiry-based learning, it's one approach, we have the teacher centred one, which is instructional, which is the learner just sit down and listen, they don't participate so much. So, I don't know if you know, from my understanding you love inquiry-based learning, that is what you use for your learner, and looking at your lab or your class, it tells me that there's inquiry-based learning going on here. So now, the aspect I want you to respond to is, why do you prefer this approach to other approaches?

Mr. Andile: The other approaches, okay, thank you for that, right. Like you indicate, my approach is interactive, it is participative. The reason for that is, I am the teacher, and I'm the source of the knowledge for the subject. What is necessary in the education sector is to ensure that you deliver what you have, because in most cases, you find that most of us as educators, we do have the knowledge of the subject, but how to deliver it to the learners becomes an issue. And in the delivery process, you need to get the feedback, the feedback is what is necessary. So if you use the inquiry-based, if you use the interactive method, participative method, it means you get to know what the learners have in terms of background knowledge, you get to check the opinion of the learner with regard to a particular concept that is relevant in as far as the learning process is concerned, where ever learners have got problems, they can feel free to ask questions, because in most cases, when I teach, I do pause, regularly so and asked questions, so I really enjoy it when my learners ask questions. That shows their involvement, because most of the learners are good at responding even nodding their heads, do we understand, they just nod without necessarily understanding exactly what you mean.

Researcher: Okay, that's true. I've observed that too. Sometimes, when they nod their heads, and you feel that they know what you know.

Mr. Andile: They want you to move ahead

Researcher: Yes, they want you to move ahead, and when you ask them, question concerning what… some of them tend to want to scratch their head, I love that. So, when you interact with them, when you make it very interactive and participative, it gives you what you want and that is why you prefer that approach to other approaches

Mr. Andile: I need feedback…

Researcher: okay, because of feedback, you need feedback. Feedback is given with this approach, I love that. Thank you, sir. Okay, I'll move to the next question.

(Interactive/participative method. It gives the learners the opportunity to be involved and give their opinion. Learners also pay attention and mistakes can be identified and corrected).

Researcher: The second question says, ***what teaching and learning approach do you frequently use and why do you prefer that approach to others?***

Mr. Bulunga: Eh, you know, um, when I teach, introduce the topic, come up with objectives, learning objectives, come up with the objectives. Normally what I do, I put the objectives and eh, on the screen

Researcher: Okay sir,

Mr. Bulunga: And I read the objectives for them, after reading the objectives, now I project the notes, and then ah, explain that notes for them. Then after that, after that lesson, ah, I check those objectives that have been projected, I give them the activity, the way you have seen it, by giving them the activity to see that now, what I have taught them, they can be able to understand. And then after giving them the activity, if they don't get those eh, activity correctly, I have to repeat the lesson.

Researcher: Okay

Mr. Bulunga: And then, eh, repeating the activities to check if they understand.

Researcher: Okay, what you have taught them?

Mr. Bulunga: I keep on repeating the lesson.

Researcher: Okay, then you know why I asked that question, because I know that eh, we have like the one where the learners are being engaged, which is like the inquiry-based, right?

Mr. Bulunga: Um

Researcher: I saw it's happening in your class today.

Mr. Bulunga: Um

Researcher: That is pure inquiry-based learning

Mr. Bulunga: Um

Researcher: You understand, where the learners had to, on their own, inquire from each other collaboratively

Mr. Bulunga: Um

Researcher: Because I remember you gave them that opportunity to sit in group and work and discuss.

Mr. Bulunga: Um

Researcher: When they discuss the learners are the ones now searching for the answer, not that they just sit down, you are feeding them with the information that you want them, because if, some strategy which is teacher-centred one, which is different, the teacher-centred is different from the IBL, the inquiry-based learning, where the teacher just give instruction, give instruction, the learners only just listen and write.

Mr. Bulunga: Um, I think I understand

Researcher: The learners are not active in that class, now I observed that your class is interactive, you use even a demonstration method, which is also under inquiry-based learning

Mr. Bulunga: Um

Researcher: Where you use demonstration to help learners understand the concept that you're trying to give them. So why do you prefer that, this strategy? Why do you prefer this strategy to you just keeping them sitting down and you just give them information?

Mr. Bulunga: They understand, they don't get bored in the class, where you, you engage, you make them, their brains to work, once they don't, they keep on sleeping, they sleep in the class. So, they won't be able to listen, you understand?

Researcher: Yeah

Mr. Bulunga: And so, once you see you don't, you switch to teach, teach, you can just make noise, you find out, they're going to keep on, you are saying wake up, wake up, waking them up, otherwise they will sleep.

Researcher: Eh, they will be fast asleep, that’s true, it means that the inquiry-based keeps them busy.

Mr. Bulunga: Um, makes them busy

	Researcher: Make them active. **Mr. Bulunga:** Um **Researcher:** Let's look at question. Thank you, sir. **Researcher:** The second question is, ***what teaching and learning approach do you frequently use and why do you prefer the approach to others?*** **Mr. Chipo:** Usually, I use a lecture method first, that is the first method that that I use. I use lecture method. The reason why I use this method is because we have, our syllabus is so broad and diverse. We don't have a demonstration kind of syllabus where we do a lot of practicals. So that's why we end up resorting to lecture method, because to be honest, we teach for these learners to pass, impact content with minimum demonstration. So, I know the method that works best is demonstrations, it is practical demonstrations, but I use that minimally, like you saw my class, it was packed, how do I do practical? How am I going to conduct it? So, at the end, I resolve to a lecture method. **Researcher:** So, do you combine these? In your class, I observed that the learners were really engaged. They were really engaged, because I saw learners coming out to answer questions on the board that is engaging the learners. **Mr. Chipo:** Yes. **Researcher:** I saw you monitoring the work that you have given them, and you are helping some of them, you are trying to guide some of them where they are going offline. I observed that too. **Mr. Chipo:** The thing is now, I give them questions, I give them a guideline, and then I give them question, which is also inquiry-based. I see what is that they know, what I do when I give questions when I go in check. I don't mark all the books, but I want to see common mistakes. So that I correct on the board before I move on to the next topic. Because if I just carry on without checking, then learners will go with the wrong concepts. So, I'll say it's also inquiry based. Okay, I want, the thing is, if you've seen, I put different questions on the board, the reason is because I want some kind of critical thinking, like to see how the examiner asked the questions. That is why, I use it. It's a different method, I use a diversity of methods, but there are minimum practical aspects in the syllabus that we are given currently in South Africa. **Researcher:** Talking about, you made mention of common mistakes, was that the reason why you ask the learners, you insist that the learners must talk about gender, when they talk about sex-link? **Mr. Chipo:** Sex-linked, yes. Like I see now, in sex-linked, one learner is just talking about, maybe the disease, but he is not mentioning that it's a male. **Researcher:** Okay. **Mr. Chipo:** So, if I see that thing in common learners, when I correct, I correct, I say everyone, even though I've seen maybe two learners, I have to emphasise it. **Researcher:** Okay, thank you, sir.
3.	**Researcher:** The next question is question number three. On page one of three. The question says, ***may you describe other approaches besides your preferred approach, you believe can be equally effective.*** Because, the purpose of this question is… during my data collection on literature review, I came across some very few researchers that say that in teaching, the teacher-centred approach is very good, because they believe that you don't waste time, they pass information they move quickly into the next where they are going, just like when your learners are nodding their head, they want you to move to the next one. So now, that is why I included this question in my research, I want to know why educator prefer this approach. Why do they feel that believe that this approach, other approaches can be equally effective, **Mr. Andile:** I will call it the lecture method. I'm lecturing to my learners. one thing that I will tell you straight up is like you indicated, content, Life Sciences is a content subject, if you check the number of topics that we need to cover, give you a time, I was going to recite them to you all of them now, right? There is a lot of contents, what we need is a lot of contact time with the learners, there are moments where I need to fill in charge, I come into my class, my learner sits down. Previous day, I have already indicated to them, what we are going to learn about, when they get in, number one, for the sake of control, I need to lecture, I need to deliver, I need to show them that I know the content, I

explained concepts to them, before, obviously at a later stage, it is not going to be used in isolation, I want you to take note of that,

Researcher: Okay

Mr. Andile: I am not going to use the lecture method in isolation, I deliver certain concepts that I feel I need to take charge and explain to my learners, they feel my presence, they understand my explanation, then after that, I will then later on include other methods, there is sort of integration, you lecture after lecturing you still bring back the interactive and participative methods that will get feedback. But in terms of time management, you also need this lecture method, and also in terms of certain topics, remember, I'm talking about theoretical concepts that need you to explain, in Life Sciences, you realise there are new terms, where learners will be puzzled, they will look at you, what is it? You will need to explain those concepts, you need to break them down, because that is the language in our subject. So, you need to give them new terms, after that they understand those concepts, then you are using them to explain other concepts, they are now more comfortable.

Researcher: That's good, so briefly, I will take your response to mean that you actually use some of those approaches like the teacher, you call it teacher method, you use that approach sometimes mixed together with the inquiry-based, and because of you're looking at time management and there's also other aspects that you need to achieve, which is, you want them to, you need to explain the concepts and terminologies, which the learners get puzzle when they hear this word for the first time.

Mr. Andile: They need to understand certain concepts.

Researcher: Oh, thanks, I appreciate that response. Then, let's move to the next question.

(Lecture method – giving insight into a particular concept. Role playing – attracts attention. Practical investigations – learners are involved. Learner – led discussions).

Researcher: Let's look at question three, three says, ***may you describe other approaches besides your preferred approach, you believe can be equally effective***. If there is any other approach? Because I know what you used is inquiry-based. Another approach is like the teaching method. Like where the teacher just speaks, that I said.

Mr. Bulunga: That, that one, I don't know the other method, I don't know. The one that I'm using.

Researcher: Is inquiry-based, what you did was inquiry-based

Mr. Bulunga: Eh, I don't know I'm using inquiry-based or what, you see.

Researcher: You know, you know sometimes, you know why I asked that, this question, is part of my, my interview, it was because some, some teachers believe that Um, the IBL

Mr. Bulunga: Um

Researcher: If used, the class is always disorganised, the learners, because when you want the learners to be active in the class, they tend to be, they tend to, you tend to have a situation where you have indiscipline in the class

Mr. Bulunga: Um

Researcher: Because the learner is active now. But they say no, they don't want it because they want to cover the syllabus on time.

Mr. Bulunga: Um

Researcher: Because that one is time consuming. These are some of the excuses, we've seen some educators and some of the authors, when I was doing my, my literature review, I was able to gather information, because they were saying that um, you, you're likely to have indiscipline problem in the class, if you use purely inquiry-based learning

Mr. Bulunga: Um

Researcher: You're likely to, not be able to cover your syllabus if you're using purely inquiry-based learning. So sometimes, they mix it together with teacher method where they just give instruction, the learners copy, then they add it with what? They mix it with inquiry-based learning, so that they will be able to cover the syllabus, when they give them information, and at the same time, they will be able to also maintain some level of discipline in class.

Mr. Bulunga: Um

Researcher: So, I don't know if sometimes you, you mix the method of just giving them instruction,

	which you did today, because I saw when you moved to nervous system, in nervous system, you gave them a lot of information before you start to get response from the learners.
	Mr. Bulunga: Um, because it's a new topic, they don't know anything about it. So, the method, I don't know, but sometimes if you want to cover time, you can just teach and teach and teach and after teaching, then you can ask them question until you test that you see if they've understood, so, that is for the other matter.
	Researcher: Oh, that's exactly what I want to get, because of, it's a new topic, because also some have said that for every new topic, you need to use the teacher method, because that is the point at which you need to first give them information
	Mr. Bulunga: Information
	Researcher: Because it's new
	Mr. Bulunga: Give the definition
	Researcher: Then you need to explain those concepts to them before you now start to get their own responses.
	Mr. Bulunga: Because, they don't know now the spinal cord, they don't know, you see, they don't know there is difference between skull and cranium, they don't know these, so you need to explain to them first
	Researcher: Explain to them first. That is, that means, you mix the methods to be able to get effectiveness.
	Researcher: Now, the next question is, ***may you describe other approaches, besides your preferred approach you believe can be equally effective***? You already mentioned teaching method.
	Mr. Chipo: Practical demonstration
	Researcher: Okay, practical demonstration?
	Mr. Chipo: Practical demonstration, yet only, to let learners to be hands-on, to be involved, if it is live, learners must see the real things, you have microscopes, it really works perfectly. That's one method that I'm 100% sure. The other method, it's when you encourage critical thinking, when you ask learners to go and do their own research, which is a problem in our system. So, that's why we end up giving learners notes instead of them going to research. So, problem solving, I can't be working on the board all the time giving them answers, I give them work, they do problem solving, I make a follow up, I scaffold, I see what is it that they know, then I start from there.
	Researcher: Thank you sir.
4.	**Researcher:** The next question is, ***in your opinion, do you think IBL approach can be effective in facilitating all Life Sciences topics and other science subjects?***
	Mr. Andile: Okay. Now, like I indicated in the previous questions, not in all, but there are certain concepts, certain topics that they need that approach. I'll give you an example. We will tackle a topic on evolution at the end of the syllabus. Evolution is an analytical topic, needs learners to analyse theories, right. What I need to do is to introduce the theories to them. So, I will definitely need to lecture, indicate, okay, what this scientist proposed, and then after that, only after I've explained, they understand the concepts, that's when we can involve them to say, Okay, fine, come in now, let's analyse this together, give us your opinion. I'll give you another topic on genetics.
	Researcher: Genetics!
	Mr. Andile: That is a very interesting topic, I love.
	Researcher: And that is where most learners struggle in Life Sciences.
	Mr. Andile: They do struggle but I told my learners to say here you got the doctor for Genetics, So, you don't need to struggle, yes. Like I indicated introducing the topic, they are majority of the terms that are new terms, they are surprised they are puzzled, they're looking at you. So, what you need to do is to, you know what? To explain clearly what those terms mean. Like I said, you need to give like a diction that's a dictionary first of all, before they can be able to use those words in tackling genetic problems. So that definitely you need to explain genetic crosses, we need to explain the concept how is it done? After having explained give an example then after that learners can then chip in, they can now ask questions, then the interactive comes in. So, looking at the variation of our topics, is a very

interesting subject.
Researcher: Very interesting.
Mr. Andile: It's a huge variation in terms of our topics, so as they come in, you definitely need to apply different techniques, different strategies in terms of delivering the subject.
Researcher: That's good. Thank you so much for that response. So very clear. Let us move to the next question.
(The IBL approach is effective in science but not for all topics. Other topics will require the educator to take charge and explain the concept thoroughly before learners can respond or take part).

Researcher: So, I'm looking at the next question, which is question four, it says, ***in your opinion, do you think IBL approach can be effective in facilitating all Life Sciences topics and other science topics?***
Mr. Bulunga: Yes, it helps learners to be effective, um, in case, if you are having gifted learners, there are learners who are very gifted, you can be able to, to assist them a bit.
Researcher: Okay
Mr. Bulunga: Hmm
Researcher: Alright
Mr. Bulunga: Then, it's good to be applied to, because sometimes you'll find out that inside the class, you will be having another eh, a very, very gifted, so you can be, at least, then you are not disadvantaging them
Researcher: Okay
Mr. Bulunga: You understand? We have kind of learners who are very fast, that as you see in the other class, I cannot group that class with that other one, these ones are very, very fast, but the other ones, when you compare the classes I wanted you to go and observe in other class
Researcher: Okay
Mr. Bulunga: These ones are, they are very, very slow.
Researcher: It's good you ask, you touched on that, the other class, you, the reason for separation, putting them into two groups is because some are, the other first group they are fast to grab, while the second group, they are not?
Mr. Bulunga: Hmm
Researcher: Okay
Mr. Bulunga: Oh, that one didn't come effective, what I would, and the, that method will assist for in case, if we are having those learners like that.
Researcher: Okay in that class, but in the second class, you need to give them information, explain because they are slow learners
Mr. Bulunga: Hmm, so, you can't mix. They want me to mix them, but you can't mix the two, you end up teaching one, one group of learners the others you are leaving them behind.
Researcher: Behind?
Mr. Bulunga: Hmm
Researcher: Okay, so the purpose of separating them is because you don't want others to be left behind
Mr. Bulunga: Yes
Researcher: Because of, they not fast learning learners?
Mr. Bulunga: They are not fast enough
Researcher: It is also a good strategy.
Mr. Bulunga: They are very slow. So, you know it's a problem. Because normally, what I do, like in that class if I have learners who are underperforming, what I do now, I separate them, I already separated them eh, in some other class, we have a list of learners who are underperforming and we give them an extra book, eh, when I, we teach them separately, like Sundays, we are having other classes, I get it, this is for Saturday, after we teach everybody, Sunday, we are having another class.
Researcher: You teach on Sunday too?
Mr. Bulunga: Yeah, we are having

Researcher: Are you serious?

Mr. Bulunga: Yeah, serious, eh, we are going to start now, we are having learners who are level one, level two. Teach, teach them the

Researcher: I hope the learners don't feel bad for being in the group that is tagged, slow learning group?

Mr. Bulunga: No, they get excited because they are assisted.

Researcher: Okay, they don’t feel inferior, that inferiority is not there?

Mr. Bulunga: They don't stay for a longer period, is the same as when you are given marks in the class, then you call their names, some of these things is to actually encourage them, you understand?

Researcher: Okay

Mr. Bulunga: The one got 10, this one was six, is not like, you want to demoralise them, you want to, it's kind of a competition to say, and this one is having marks more than me, and then.

Researcher: Yeah, I’ll go and study more

Mr. Bulunga: Yeah, like that's kind of encouragement.

Researcher: Okay, I got that.

Mr. Bulunga: So, I think that it could help learners, um, like to become more effective.

Researcher: Okay

Mr. Bulunga: Those learners who are gifted

Researcher: Oh, I got that

Mr. Bulunga: Yeah

Researcher: The next question is, ***in your opinion, do you think IBL approach can be effective in facilitating all Life Sciences topics and other science topic?***

Mr. Chipo: Inquiry-based learning, it, to some extent, yes, it works. But now, the problem that we are having, the learners that we have, they are blank, so inquiring from them, if they are blank, does not help. I think inquiry-based learning, it helps to learners that have got something. But now if you have learners, for example, that are changing subjects like that in our school, we have problems of learners that change subjects. What do inquire? You inquire with someone who has got some ideas. So, inquiry-based learning, it works at certain stage, not from the start.

Researcher: Because you cannot ask learners to inquire, to engage in inquiry when there is no, something…

Mr. Chipo: There is no foundation

Researcher: No foundation

Mr. Chipo: There should be foundation, then when I come in, that's when I can come and inquire. So, at the end, that is why you find it's effective, but at a later stage, not from the word go. Inquiry-based method, it was working today because we did not start this topic today. We have been doing this topic, it’s a continuation, now, it's easier to do inquiry, but not from day one of the topic. At a later stage in the subject, you can use it but not from day one. Day one, you can just inquire maybe briefly what, okay class, you know what we did in Grade 10? We start from there.

Researcher: Yes.

Mr. Chipo: But now, when it comes to introducing new content, you should give knowledge, unfortunately, that’s how it is.

Researcher: It's a challenge.

Mr. Chipo: It is a challenge.

Researcher: So, Inquiry-based learning. What I can also deduce from what you have said now, is to say that inquiry-based learning is really perfect for learner who has got prior knowledge.

Mr. Chipo: Yes, exactly, that’s what I mean.

Researcher: A learner without prior knowledge of what you're doing, or what you want them to build on, will not, it will mean nothing.

Mr. Chipo: It will not work. Inquiry-based knowledge means foundation, it means the learners have foundation, now, okay, what they have, then, you start from there. But what about if you've got a group of learners that you are starting from scratch, you can’t use inquiry-based learning.

	Researcher: And that will be time consuming.
	Mr. Chipo: Yes, it’s time consuming.
5.	**Researcher:** The next question is, ***how would you describe the level of your learners’ participation, motivation and performance when using IBL approach or your preferred approach to the teaching of Life Sciences?***
	Mr. Andile: Right, based on my experience, my brother, I think, I have managed to master the art of grilling my learners on how to participate, I've learnt how to motivate them, you'll see as they come in, yeah, I've used a lot of incentives a lot of motivational approaches to ensure that learners in class are participating, learners in class feel good, feel confident in participating and the inquiry-based approach is actually a very important approach for us, because, this is a science subject, you need to interact with your learners, there are moments where I, I calm down the situation, and bring everybody into the discussion. Just to make it easier for others, remember, we've got differences in terms of the learning approaches one, we also have learners with different strengths. So, others at one moment they might feel intimidated, especially there are learners, you’ll see as they come in, there are learners who are very active, very participative. At the end of the day, if they keep on participating, and you are focusing on them, you are living out other weaker learners.
	Researcher: Oh, that’s good, I got that, then how do you manage that aspect?
	Mr. Andile: That aspect?
	Researcher: That is the slow learners now.
	Mr. Andile: The motivation, that's where it comes in
	Researcher: Okay.
	Mr. Andile: The incentives, that's where it comes in, those slow learners once they give you an answer, whether right or wrong, there is always that motivation, I've always had that…
	Researcher: Whether right or wrong, you need to motivate them?
	Mr. Andile: Whether right or wrong, you appreciate them, I’m appreciating my learners, just for participating, thank you for that. Class, can we listen to this? Let's, without demotivating them without discouraging them, because once a learner says out an answer, and then there is… and I've also warned my learners, there is no learner who laughs at others, we don't do that.
	Researcher: That’s good.
	Mr. Andile: this is a learning curve, everybody is a learner here, there is always something new to everybody. So, whenever we respect each and everybody's opinion, so that actually motivates, it gives them that leverage to say, in this class, I'm free to say out any answer as long as I'm participating. So, I've tried that and I think it has worked for me, most of my learners, if you see we are three Life Sciences teachers here, but if you check here now, they are motivated, most of them are happy to be here, although there are moments when I'm harsh, very harsh, and very stern, especially if a learner keeps quiet for too long, and do not want to get involved
	Researcher: When they keep quiet for too long?
	Mr. Andile: If they keep quiet for too long, what do I do? After trying to motivate, I’m on their case now, I will make it a point that I'm on their case until they realise they need to get involved. So, I've used the each and every trick in the book to make sure that I bring all the learners on board.
	Researcher: That’s good, it means that, I see something from your response. What I was able to pick again, additional information I was able to pick from what you've just said, is that even when your learners make a mistake, it's also part of learning process.
	Mr. Andile: It is part of learning definitely, definitely, they need motivation. These learners, I can tell you, they need all the motivation in the world, even after class, the way you interact with them. They, they need to be a friend to you
	Researcher: Exactly
	Mr. Andile: Yes, they need to see you... as I've told them, I'm a brother, I'm a father figure, I'm your friend. Whenever you feel like you are not comfortable in a class set up, please remain calm during break time. Talk to me, each and every feedback that I give, just to give additional, if I mark the scripts, I try by all means to make sure that as soon as they write before they forget, I have marked, and when I realised certain mistakes that are really crucial. I put a star and I indicate please see me, so I give them that opportunity to come and see me privately so that I do not necessarily
	Researcher: Discuss in the open

Mr. Andile: Yes, so when they come, and you see them nodding to say, oh sir, I realised my mistake, in class they're a bit confident. They're coming back to say, oh sir, we corrected that. If I make a reference to say okay Thabo, remember we spoke about that during break, yes sir, I remember it, he is even confident enough to raise that piece and talk in class.

Researcher: I love that, thank you so much. I'm happy to have this interview with you. But we still have some more question. Let's move to the sixth one, the sixth one says. I want to see if we can beat time, we have few minutes before your learners arrive.

(They are always hands on, very involved and motivated. This is because I give them a chance to go and read, prepare in advance before the next topic).

Researcher: Okay, let's look at five, it said, ***how would you describe the level of your learners' participation, motivation and performance when using IBL approach or your preferred approach to teaching of Life Sciences?***

Mr. Bulunga: Let me see, I wrote it here, I said due to gaining attention, during lesson, which start from previous knowledge to the unknown. What does that mean? You see, when I started the lesson, you give them the, you connect both lessons. Like what is it that learners know?

Researcher: Okay

Mr. Bulunga: Hmm, first? Do you know what is the skull that is covering the brain like that? And I have reckoned the learners develop a curiosity on what is to come, and I recall, every time you entice them, they don't get bored. I don't see my learners sleeping in the class, even if they are many, when you look at them, everybody they wake up, they want to see what is it, that is coming.

Researcher: Okay.

Mr. Bulunga: Like that. So, you actually gain that attention during the lesson

Researcher: That means, their level of participation is high

Mr. Bulunga: Is very high

Researcher: And they are motivated to perform in class.

Mr. Bulunga: Yes hmm.

Researcher: Okay, alright, let's move

Mr. Bulunga: If you have another lesson, like today, they want to know now, what exactly, because we have been talking about meninges, what are those three meninges?

Researcher: Okay

Mr. Bulunga: That's because, people who are having meningitis, like seeing the inflammation of those three layers, they want to know more, so tomorrow, building eh, to be curious, and they want to know

Researcher: Okay

Mr. Bulunga: Exactly what is going to happen next?

Researcher: Next, so did you, the, the, they have that um, their mind is set towards the next class?

Mr. Bulunga: Hmm, they usually said that they actually develop curiosity to what is coming next.

Researcher: Curiosity, next, okay alright, Thank you sir.

Researcher: Thank you, sir. Number five, ***how would you describe the level of your learners' participation, motivation and performance when using IBL approach or your preferred approach to teaching of Life Sciences?***

Mr. Chipo: How do you describe the level of your learners' participation motivation and performance when using your preferred approach of teaching? I'll say learners, they respond well, but now we've got different groups of learners. You have good response and, but not from everyone, what I would say, inquiry-based learning, it works for certain group of learners. Right? Because you have, obviously a diversity of learners in a class, is not going to work for everyone. That's why you have to infuse different teaching methods, that one (IBL) is going to work for the other group, those who have got prior knowledge, then there's another group who doesn't have prior knowledge, it's not going to help us, because they are not going to give you any feedback. Even if you give them work, they will bring blank papers. So, you have to give knowledge based.

	Researcher: They will return the paper back to you?
	Mr. Chipo: Yes, you can't ask me about USA if I've never been there.
	Researcher: Never been there, yeah, I got that.
6.	**Researcher:** ***How does IBL approach or your preferred approach allow your learners to construct new scientific knowledge from their prior scientific knowledge?***
	Mr. Andile: The learners feel part of the learning process. As long as you get them involved. As they feel part of the, they are always eager to research, they are always eager to go and say, Okay, fine. Maybe I've said, we've got a new topic tomorrow, this is what we are going to be discussing. And if we check our subject, trying to strictly answer based on prior versus the new knowledge.
	Researcher: Okay,
	Mr. Andile: Our subject is very much progressive. If you check the content in Grade 10, 11, up to 12, there are topics that are in sync, they integrate, they move on slowly so. So, if you do that, most of the time, I always make them to get reference from their previous years, and then carried forward into the next year. The simple concept, the scientific process actually starts in Grade 10, up to Grade 12 we're doing investigative questions. So, the basic concept of those, are background information, so you need them to apply whatever they've learnt there, take it in. So, the inquiry-based obviously, the moment I start I'm like reference to Grade 10, reference to Grade 11 in a Grade 12 class, already they are like, "okay sir we remember that concept, so are we still using the same concept?" yes, same concept, but now, let's step it up a bit. So, the inquiry-based is still very relevant in this.
	Researcher: Alright, let's move to seven.
	(The learners feel part of the learning process therefore they are always eager to research so that they can either ask questions or answer to questions in class).
	Researcher: Then um, number six is ***how does IBL approach or your preferred approach allow your learners to construct new scientific knowledge from their prior scientific knowledge?***
	Mr. Bulunga: Hmm, continuity, also previous knowledge to unknown, curiosity level is high, because moving from previous to unknown, their hunger is going to be very high, which makes learning interesting to all the learners.
	Researcher: Okay sir.
	Mr. Bulunga: So, they have already been that is very high, they want, they have that hunger to, what is it that is going to happen?
	Researcher: Happen.
	Mr. Bulunga: Hmm, so.
	Researcher: That means, that means they are able to be, I saw that, you know, one of the questions you ask them in the class, you were asking a question where it was not part of that topic, but the learner needs to go back to go and make use of what
	Mr. Bulunga: Eh, eh
	Researcher: Um, specifically, I'm trying to remember that response the learner gave, the learner said DNA.
	Mr. Bulunga: Eh
	Researcher: You were saying that um, why do you use this particular nucleus?
	Mr. Bulunga: Instead of saying, guess
	Researcher: Yeah, the learner said the nucleus
	Mr. Bulunga: Characteristics
	Researcher: It's because, and it's the one that is carrying what? The characteristics, then, you now further ask a question, what is that characteristic? Which one? Then the learner went ahead to say, the DNA is in the nucleus.
	Mr. Bulunga: Hmm
	Researcher: So that one is, that is what I'm talking about, prior knowledge. Okay fine, they are able to make use of that, I saw that happened in the class.
	Researcher: Number six, ***how does IBL approach or your preferred approach allow your***

	learners to construct new scientific knowledge from their prior scientific knowledge? **Mr. Chipo:** Okay, now, if you are enquiring, it helps learners to see what they know and what they don't know. If you're asking questions related to that specific topic, then learners would say, okay, sir is asking this because it's related to the topic, I don't know it, then, it encourages them to see the depth how much they know, how much they don't know, so that they know what to do and work on. It also assesses the prior knowledge. So, learners will know now okay, this section I don't know, so I must go and look at it. And when I'm doing inquiry-based learning, I also use scientific language. It also helps for the learners to understand the scientific language, how do I express the scientific language? And how do I expect them to respond? **Researcher:** Okay, thank you sir.
7.	**Researcher:** Seven says, ***how would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any?*** **Mr. Andile:** Challenges? Like I've indicated, not all learners are active in class, so that gives sort of a challenge. I've indicated to say, you find overconfident overactive learners who are always dominating in a class set up, they tend to intimidate others. So, the challenge, of course, I'm trying, and I think my tricks here are working, but I can still tell you to say we have got difficulties, there are certain learners with… you cannot break them easily, you cannot easily reach out to them. The calibre, my brother, let me tell you something in the education system, the calibre of learners that we have these days, is slightly different from the calibre of learners. I started teaching in South Africa 2006, the old curriculum. **Researcher:** Wow **Mr. Andile:** Yes, that was my first matric group, I can tell you, the setup was in a private school, and the kind of learners that I would have, even on a weekend would sit like this on a Saturday, I can tell you to say, we would have learners who are enthusiastic, learners who are fighting to learn. So, my challenge now is with those learners who are not really motivated from within, intrinsically, they are not motivated. So, what you need to do is the biggest challenges it's you who will keep on hammering, you keep on hammering. So, the method that you use, you never know if it really motivates, or sometimes they'll feel like "ah, Mr. is too strict on us". Some of them really call me, "this guy is too strict". But I'm happy there are certain individuals who appreciate that strictness because they know the end results. But the challenges, I don't want to lie, they are there. Motivating learners, making sure that everybody works up to the standards that we expect is not easy. **Researcher:** Trying to move on same level. **Mr. Andile:** Yeah. **Researcher:** Okay, alright. **(Not all learners are as active and participative in class. Over-confident and active learners tend to dominate and intimidate some weaker learners).** **Researcher:** Now the next is in seven, it said, ***how would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any?*** **Mr. Bulunga:** Okay this one, eh, sometimes, teacher to a classroom ratio is making teaching difficult, the ratio. **Researcher:** Okay, that is the teacher ratio, teacher ratio is supposed to be 1 to 30 **Mr. Bulunga:** Yeah, because I've been teaching, I started with nine learners, right. **Researcher:** You started with nine learners? **Mr. Bulunga:** Nine learners, yes. Those nine learners, it is actually difficult again to teach few learners, eh, like you know, when compared to as fifty. **Researcher:** Hmm **Mr. Bulunga:** Is difficult, very difficult because if one learner fails, the percentage is not going to be what? Eh, ninety, is going to be eighty-something **Researcher:** Hmm **Mr. Bulunga:** If two fail, you understand, but, whereas if you have fifty learners in the class, two fail, you are still at ninety, now, sometimes, teacher to classroom ratio is making teaching very difficult **Researcher:** Difficult

Mr. Bulunga: Now if you are teaching more learners in the classes, it becomes more difficult for you, like when you teach nine learners, you can be able to give them test, you see this class test for how many learners? Eighty-seven learners, if you have like nine learners, I was going to mark them and give them feedback.
Researcher: Immediately?
Mr. Bulunga: Yes
Researcher: Almost immediately?
Mr. Bulunga: Yes, immediately, so it's teacher to learner ratio
Researcher: Okay
Mr. Bulunga: That's as much as attention is given to the A-plus learners, A-plus, those
Researcher: Okay, the A-plus learners are the high-performance learners?
Mr. Bulunga: Hmm, hmm. Those with the learning difficulties have their learning after ten, because now we are going to look at those that are performing, what about those who are
Researcher: Under performing
Mr. Bulunga: Having difficulties, so, I know they are going to be affected due to the pace to cover what?
Researcher: The syllabus
Mr. Bulunga: The learning objectives
Researcher: Okay
Mr. Bulunga: Hmm, so, they become difficult, there are learners who are not peculiar, then but the case is underperforming, but due to many learners, the school wanted where they can assist in, like even if you are separating, then put them aside, but it was going to be easy if that teacher-learner ratio
Researcher: Ratio is complied with
Mr. Bulunga: Hmm
Researcher: Are you the only Life Sciences teacher?
Mr. Bulunga: A Grade 12, yeah, three classes
Researcher: And you have how many classes for this? How many of them in total? Because I saw your first group is, was 21
Mr. Bulunga: Hmm
Researcher: The second group is what?
Mr. Bulunga: It's, eh, the second is 43
Researcher: Forty-three?
Mr. Bulunga: Hmm
Researcher: I thought, I thought forty-two, forty-three
Mr. Bulunga: The third one is 23
Researcher: You mean you have three groups?
Mr. Bulunga: Hmm, I'm meeting the last one now
Researcher: Good Lord, 21, 43 and 23 groups?
Mr. Bulunga: Hmm, the last one
Researcher: Good Lord
Mr. Bulunga: If they were few
Researcher: The third group is better than the first group
Mr. Bulunga: Last year, if this was Maths and Science, you see this one, last year, I was just teaching Maths and Science learners, last year, they came first position in Rustenburg, the second group again, I'm talking about those schools that we went to, in…
Researcher: Okay.
Mr. Bulunga: Bojanala, the whole Bojanala, Brit into the other town, we came position 2, this year now, I mean, the group that went there this year, it was position one in Rustenburg, Position one in Bojanala, position three in the Province, you see, because I can be able to manage those learners, but although there are Maths and Science around, it's not like, which means that, the method that I'm using assisted me, but if they were that teacher to learner ratio, it's manageable.
Researcher: One to thirty
Mr. Bulunga: Miracles are going to happen rather.

	Researcher: Hmm
	Mr. Bulunga: And then another difficulty is the use of laboratories, because we don’t have labs, you understand.
	Researcher: Hmm, but you are working on it?
	Mr. Bulunga: Hmm, I’m working on it, but if there was laboratory, we were going to perform a lot of practicals, of which performance level
	Researcher: Yeah, will be high.
	Mr. Bulunga: Like that**.**
	Researcher: So, that's also is another challenge?
	Mr. Bulunga: Hmm
	Researcher: Okay.
	Researcher: Question number seven, ***how would you describe some of the challenges encountered in implementing IBL or your preferred approach if there are any?***
	Mr. Chipo: Yes, there are challenges like I was saying, number one, you have a class that is very diverse, you have learners, the range is too wide, you might choose inquiry-based learners, then you end up having few individuals dominating the group. Because now you are asking the learners to give you feedback, isn’t it? Let's say it is participation. If you're not careful, you proceed with just a few groups that are participating, then the rest can be neglected and left behind. That is one challenge. Or you're implementing it on learners that don't have foundation. Like I was saying, we meet with learners that don't have foundation. Okay, let me just give you an example of these learners who were affected by COVID, some of the learners that we have in Grade 12, they don’t have foundation, if you inquire, they don't have the
	Researcher: Because of COVID?
	Mr. Chipo: Yes, it contributed. You have to give knowledge first, then you can use inquiry-based learning at a later stage in the topic.
	Researcher: Thank you sir.
8.	**Researcher:** ***How have you been able to manage or overcome the challenges mentioned in question seven?*** I've seen that this question. You've already given me the answer while you're explaining. So, I'll take your response to fill in that place for eight. So, I don't need to go there. Because you already given me how you were able to manage that.
	Mr. Andile: Yeah.
	(Yes, definitely. One on one sessions with weaker learners have helped to boost their confidence along the way).
	Researcher: How would you, um, number eight says, ***how have you been able to manage or overcome the challenges mentioned in question seven above?***
	Mr. Bulunga: Hmm, I’ve already mentioned remedial action activity
	Researcher: Okay.
	Mr. Bulunga: And we are separating learners, giving the learners extra book
	Researcher: Okay.
	Mr. Bulunga: Extra book, meaning if they are having class activity, eh, all them, they are having class activities, but the one that are underperforming, you give them extra book, new book, when you teach, give them extra class activity on their side, then, you might give them tests separately also, so that this eh, you can use it to remedy that situation. Reducing the learning objectives, because when you teach, you are going to.
	Researcher: Okay, you have to reduce the learning objectives?
	Mr. Bulunga: Yes, for those learners
	Researcher: Those struggling ones?
	Mr. Bulunga: Underperforming, yeah, you reduce the learning objectives for them. If, today, you are going to study meiosis and you said in meiosis, the important ones, I say see, read them and then for them you will reduce them and then check if

Researcher: So that means, that means the, if is going to take you one period to teach the high performing class, then that period, you are going to use for like two or three periods to use it for the same topic, you are going to use two or three periods to teach the underperforming class?

Mr. Bulunga: Eh, because you are, we are having

Researcher: Because you are reducing the learning objective now?

Mr. Bulunga: Hmm, I can have remediation, I can have a separate in those learners, they are not, no longer attending with the others.

Researcher: Together?

Mr. Bulunga: There's a time when they attend after school, like you have, having an extra lesson, you can let the others to go and then you have extra classes with these ones, as in

Researcher: To be able to meet up with the other learners

Mr. Bulunga: Then, these ones when you teach them, you will reduce the objectives

Researcher: Okay

Mr. Bulunga: If you have five, you can reduce them to three

Researcher: Okay

Mr. Bulunga: Hmm, yeah, and another thing, those who are gifted, eh, we give them extra work, in order not to be

Researcher: To do on their own

Mr. Bulunga: Not to be discouraged, yeah.

Researcher: Okay

Mr. Bulunga: We just give them extra work to take home

Researcher: To engage them

Mr. Bulunga: Yeah

Researcher: Okay the high performing now, you give them extra work, high performing learners

Mr. Bulunga: Um, you give them extra work.

Researcher: Are given work, okay, to engage them.

Mr. Bulunga: Um, like.

Researcher: While you have time to

Mr. Bulunga: For these ones

Researcher: For these, okay, it's a good strategy

Mr. Bulunga: Hmm

Researcher: It's a good strategy. While they are busy on their own, these are the guys who are really doing the inquiry, because now, they are the ones who are doing the extra mile work on inquiry, because now, when you give them a task, on their own they are able to go and search for information

Mr. Bulunga: It's true, most learners who are performing, they are the ones that you can be able to

Researcher: Enjoy that

Mr. Bulunga: Eh, lesson, we leave them, I mean in their class, you leave them, they will keep on doing

Researcher: Doing something,

Mr. Bulunga: When you come, you just

Researcher: But you can't do that with the

Mr. Bulunga: With the others, you can't, they are underperforming

Researcher: It's quite understandable

Mr. Bulunga: So, that is normally what we do here, we give them extra book, like now, because in the beginning when we started in January, they are still acclimatising to Grade 12, they don't know what is happening now, now term two, now we already know, these ones are struggling now, start separating, give them extra books and then you mark it, you also engage parents to check on learners

Researcher: Did you get textbooks from the school?

Mr. Bulunga: They do, but normally we they don't use textbook, textbook is for them to be able to study

Researcher: At home?

Mr. Bulunga: Hmm, yeah

Researcher: Okay
Mr. Bulunga: The study, they use it at home but normally
Researcher: Did you give them tab?
Mr. Bulunga: We give them the
Researcher: Do they have tab?
Mr. Bulunga: They don’t have
Researcher: Okay
Mr. Bulunga: But we, I encouraged them to buy also this book that was produced in Gxxxxxxxx, this way.
Researcher: Hmm
Mr. Bulunga: This lady, is one of the, these ones, there is one lady who wrote it and is also at Gxxxxxxxxx there, Miss CChem.
Researcher: Okay
Mr. Bulunga: This one was taken for a sample, so this one they have to buy, but those underperforming learners, say, they have to get extra textbooks to assist them
Researcher: Assist them
Mr. Bulunga: Hmm
Researcher: Okay, let’s, can take the next question before you go?
Mr. Bulunga: Hmm, Hmm.
Researcher: Can we see?
Mr. Bulunga: Yeah, it's time up.
Researcher: Okay, it's time up?
Mr. Bulunga: Yeah
Researcher: Okay, let’s do it this way, after your class, we’ll only be left with, from nine to twenty
Mr. Bulunga: Alright
Researcher: Then we'll be able to, thank you so much.

Researcher: ***How have you been able to manage or overcome the challenges mentioned in question seven above?***
Mr. Chipo: Okay, so we said, you, one challenge that I said is that you can’t leave learners dominating the response, how do you overcome that? In my class, I give every learner chance to participate, then, you don't use only one teaching method. The reason why I have to see, I need to go and mark myself, is because I don't feel individuals should dominate. I can give a question on the board, then ask one person who lift up his hands, gets it right. But I don't know what is the misconception. So, I have to assess, different assessment methods, then, I will give a test, formal activity that I will control, so that I’ll see if learners are following. So that is how, one way that I use to infuse inquiry based.
Researcher: To overcome, it’s quite challenging.
Mr. Chipo: Yes.
Researcher: Those learners who dominate, how do struggling learners feel? Do they feel challenged, or do they run back into their shell?
Mr. Chipo: Yes, some, it depends on you as a teacher, how do you deal with learners that are dominating? Because if you have dominating learners, sometimes, the rest of the class may be left behind, they might feel discouraged if you don't recognise them. So as a teacher remember, you must know the strengths of your learners. So, when you mark, you don't have that learner that says I’m done. You must also check other learners that are behind to see how they are doing, motivate them to see that I'm recognizing you, I know you are persuading us, but I want to see what you are doing, and I’m not focusing only on one group. So that's why to say I try by all means, because I know the learners that are, that usually are behind, they also sit behind at the back. So, you mustn’t leave them also, the good ones, you find them here. So, even the way your class is arranged, it's also very critical, today was a Saturday so the approach is different.
Researcher: So, you mean that, you sometimes prefer that they are arranged in a particular manner to help them, to control that.

	Mr. Chipo: Yes, the way they sit, I don't just let them sit randomly. I want them, a weak learner to sit at least with someone who can help, of course I don't force them, because I prefer also to sit where they are comfortable but, if they are, it’s mixed, the learn better like that.
	Researcher: Each time you put them with these high performing learners, do they take that advantage of getting help from the, I mean the weak learners now, do they take the advantage of getting help from the high performing learners?
	Mr. Chipo: It depends, it depends, because they have to be friends also.
	Researcher: That’s true, that's why I asked that question.
	Mr. Chipo: They have to, because they have to be compatible in some way. Because sometimes, now, you say, okay, let me give you an example of what it is like in our school sometimes. Sometimes, we, let’s say, you have said, no, you must sit next to someone different, right? There’s this day, like we say diversity, like we say you must sit next to a white person I’m black, we are not used, you know this thing, you forced me to sit next to this person, but I will be talking to someone that side. So, it’s not going to help, if you force them to sit like that. So, you also have to be careful with that, because there are some highflyers that are not willing to help, you, see? So, we also see how they relates, we always try to find a learner to sit next to someone that you know, this person is going to help and the learner is comfortable.
	Researcher: Apart from being an assistant, a helper, the one being helped also must be comfortable?
	Mr. Chipo: Must be comfortable.
	Researcher: I got that sir, thank you sir.
9.	**Researcher:** So, if you look also, question nine says, ***what learning opportunities or benefits does IBL or your preferred approach provides for you and your learners from your own assessment of their learning progress?***
	Mr. Andile: I have indicated also to say, everyone is motivated in my class, almost everybody is motivated to work, and everybody is prepared to go and prepare, because we are saying, when we come to class, remember, tomorrow, everybody, you should be able to remember the concepts that we discussed today. So, there are moments where I’m, “everybody, close your notebooks, close your study guide, Let's refresh, right. The concepts that we discussed yesterday, everybody can we, anything, mention anything that is also something that is going to help to overcome that… because if you say anything, you are not confining the learners to a particular concept, because the learners also do not want to feel cornered, they want freedom. So, if you say, we discussed the concept of meiosis yesterday, alright? Give me anything that you remember from there, even the weaker learners are happy to say, “sir, we discussed the structure of a chromosome”. Right? How is it structured? How is it designed? And so, then everybody would say… So you just need to make sure that you do not put them in a corner, give them the freedom to express themselves, then they are in.
	Researcher: Good, thank you sir. Let's move to the next question.
	(Almost everyone is motivated to go and prepare for the next lesson in advance as they feel good getting involved).
	Researcher: Thank you sir. It is the last part of the interview. We are done with question eight. Now we are moving to question nine, and question nine says, ***what learning opportunities or benefits does IBL or your preferred approach provides for you and your learners from your own assessment of their learning progress?***
	Mr. Bulunga: Okay, so it will assist me to be able to see if learners do understand or not, you will be giving them an assessment after that, so now, you will be able to see if they understand or not, if they don’t understand what you do, you revisit your outcomes, and then you reassess with a different question. But similarly, the same, you can use the approach of questioning you know, questionnaire.
	Researcher: Yes sir.
	Mr. Bulunga: Questioning, like now, you teach them, you put the question there, and then you ask them a question or the question that is related to that. So, the question that I've been asking on cloning, there is another one that talks about the Futi, there is another that talks about eh
	Researcher: The disease?

	Mr. Bulunga: Dolly, Dolly
	Researcher: Okay, Dolly
	Mr. Bulunga: The different questions
	Researcher: Okay sir
	Mr. Bulunga: So that they understand
	Researcher: Alright sir
	Mr. Bulunga: So, the opportunity is that you can be able to see if they understand or not
	Researcher: Okay, thank you sir.
	Researcher: Then, ***what learning opportunities or benefits does IBL or your preferred approach provides for you and your learners from your own assessment of their learning progress?***
	Mr. Chipo: Okay, what learning opportunities or benefits okay? For you and… okay. For me? Obviously, it helps me to know what the learners know and what they don't know. It is like a continuous assessment. It's not like, it's not like formal. Its continuous assessment, so that I know if my learners are following, so, it helps me also to know the pace that I must move, when I'm teaching. Because when I'm not getting feedback, it means, I have to slow down. If learners are assured that they are following, then I have to move fast.
	Researcher: Okay.
	Mr. Chipo: For the learners, it also has benefits, to the learners, in the sense that, learners, they also know what, what is it that they know, what they don't know. That's why I'm sure you've seen that's why I always give questions.
	Researcher: Yeah.
	Mr. Chipo: Because what I want to see is, I want the learners to assess themselves. It's like self-assessment. Okay, I know this one, so, it means I must go and look into this one. Right. If also I see, Okay, then my learners, I've given them, they are not following on this section, I know exactly where I'm going to start next. Already when I was assessing, I've seen okay, I have one group that I know, it ahead, then I know. Already I know the other group on Monday I'm going to start a new topic, but I know there's another group that I have to give more questions again because I've seen that they, there's something that is lacking. So, it helps in assessing, your only progress as a teacher to assess your class to see if you can carry on.
	Researcher: Thank you sir.
10.	**Researcher:** Next question says, ***do you think that one or more of the learning opportunities listed in question nine above will help to retain learners and minimise dropout among Life Sciences' learners?***
	Mr. Andile: Definitely, yes, we have tried. In fact, maybe this is a case in point where at our school, I will show you my colleagues that we have there, we have managed to keep numbers, actually we, we were like even trying to limit them because ever since.
	Researcher: So, you are saying now that you have retained them that even you don't want to take more?
	Mr. Andile: We have full house here, in Life Sciences, I can tell you to say, when we did our marketing, because usually what we do, we do our aptitude test with the Grade nines, then from there, teachers are allowed, the principal would say, "teachers, you can go and market your subjects", the marketing strategy that we have used and the pride that we have taken in our subjects, I can tell you, they came flocking, they were packed.
	Researcher: So, you'll agree with me that the purpose, the reason why you have this high-level retention of your learners, and why you don't have dropout could be because of the interactive, enjoyable, interesting method of IBL?
	Mr. Andile: That's true, there are learners, the IBL method, there are learners who take pride, we have taken pride starting with us as the educators, I take pride in my subject, if I stand here and talk about my subject, it's about my subject, if I stand outside talking to my learners, it's about my subject, they know me, "that's Mr. Life Sciences. So, even the Grade nines before they get into Grade 10, they are eager, they are now anxious, we want to go to that class and also get first-hand information

on what that guy is teaching because everybody when they come out of that class, they are excited, they are happy, they want to be involved. So, I think the pride that we have taken and the way in which we have handled the subjects has also given them that advantage.

Researcher: That's very good sir. Okay, what do you think? Do you want us to continue the interview, or we should pause it then after your class,

Mr. Andile: After the class we can complete it. I think we are halfway through. What we need to do now is, let the learners come in, we go through the lesson, and then I will give them something to do along the way. I've got some questions that they should do.

Researcher: Okay.

(Definitely. Motivated and involved learners will always feel good about the subject and they also encourage others to take the subject).

Researcher: Let's move to the next question, the next question is question 10. Question 10 says, ***do you think that one or more of the learning opportunities listed in question nine above will help to retain learners and minimise dropout among Life Sciences' learners?***

Mr. Bulunga: Hmm, hmm, what are they talking about here, about retain, retaining learners from which?

Researcher: Retaining the learners

Mr. Bulunga: In the Grade?

Researcher: Yeah, as in, your learners who, learners who

Mr. Bulunga: Grade 12 or what?

Researcher: Your Grade 12 learners now, don't forget that we normally have dropout at different level

Mr. Bulunga: Hmm

Researcher: Even in Grade nine you can have dropout, in Grade 12, you can have dropout

Mr. Bulunga: Hmm

Researcher: So, what this question is asking now is, this method you are using, these benefit that you mentioned, that you use to know whether there, to monitor the progress of the learning. Does it, the benefit that we just mentioned earlier, does this opportunity, does it give you that opportunity to retain your learners?

Mr. Bulunga: Hmm

Researcher: To avoid them dropping out from school?

Mr. Bulunga: Okay, now I see, this year it will assist them

Researcher: Okay, it assists them?

Mr. Bulunga: Is going to assist them.

Researcher: Yes sir

Mr. Bulunga: Hmm

Researcher: Okay, it assists to retain

Mr. Bulunga: Yes, it will assist them to retain them and not to drop out

Researcher: And not to drop out

Mr. Bulunga: Because, what you'll be teaching, they will be understanding, they actually understand what you're teaching them.

Researcher: Okay, that's good, because once they understand what they are doing, they are motivated to keep on doing it.

Mr. Bulunga: Hmm, hmm

Researcher: That is why they will not drop out, because they'll also, they will also understand. Okay, understand and that avoids what? That avoids dropout.

Researcher: Question ten says, ***do you think that one or more of the learning opportunities listed in question nine above will help to retain learners or minimise dropout among Life Sciences learners?***

Mr. Chipo: Continuous assessment, it helps to minimise dropouts, it does minimise dropouts in Life

Sciences in the sense that, when you assess continuously, you engage your learners, they are involved in the teaching and learning process. It's not that you're just going to give, to give a test. It's not a testing method, it’s not examination. It's a continuous, so it helps when I'm asking questions in inquiry based, I see what they don't know then I help with the information, that is the information that I'm going to ask, that is what I’m going to assess in the end of the year, that is the idea.

Researcher: Okay.

Mr. Chipo: So, when we do inquiry-based, we inquire, we give feedback, giving feedback, guiding what we expect at the end of the year. So, that reduces dropouts. So, there is no, there's no surprises at the end of the year, actually it prevents surprises, because now the learners know what to expect at the end of the year.

Researcher: They know what to expect.

Mr. Chipo: Yes

Researcher: Thank you sir.

11.

Researcher: So far, we are back to the last part of this interview, which will take us to question number eleven. ***How have you been able to prevent learners’ dropout and improve on their attendance and retention rate?***

Mr. Andile: Um, I think we did that before we left the previous session.

Researcher: I think the last one we took was, do you think that one or more of the learning opportunities listed in question 9.

Mr. Andile: Okay, because I link the retention, I spoke about the pride in the subject.

Researcher: Oh, that's true.

Mr. Andile: I spoke about us, starting with us as the educators because obviously, you need to show the love for the subject as an educator, before it even spreads to the learners. So, what we have done with my colleagues here, is we have shown the pride in the subject, we show the knowledge also you need to be confident, you definitely need to be confident in what you are doing so that the learners have that trust in you. So, what we have done is, we have inculcated that culture into our learners to say, this is one of the best subjects in the school. If I can tell you, in our school, we also have competition between subjects. Yeah, I’ve got a Business Studies colleague there, at the end of the year will tell them, it’s okay, fine, Let's look at the number of distinctions that we are producing. Let's look at your subject average. So, when you share such information with the learners, they become interested in taking part in the subject and also inside the subjects where you indicate the career choices. It's not only about the classroom here, it's about what's out there for the subject. So, inform your learners, provide information to the learners to say, okay, fine, out there. These are the opportunities that are open when you take a subject like this one. So, I think that has helped us a lot in keeping learners as well as making sure that every time the learners are here, we are working. We don't have a time where we bring learners to our classes, then, they just sit and relax. No, they know when they come here, it’s time to work.

Researcher: Thank you so much sir, that’s well understood and well taken.

(I personally love the subject and have made it my personal goal to show the learners how proud I am about my subject. My learners all share the pride and the prestige of being taught by me).

Researcher: Thank you sir. Let's move to eleven. ***How have you been able to prevent learners’ dropout and improve on their attendance and retention rate?*** The questions are very close, but they are not the same.

Mr. Bulunga: Hmm

Researcher: Don't forget that, it said, do you think that, that strategy help you? You said, it's yes, because it assists you. So, some of the answers for here, is what you've already answered here. So, what this one is saying here is just like, I need you to look, what strategy, how did you do it that made the learners not to dropout?

Mr. Bulunga: Most of the learners who are dropping out are the ones that are failing, isn't it?

Researcher: Yeah

Mr. Bulunga: Those that are not the passing. Those that are not are, those that are underperforming.

Researcher: Underperforming

Mr. Bulunga: They feel like now, because they don't understand, now normally here, what we do, learners who are underperforming, um, sometimes learners will distance themselves from not coming to school, from coming to class, bunking classes. One on one session, we call the learner, after calling the learner, um, you need to know the learner that you are teaching, knowing where are they coming from, what makes them not to, because some of the learners underperform and dropout because of certain family problems. So, you need to know the learner, where are they coming from? Call their parents, so that you'll have to have parents also parents' intervention. You need to know where they come from, sometimes, they are struggling with those kinds of things. When was it? Last of last year, I had few learners who were underperforming, five of them. I think these five learners are going to drop my results. So, I had to know where they are coming from, and then in the morning, like in the morning where they come, I'll go and collect them, bring them to school, you know that kind of thing

Researcher: Okay you were the one who normally go to collect them?

Mr. Bulunga: Uh, collect them from their home, where they are staying, collect them, I go

Researcher: Because they were not coming?

Mr. Bulunga: Yeah, they were not coming.

Researcher: So, you have to be collecting them?

Mr. Bulunga: So, you make them love what they're doing

Researcher: Okay

Mr. Bulunga: And then when you win them, once you win them, they won't be able to, if they don't do, it like they are disappointing you

Researcher: Hmm

Mr. Bulunga: That is actually. I mean, and so

Researcher: That was an, that is an extra effort from your side to make sure that they get to school on daily basis

Mr. Bulunga: Hmm

Researcher: But it's not as if they are, they were struggling with transportation.

Mr. Bulunga: Sometimes, you know, you did need to develop that kind of love

Researcher: For them.

Mr. Bulunga: Eh, that kind of,

Researcher: And they are also, will be attracted to you because they know, you love them.

Mr. Bulunga: That kind of love with their parents, the good parents, to know where they are staying these kinds of things. So, if you don't, they'll dropout

Researcher: Hmm

Mr. Bulunga: And normally, the ones that dropout is because you can't be able to assist them. You won't love them. So, once you bring them closer to you or phone them. You see, there's one tall one who was here, that one is underperforming, when he underperforms, he ends up hating you

Researcher: As if you are the one who just mark him down.

Mr. Bulunga: When you hate the subject, you'll hate the teacher who is teaching the subject

Researcher: Exactly, I got that.

Mr. Bulunga: So, once you bring him closer, he will starts loving even your subject, yeah.

Researcher: And also, when, once they love your subject that they also tend to want to know it and become better

Mr. Bulunga: And so, you need to bring them closer, love them and then, by so doing

Researcher: So that they will be here

Mr. Bulunga: So, this third one, I have to start doing that.

Researcher: Okay

Mr. Bulunga: The one that I called, the tall one during the break time.

Researcher: The tall one, yeah. That's good, yeah, that is why, you know, initially I said that you, I see that you have that good relationship that makes them to be able to approach you when they have problem. And that is one very good quality that every teacher should have.

Mr. Bulunga: Um

	Researcher: Because when you are too strict, you don't have, you're not approachable, when they have problems, they're not able to come to tell you
	Mr. Bulunga: Um
	Researcher: That also may make them dropout.
	Mr. Bulunga: And it's not easy, now, if a learner is not doing the work, you end up hating him, but now you need to change
	Researcher: Exactly
	Mr. Bulunga: Change, and start to love that person, if he fails, you feel like, this one is going to drop my results. So, you need to change the way you approach him.
	Researcher: Yeah
	Mr. Bulunga: The way you talk with him, so that he can be able to love the subject. If you love him, he'll end up loving the subject, even if the subject is difficult for him. So that will make the subject easy for him
	Researcher: Easy for him, because his already showing interest
	Mr. Bulunga: Yeah, that is the strategy that I'm going to use for them, and I think um.
	Researcher: Good, and it's working for you.
	Mr. Bulunga: They are only six maybe. Yeah, it worked before.
	Researcher: That's good
	Mr. Bulunga: For this year, I'm going to apply that strategy.
	Researcher: Okay, you'll observe it, that's good, I love that. Thank you, sir.
	Researcher: Eleven says, ***how have you been able to prevent learners' dropout and improve on their attendance and retention rate?***
	Mr. Chipo: Okay, the first thing, you have to make the subject interesting, and you have to minimise to be predicted.
	Researcher: You have to?
	Mr. Chipo: The learners should not predict, like say okay, sir, is just going to give us notes, you have to use diversity in assessment strategies.
	Researcher: Okay, what you mean is that, you should avoid learner predicting your...
	Mr. Chipo: Yes, so obviously, I must have different teaching strategies.
	Researcher: Avoid being predicted by learners.
	Mr. Chipo: Of course, by making the subject interesting.
	Researcher: Diverse, okay, thank you so much sir.
12.	**Researcher:** Now let's move to the next question, which is twelve, ***how would you describe your learners' examination success or pass rates in the past three years?***
	Mr. Andile: In the past three years? I'm excited. Last year was good, last year was good, I think we have been on the ascendance from 2019, 2020, and 2021. If you check, number one, looking at subject average, we have set up targets. Starting from the subject advisor level, the subject advisor is an area office there, she has encouraged us to set up targets, that's one. Two, we have also had a new principal, so a new broom, she comes in with new demands. So also, that pressure and all the efforts that we have been making already, I think it has helped us also to push up our pass rate. So, like last year, to be more specific, in my class only, I have five distinctions. My highest is one of the, the highest learner was also in my class with 88% for Life Sciences. That was, I think one of my highlights, five distinctions.
	Researcher: Last year?
	Mr. Andile: Last year, 2021 class. So, it's for Life Sciences, if you check the national average is in the number of this, It's not that easy.
	Researcher: It's not.
	Mr. Andile: Yes, So, if you can check some of those certificates there, there are incentives from the school, they gave us some vouchers, you see those.
	Researcher: Okay,
	Mr. Andile: You'll check them on your way out.
	Researcher: I mean, I will require you to send me pictures of that.

Mr. Andile: I'll do that. I'll do that, I’ll send you.
Researcher: Please.
Mr. Andile: Yes, that's not a problem. So, I'm glad the trend is improving
Researcher: On upward trend
Mr. Andile: We have targeted the subject average, we have also looked at the past percentage,
Researcher: Okay
Mr. Andile: So, our past percentage also, this has been because, also I think we are targeting to say, let's look at our weaker learners. Let's invest more of our time. We had a program here in the school, where we invited only the weaker learners. We started analysing early in the year, March examinations, we checked already, how many learners have failed, what do we do? Intervention quickly, June, after June, we checked again, if we have improved the number, then preparatory examinations, after preparatory examinations, all learners who have not passed up to the standard that we expected were here on a daily basis under supervised study. So, we made sure that that works for them. We provide material, we provide past exam papers and everything, so, it worked.
Researcher: Thank you sir.
(It has been on the ascendance. 5 distinctions obtained in the 2021 matric final examinations. Many learners obtained level 6 and that was a huge improvement from 2019 and 2020).

Researcher: Then ***how would you describe your learners’ examination success or pass rates in the past three years?***
Mr. Bulunga: Um, from the past three years, because the third year, I was not teaching Grade 12, eh, I started here in 2019.
Researcher: Okay, you started in 2019, Grade 12 in 2019?
Mr. Bulunga: 2019. When I started here, I was coming from the other school, yeah, they brought me to the school here
Researcher: Okay
Mr. Bulunga: And then uh, it was a transfer, but from the first year, the, we were position one like I told, the sub-district, the sub-district is Rustenburg as a whole, those white schools and everywhere, so we become position one. In the discharge of
Researcher: So that one was position one?
Mr. Bulunga: Yes.
Researcher: So that position one means that um
Mr. Bulunga: Position one with the average performed, like, you know
Researcher: The least?
Mr. Bulunga: No, no, no.
Researcher: The highest the highest?
Mr. Bulunga: The highest, yes.
Researcher: Okay.
Mr. Bulunga: Like 62 average it was 62
Researcher: Okay, as in 62% average
Mr. Bulunga: 62% average
Researcher: That is in 2019?
Mr. Bulunga: Yes, 2019 or 2020, we are in 20?
Researcher: 2022, no we can’t count this year because the learner is
Mr. Bulunga: Oh yeah, they are 2019. 2019 or 2020 I don’t have the results. And then uh.
Researcher: But was 2020, was 2020 better than 2019?
Mr. Bulunga: Yes, it went high.
Researcher: Okay, better.
Mr. Bulunga: But these ones were um, position one, in the sub-district and they become position two, in the Bojanala district, Bojanala and Brits, Sun-City
Researcher: Okay
Mr. Bulunga: And the position of five in the province. So, this must be the average when I arrive
Researcher: Position five in the province?

Mr. Bulunga: Yes,
Researcher: That means, it's a good is a good result.
Mr. Bulunga: So, this year now, this, the last year 2021 uh?
Researcher: Yeah, last year 2021
Mr. Bulunga: Uh, then, this is 2020, 2021. And these ones they become position one in the sub-district, position one in the district, position three, they move from five to position three, so it.
Researcher: That is to say, it is, this one position
Mr. Bulunga: We are with the average of 70% now
Researcher: In the province, let me say province now.
Mr. Bulunga: Uh
Researcher: It was, 2019 was position five?
Mr. Bulunga: I think 2019, I have not started teaching here, I didn’t have Grade 12. 2020
Researcher: Okay, what I will look at it’s this, I want to look the 2020, Even if you were not teaching, I want to see, because when you came in also, it was a plus, because they didn't go down.
Mr. Bulunga: Uh.
Researcher: It was an increase. That was what I’m looking for, position five, then in 2020, they were position?
Mr. Bulunga: Position one in sub-district
Researcher: No, the province?
Mr. Bulunga: The province, three
Researcher: Three
Mr. Bulunga: Uh.
Researcher: Then
Mr. Bulunga: I think its 2021 three that is the last year one.
Researcher: Okay, 2021, 2021?
Mr. Bulunga: I think three
Researcher: Is three. This one (2020) is position five?
Mr. Bulunga: In the province, yes.
Researcher: But you don't know whether it was. You were not there then, you don't know whether it was? In 2019?
Mr. Bulunga: I was not teaching here
Researcher: Okay, you were not teaching here
Mr. Bulunga: We didn’t have Matric
Researcher: Okay
Mr. Bulunga: This one here is the third Matric that we are going to have
Researcher: Oh, oh, oh
Mr. Bulunga: You understand?
Researcher: So now, let me do it like this, okay, position?
Mr. Bulunga: Um, the average was 70, from 62 to 70
Researcher: This one from 62 percent
Mr. Bulunga: Now to 70 percent
Researcher: Now the average was now 70 that was a big jump.
Mr. Bulunga: Um, so it means most learners
Researcher: And it was the same method you've been using, you use
Mr. Bulunga: No, I keep on changing.
Researcher: No, what I mean is, I know you, of course will change, but you know inquiry-based is engaging the learners?
Mr. Bulunga: Is the very same method that I’m using
Researcher: The same engagement, yeah, engaging them
Mr. Bulunga: But, you know, you keep on changing here and there
Researcher: Of course, it's
Mr. Bulunga: A form strategy like the way, you know, using mnemonics, you know mnemonics?
Researcher: Yeah, mnemonics, I know mnemonics, where you use alphabets, a name of a word to make me remember.

Mr. Bulunga: Very, very earlier like that, if the learners are

Researcher: You use mnemonic too, that's interesting, I used to, I used to give my learners that when, when you have a list of something that is getting to almost 10 or 15. I know in the exam, they say list or where something that has to do with a kind of procedural, you understand explanation. I like to use mnemonics so that it will help them remember the next process the next stage the next stage like that.

Mr. Bulunga: Um

Researcher: Now, it's a good way of, it's a good strategy, that's good.

Mr. Bulunga: So, they actually improve, so I wish this year also

Researcher: It will improve

Mr. Bulunga: It will move forward, but now, they are at 50 percent

Researcher: Okay

Mr. Bulunga: It is the first term, I wish they beat that 70%

Researcher: Then you want to push them, that's good

Mr. Bulunga: Um, by the grace of God

Researcher: It's a good push. You are working on them, it's good.

Researcher: Then number twelve says, ***how would you describe your learners' examination success or pass rates in the past three years?***

Mr. Chipo: I would say, fair, it's not the best. Our school, it is facility, I'm sure you can see, we have facilities, but…

Researcher: I was going to ask you that, if the learners are lamenting that they need lab. They need, they need science lab. But it doesn't cost much to start the lab. We are not saying that they must empty the school account.

Mr. Chipo: Yes.

Researcher: You see, even if they are starting with just a microscope may be three, then, the following month when they get money, they can talk to, even their parents, the parents can come in assist, if the parents are informed about it. You see, it was not in this line of questions. But there are questions that I intend to ask you and see how we can help the learners from some of their challenges. Because, after, I like to have the interview with the learners first, before I meet, because if I have the interview with you, before meeting the learners, I will miss, I will not have the opportunity to come back and address certain matters.

Mr. Chipo: Okay.

Researcher: Yeah. So, facilities

Mr. Chipo: Yeah, how would you describe your learner examinations and success?

Researcher: Success.

Mr. Chipo: Okay. But I say it's fair. Okay, we have facilities, we can say our school is Um, but the catchment of, the catchment for our school, we are a township school. We have learners, we have parents that just say, Okay, I pay school fees that, the community, the parents are not much involved. Parents of the learners are not much involved. That is what I can say. Then the other thing, I'm talking about my subject, the learners that I teach, they are not, some of the learners are not science-oriented. The subject choices, you have learners that are doing Math-Lit, history. Our subjects are mixed up. We don't have like science stream, commerce stream, so that is one of the problems that we have, with science subjects, I take Life Sciences, Life Sciences is a science subject, but we have learners that are not science-oriented but they take the subject, that is one of the problems that we have.

Researcher: So, but the pass rate that you had, is it on the progressive trend, or downward trend? What I mean is, is the 2019, is it better than the 2020?

Mr. Chipo: Remember, to compare 2020 and 2019 is difficult because of COVID.

Researcher: COVID.

Mr. Chipo: And remember also, it depends on the group, with the group that we have in that particular year, like, Okay, you call for extra classes, sometimes you find there is a group that doesn't respond. It's, if the group is cooperating, you tend to get

Researcher: is it that their parents don't want to bring them to school, or their parents tolerate them not attending when you call for extra classes, or they're not even aware?

Mr. Chipo: Yeah, like I said the parents are not much, much involved.

Researcher: Yeah.

Mr. Chipo: Because, at Grade 12, it's about the individual not the parents. So, but I can say the results, I would say they have been fluctuating and with a, not a sharp increase but a steady increase.

Researcher: Thank you sir.

13.

Researcher: Question number 13 says, ***has there been an increase in the number of learners enrolling in Life Sciences and other science subjects in the past three years?***

Mr. Andile: Life Sciences, yes. Life Sciences specifically, yes, it has been increasing. It has always been increasing. But to be honest, other science subjects Yeah, it's a bit tricky. Yeah, let me give you the honest truth, Physical Sciences, our Physical Sciences has not been increasing, number of learners, I think it has actually dropped slightly, because the notion now in learners is Physical Sciences is difficult. So, they are not taking that well. So, the response hasn’t been good in Physical Sciences, but in Life Sciences, I don't know whether they are okay, there is another perception also to say, Life Sciences is the easier science subject, I don't know, it’s up to them, but still, our numbers have always been ballooning out of proportion.

Researcher: What about mathematics?

Mr. Andile: Mathematics also, there are learners who have been going there, let me just say, there has been an average for Mathematics. The issue is, for Mathematics there is an option, there is Maths and there is Math Literacy. But we have had scenarios in which most learners come in initially, let’s say, at Grade 10 level, entry level. By the time they reach up to Grade 11, then they realise it's getting tough, then they switch.

Researcher: They switch to Math Literacy.

Mr. Andile: Yes, that has been the scenario. We have had also scenarios where parents will be very adamant to say, my child will do Mathematics, but the performance is not giving us, you know, what we really need.

Researcher: The parent wants but the child is struggling.

Mr. Andile: The parent is trying to say, “I need my child to do Mathematics”

Researcher: Not Math Literacy.

Mr. Andile: Not Math Literacy, yes, but the numbers, I think Life Sciences has been toping up and then Mathematics, then Physics.

Researcher: Don't you think? The teacher? Are you the one taking Mathematics and Physical Sciences?

Mr. Andile: No, not Maths and Physical Sciences

Researcher: Don't you think that there is also a challenge with the teachers?

Mr. Andile: There is, Yeah, there are challenges here and there, our Maths teachers, I think, Maths teachers, then, there's another issue of learners also preferring a certain over another, I've seen that in Physics. They've been doing that.

Researcher: Okay, do you have more than one teacher for each of the subjects?

Mr. Andile: Yes, our school is big, It's more than a thousand learners. So, for every subject, we've got more than one teacher, Grade 12, It has been the two of us only teaching G12LS, but this year we added, we are now three, Physics, there are two teachers, Maths, they are four or so, because there are too many learners.

Researcher: There is a learner, who also said, she is trying to come to terms with your strategy, I don’t want to mention the learner’s name, anyway, but it’s a purpose for learning and to improve. She's struggling because the person who took her, the style of that person is quite different from the style you are using in the class. And what I got to understand from that interview was that the former, she had to leave that class to your class because she was not achieving what she's getting in that class. And what she wants to get she's getting in this class. But now, another suggestion again from that same learner is that they should maintain one teacher for them from.

Mr. Andile: From Grade 10

Researcher: Yea, you understand, she said, because that is where they missed it, because this teacher is boring. Now they come to this one who is trying to say, oh you can make it you can make it. So that is another problem I observed.

Mr. Andile: I think that can actually help us. But now the system in our school is we work with what are known as links, from Grade 10, 11 and 12 we use what are called links, links are based on the subjects that you are taking. So, what they do at the office there is, they put learners, this is Learner A, and he is doing these subjects they enter into the computer, when they enter into the computer, the computer generates a link for that learner. So, learners with common subjects are going to be placed in one class. After doing that, then they allocate to say, okay, for Life Sciences, we have got two teachers, if we have got two teachers and we've got four classes. They just tell you to say, Okay, fine, according to the timetable. Mr. Andile, you are taking link one and link three. Ma'am. Bridgette you are taking link two and link four, randomly so, without, because there's no criteria to say this teacher should teach this learner

Researcher: Okay

Mr. Andile: Yes, so unfortunately, that won't allow a scenario in which a learner can take a teacher.

Researcher: I want to choose my own teacher.

Mr. Andile: I want to choose my own teacher, and then to be honest, you are right, we have had scenarios like those where learners will even bring their parents to say, I want to switch, I want to go to this teacher, but then once we open that, you know it becomes chaotic.

Researcher: Yeah, but don't you also think that what is it that the learners found in a particular teacher that they didn't get in a teacher that want to make them to go to that teacher? Why is other teacher not also, there is no crime in say, pedagogy is the main, main thing.

Mr. Andile: Yes

Researcher: We all can have the content in our head

Mr. Andile: in our head, that’s true.

Researcher: But how do we deliver that content to the learners, if we don't have solid pedagogy, pedagogic skills.

Mr. Andile: That’s true.

Researcher: So, that is where I think that other teachers also need that training.

Mr. Andile: That training

Researcher: You understand, but you know, you don't train people on pedagogy, is something that is inbuilt some worth.

Mr. Andile: That is within, that’s true

Researcher: Within, is not like the content. I think, it’s not a shameful thing for me to say, let me see how this teacher is teaching so that I can adjust to the way he's doing just to attract the learners to sit and learn.

Mr. Andile: I have analysed that. I will answer in two ways. One way is that as individuals, we are different. Just like you said, in terms of pedagogy, it's something that is intrinsic that comes from within. So individually, our personalities are different. So sometimes there are certain things that you cannot change in a person, in an individual. Then number two, there is something funny, if I can tell you again, to disclose is not a problem. I've seen it in most of these learners. I was raised in a system that was tough.

Researcher: I saw that when you said, when you mentioned that, when a visitor comes to our home, our parents don’t talk, they just look at you, and get all the message, a message of one page.

Mr. Andile: My system is this is Africa, if you asked my learners, they’ve quoted me to say, this guy would tell you to say, this is Africa, you reap what you sow. They've said what they have supported, maybe they admired on my side is I force things out of them, I push them, and when I stand up there, it means I'm there watching everybody, I'm screaming up there, there is no chance to sleep. Once you lose concentration a bit, I’m onto you, and I constantly pressurise to make things happen. One girl spoke to me yesterday and said, sir, something funny that I want to tell you that you didn't even know I will tell you is, the marks that I produce here, my parents are just fine with it they'll say it’s fine my girl you will get it next time, don’t worry, but you, sir, my teacher, not even my parents, you tell me to say, you are going to suffer until you get those marks. Sir, do you know what? I want that, some of us as learners, we want that. We want somebody who squeeze it out of us.

Researcher: Exactly

Mr. Andile: Yes, we want somebody who squeeze it out of us, because at home there are parents who will just be content with whatever have. They are okay with it, no, my girl is okay. So, sir, that's what we need from you, even though, we don't tell you that much to say, sir, what you're doing is right, but you squeeze it out of us and you force it out of us. There are moments when we come here and we want to sleep, but you say, there's no free period, nobody sleeps here, everybody works, then so the strategies, techniques, they differ that’s where the issue is actually.

Researcher: Because my great concern in this is that, we can talk about Life Sciences. If the learner is suffering in Physical Sciences and Mathematics, it may affect that learner from enrolling in science subjects in the University.

Mr. Andile: True, yeah, very true.

Researcher: Okay, let's move to the next.

(Life Sciences has always been leading in terms of numbers. Our marketing drive as well as the pride in our subject has been excellent).

Researcher: Let's go to 13, 13 said, ***has there been an increase in the number of learners enrolling in Life Sciences and other science subjects in the past three years?***

Mr. Bulunga: Yes

Researcher: The number, it is on progressive

Mr. Bulunga: It was 9, and then 21 and then 87

Researcher: Okay, that is why, because I know this year alone, your Life Sciences Grade 12

Mr. Bulunga: 87 learners

Researcher: They are 87 learners

Mr. Bulunga: It was 21 last year

Researcher: In 2022, 87 learners, but before, in 2001 are they up to?

Mr. Bulunga: 21, um

Researcher: They are how many?

Mr. Bulunga: 2021, they were 21

Researcher: 21?

Mr. Bulunga: Um

Researcher: What a good, what a big push

Mr. Bulunga: When I started, they were actually 19, 2019 to 2020

Researcher: Let’s say 2020

Mr. Bulunga: They were 9

Researcher: 9 learners

Mr. Bulunga: It increases

Researcher: Is this increase also, um, does it reflect on other science subjects like Chemistry-Physics

Mr. Bulunga: Yes, yes

Researcher: And Mathematics

Mr. Bulunga: Because, these ones are Maths and Science also

Researcher: Okay

Mr. Bulunga: So, these ones are Maths and science also

Researcher: So, the same increase that you have in the enrolment in Life Sciences, you have same increase also in Maths and Science

Mr. Bulunga: These learners are doing Maths and Science, these ones also are doing Maths and Science, they were doing Maths and Science, these ones here they are 21, you see 21 Maths and Science

Researcher: Maths and Science. Okay, the additional are those ones who are doing other subjects, Okay

Mr. Bulunga: But in my Life Sciences, they have increased

Researcher: Okay, but in the Life Sciences, it increased

Mr. Bulunga: Um

Researcher: Okay, I got that, that's fine, it’s good. Thank you, sir.

Researcher: Thirteen, ***has there been an increase in the number of learners enrolling in Life Sciences and other science subjects in the past three years?***

Mr. Chipo: In Life Sciences, yes, there has been increases in the number of learners,

Researcher: There's been?

Mr. Chipo: Big increase in the number of learners taking Life Sciences.

Researcher: Big increase in enrollment?

Mr. Chipo: Yes.

Researcher: But other, other science subjects?

Mr. Chipo: Even in Mathematics and Physical Sciences.

Researcher: There's increases?

Mr. Chipo: There's increase, yes, okay to start with, I think the enrollment of the school has gone up. I think that is one contributing factor.

Researcher: Okay.

Mr. Chipo: Yeah, and also, I think because of the outside community that are engaging with the school.

Researcher: It make…

Mr. Chipo: And that is why, it's what has caused these results to be fluctuating. Because remember, the more learners we have, the more challenges we have. So that is why I do not say my results are increasing, this increase include.

Researcher: Okay, that's true, the more learners you have the more challenges you are likely to have.

Mr. Chipo: Yes.

Researcher: Because, it is spread out, it includes the science one, science-oriented like you've said earlier.

Mr. Chipo: Yes, that is what I mean.

Researcher: I got that.

Mr. Chipo: The more the school is becoming bigger.

Researcher: The more challenges you are likely to have.

Mr. Chipo: The more challenges that we are getting, and to get hold of all the parents.

Researcher: That also will deplete your resources.

Mr. Chipo: Yes.

Researcher: Teaching and learning resources, because, even if you had one small lab, it will mean that, once you have more enrollment, it means that, you have to expand the science lab.

Mr. Chipo: What it also means, if I'm checking now, I have to sample the books, I'm not going to check each learner's book.

Researcher: Yeah.

Mr. Chipo: So, you might meet, you know there are some learners that are hiding, they won't give you, their books.

Researcher: I got that.

Mr. Chipo: And so, you can easily miss out some learners, even if a learner bumps, who does not come to school, or he's, you won't notice.

Researcher: You may not notice on time.

Mr. Chipo: You might not notice, that's why, you see now, that's why I give the register.

Researcher: You started with, was that the reason you started with the register?

Mr. Chipo: That is why I have to check.

Researcher: Yeah, I saw you started with the register, it was first thing, you said no, you want to take the register, I saw you insisted.

Mr. Chipo: I want to check everyone who is in, because the group is big, if it was a small group, I can just count.

Researcher: Count and just know they are all here.

Mr. Chipo: But without the register now, I will not be able to count.

Researcher: About forty-eight learners in the class?

	Mr. Chipo: Yes
	Researcher: That’s huge.
	Mr. Chipo: It’s a big class, it’s many, in other schools, if you don’t manage with discipline, you won’t get them right. I don’t know if there is anywhere which talk about discipline, but it’s another factor as well.
	Researcher: Yeah, you see, it’s a problem.
	Mr. Chipo: But discipline, I won’t say it contributes to those kinds of results.
	Researcher: So, being discipline could help to improve results too?
	Mr. Chipo: Yes, it does, it does, then, okay I think there’s, when you say inquiry-based learners, you are saying the learners, they have access to resources?
	Researcher: Yes.
	Mr. Chipo: They must have access to resources?
	Researcher: Because, without. You don’t talk about inquiry-based when there are no resources. How are they going to conduct themselves in the inquiry of a particular task that you have given them, if they don’t have the resources?
	Mr. Chipo: Yes, that is what I, so I think that is one thing, that is one challenge that we have when it comes to inquiry-based, our learners, you know in our school, we use tablets, but they don’t use them appropriately, that is one challenge, with the social media, some of them, they don’t have tablets, so, we must put their books in the tablets, which is difficult from ours.
	Researcher: So, they don’t have hard copy textbooks?
	Mr. Chipo: We don’t have hard copies here, from Grade 8.
	Researcher: Are you serious?
	Mr. Chipo: Yes, we don’t use hard copies.
	Researcher: I was about to tell you that, at the end of interview, there are, what I’m going to ask you, that will be over the phone, is not something we have to sit down and talk about, like giving me the list of the books that you have, just, even a picture of it, and just send to me, and the names of the book, the writers, the publishers, you know, things like that, because that falls under my document review.
	Mr. Chipo: Okay, we don’t use, okay, learners are supposed to have books, my eBooks in their gadgets.
	Researcher: So, what they use is eBook?
	Mr. Chipo: Yes, eBooks, that they fit in their iPads.
	Researcher: Because, because of social media, when they tend to get carried away with Facebook, instead of doing the right thing.
	Mr. Chipo: Yes.
	Researcher: It’s a big challenge?
	Mr. Chipo: Some, they don’t have, they don’t have the tablets.
	Researcher: Even some don’t have the tablets?
	Mr. Chipo: They don’t have.
	Researcher: Wow, then, how, what do they use, what have they been using?
	Mr. Chipo: That is what I’m saying, how do you do inquiry-based learning in that case?
	Researcher: It’s a problem.
	Mr. Chipo: It’s a problem, because you can’t base learning with learners also that, do an extra mile, that’s if he had got access to some resources. So, like what exactly we teach.
	Researcher: Like internet?
	Mr. Chipo: We give them information, because they don’t study on their own, let me put it in that way.
	Researcher: There are a lot to be done by Government, a lot.
	Mr. Chipo: It’s quite a lot, no, some public schools, they use hard copies, I’m just talking about in our, some of the challenges we get when we try to use inquiry based. So, what does that means, it means, I have to give them information, we have to work.
	Researcher: Oh, good Lord. Alright thank you sir, because of your time.
14.	**Researcher:** 14 says ***what strategy or strategies have you put in place?*** I know you spoke about this briefly while you were talking to avoid decreasing number of learners enrolling in Life Sciences

and other science subjects. Can you just touch on it, because I know you spoke about it, so that at least I can have it recorded again.

Mr. Andile: Alright, we have maintained a very good standard of work ethic, especially the science subjects, we've got a new HOD somebody who is working with us constantly, closely monitoring, because what we need to improve, what is the bottom line in terms of science subjects, it is the subjects pass rates. If we do that, then obviously the learners will have confidence in us, so we are working tirelessly towards that. Even I think when it comes to extra classes, we have actually allocated more time, more contact time for the science subjects. Weekends, when the government introduce the weekend lessons, our academic head has prioritised, which is something good, has prioritised to say okay, let's give the science subjects more time as compared to the other subjects. So, I think that has also helped us, because, really, the pass rate is the bottom line, once a learner sees a subject being passed the confidence, now they come in.

Researcher: Thank you, sir.

(We have maintained a very good standard of work ethics and have also embraced a spirit of professionalism and the pride in our subject have kept the learners coming).

Researcher: Number 14 says ***what strategy or strategies have you put in place to avoid decrease in the number of learners enrolling in Life Sciences and other science subjects?*** Do you put any strategy in place to ensure that enrolment continue to increase? But while we, when we ask for enrolment

Mr. Bulunga: Um

Researcher: It means that you are going to have many, many learners in the class anyway.

Mr. Bulunga: That one, is not me who is doing it here

Researcher: Okay, is the school?

Mr. Bulunga: Yeah, it is management, they look at the results of the learners, when they place them, it's just depended how many passes an S in Grade 10, so they place them like that accordingly

Researcher: Okay

Mr. Bulunga: But it's going to keep on increasing, because the school is now growing. So that, it's not me who is doing that

Researcher: Okay, now, the strategy now, is the management who, who handles the strategy of making sure that the enrolment does not drop

Mr. Bulunga: Um, they look at those who have passed an S for Grade 10, they will place them accordingly, those ones are going to do Business Studies and Life Sciences, these ones will be doing Geography and Life Sciences; Geography and Business Studies and Life Sciences. These ones are going to do Life Sciences with Maths and Science.

Researcher: Okay, that is with the management. Okay, I got that. That's a good strategy too. At least it gives you enough time also, to concentrate. It's just like in the first school I went to, it is the management of the school also that work on, but they use um, stream

Mr. Bulunga: Yes, stream yeah

Researcher: Yeah, streams, that is what they use in the first school I went to.

Mr. Bulunga: Yeah, they will take these ones and these ones, for those who are in Business and Life Sciences, is only few numbers of learners like 20, they are less, because they didn't pass well, Life Sciences.

Researcher: ***What strategy or strategies have you put in place to avoid decrease in the number of learners enrolling in Life Sciences and other science subjects?***

Mr. Chipo: Okay, what we've done, we actually, like now, I'm actually overloaded with the number of learners, one thing that works is, know what learners want to do, are they career-oriented? If they are career-oriented, they will stick to the subject, so, number one, you must know why the learners are doing the subject, tell them the opportunities in the subject, discuss with them, the targets, and share with them your previous achievements

Researcher: Okay, you said eh, you discuss, the last one you just mentioned now?

	Mr. Chipo: You share with them, your achievements.
	Researcher: Okay, to motivate them to stay?
	Mr. Chipo: Yes.
	Researcher: Thank you sir.
15.	**Researcher:** ***Have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it?***
	Mr. Andile: Yes,
	Researcher: You’ve been trained?
	Mr. Andile: Yes, the CAPS curriculum does that, the CAPS curriculum has actually centred the attention or prioritises the learner as the main stakeholder in this. So, if you check, most of the principles under CAPS, when we got the training, they are saying, get the learner involved, the learner should be involved in everything that we do. The learner should be involved during your planning learners should be involved, assessments, make sure that the learners get enough assessment, get feedback from the learners. So, in line with the idea with the CAPS curriculum that trained us that we are using right now, I think its spot on when it comes to teaching the learner.
	Researcher: Okay, thank you sir, but you've not been to any formal gathering where people, they call a professional person to come and speak on how to, I don't know, do you have such?
	Mr. Andile: Workshop?
	Researcher: Yes, workshop
	Mr. Andile: Yes, I've been trained on each and every curriculum that I have taught, like I told you, I started from what was called the report 550. That was 2006 very old. After the report 550 I was trained on NCS National Curriculum Statement. After that, it was a Revised National Curriculum Statement, then from there came the CAPS. Then on top of that, now, we have got what we call the PSF Professional Support Forums, right professional support forums are workshops that are subject based. I've mentioned a subject advisor, or subject specialist, somebody who is employed by the department in the area office, like here in Rustenburg, in the area office there is a subject based, I am in close contact with, and there is a lady that I work with there. She likes me that much. Most of the time when we do workshop, beginning of the year, every year, we have got Grade 12 teachers come we sit, we refresh on content, any changes in terms of the content within the subject, we talk about it, examination guidelines, if there are any new things, we talk about it, also the experience that we gained from marking nationally is also very good forum.
	Researcher: Okay, as in marking, marking also you have training there?
	Mr. Andile: I've gone there, yes, I’ve been to the marking centre, before you even sit to start marking learners’ scripts, you have got two to three days of training, proper training with internal moderators with chief markers. That is actually another very crucial aspect that keeps you in touch with the content of the subject.
	Researcher: Okay, thank you sir.
	(Yes, the CAPS curriculum prioritises the learner involvement, and it is very applicable and effective to the subject).
	Researcher: Okay, I got that. Okay, let's move to the next question sir, its 15, it said, ***have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it?***
	Mr. Bulunga: Where did they learn this one? No, no, no.
	Researcher: You have not been trained?
	Mr. Bulunga: Uh, uh
	Researcher: You have not attended any training before like a workshop, where they are conducting a training for teachers, to say, okay, we want to train you how to conduct, how to organise class management?
	Mr. Bulunga: Ha, no, they don't, they don't do these days
	Researcher: Okay, but have you been trained on CAPS? How to make use of
	Mr. Bulunga: CAPS, yeah, CAPS training
	Researcher: That is the training I'm talking about

Mr. Bulunga: Uh, but these people when they train us, they don’t emphasise on how we teach, they will just use slides and they don’t, they don’t put into practice, but some of these things we just um, but we have training on CAPS

Researcher: Like how many, have you gone for training on CAPS regularly?

Mr. Bulunga: Yes, but, when we started, we were going, many times, often.

Researcher: Okay

Mr. Bulunga: Like, yeah.

Researcher: Do you also attend um, this marking of scripts?

Mr. Bulunga: Yeah, yeah

Researcher: But you know, before you start marking, also, there's always this training that is given

Mr. Bulunga: You sit down, we sit down, and they discuss the question paper and stuff like that

Researcher: Yeah, it's also part of the training

Mr. Bulunga: Is it? Okay

Researcher: Because you know, when you go for that training, when you did, from that discussion, you know how, you when you come back now, how you are going to

Mr. Bulunga: Oh, like how, this is how you are going to teach the graph

Researcher: The cognitive levels, you understand how you balance it, you understand

Mr. Bulunga: Oh, we have done it

Researcher: Because those who don't go for that training, who don't go for marking, don't have the opportunity to know how they organise the cognitive level or which area you need to have more questions and you know, just like that.

Mr. Bulunga: Um, like sometimes, we even did the memorandum for National.

Researcher: Yeah

Mr. Bulunga: Before or after learners have written, they call us, like last year, they call us, we sit down, we type the memo, and we send it to Pretoria.

Researcher: Yeah, exactly. That's what, that's part of the training. That means you've been trained, is just that um, you, you

Mr. Bulunga: I need more

Researcher: Ha, you do need more?

Researcher: Number fifteen says, ***have you been formally trained on the use of IBL or your preferred approach to teaching and learning, if yes, how applicable is it?***

Mr. Chipo: Yes, yes, I am.

Researcher: How applicable it is to, the training you have now, how applicable to it in reality, you know sometimes we go for training, they’ll say, do this, do that, then you, but when you come to class, that training is it applicable in the class?

Mr. Chipo: It’s not 100% applicable, because now, like we were talking about the resources that we have, they limit you to use that method, so the way you are trained and the way you must come and present, sometimes, it is difficult, time is another problem also, if you say, I’m going to use inquiry-based method, how long does it take? You need to inquire, how long do you wait to get feedback from the learners? If you, are you expecting a written work or oral questions? If it is written, how long does it take? Are you going to give feedback? So, time, sometimes, is another problem. We also have a problem of dominating learners.

Researcher: That one, that one has been appearing, that dominating, appeared in my first interview, it was so obvious.

Mr. Chipo: You give learners work, they don’t do it, because you can give homework, is inquiry-based learning, isn’t it?

Researcher: Yeah.

Mr. Chipo: They don’t do it, is it going to work? So that’s another problem, lack of cooperation from learners.

Researcher: Okay, but when you have a problem like this, where the learners are not cooperating, you don’t have any disciplinary measures that you can put in place to make, to ensure compliance?

Mr. Chipo: Of course, number one, you have to manage your class, you have to manage the discipline of your class that is very important, your learners must know what you want in your class, you will be having your class rules. But now, the thing is, the agreement with learners and you don't want to pull them down at the same time, but you have to tell them now, no, let's give someone a chance. But discipline, I can't say it's a big challenge.

Researcher: It was another challenge I observed from the interview with the learners, these high performing learners, want you to just move on.

Mr. Chipo: Yes.

Researcher: not, I had to tell them, the example I gave them is this, every educator is a father and a counsellor.

Mr. Chipo: Yes.

Researcher: Now, if as a father in the house, you have six children, two boys, they are able to cut the pap and swallow it, they are full on time, but the remaining ones, they have tiny hands

Mr. Chipo: Yeah.

Researcher: Before they cut twice, the food is finished

Mr. Chipo: Food is finished.

Researcher: And you as the father, you must, it is your responsibility to make sure that others too are full

Mr. Chipo: Yes.

Researcher: These guys are full, but what about, should we leave them hungry? No, you know, alright, thank you for that. Let's move to the next question sixteen.

16.

Researcher: Let's move to the next one. And the next question is 16. Getting close? ***Do you think you need more training on IBL? Do you need, you think you need more training to improve classroom management?***

Mr. Andile: I'm always welcome to training, that's why I took this opportunity, I think you thought I was going to be lazy or to be. But I'm happy when I have moments like this where we discuss subject, where we discuss, you know intellectual aspects like these, I'm happy to do it. I'm not one person who sit and relaxing, I don't like that. Because once you do that, it means you are blocking other developmental opportunities.

Researcher: For yourself.

Mr. Andile: Yes, so when it comes to training, I would never say no to training, yes, I definitely need, there is need for training with regard to planning. You can never say you are up to date you are 200% Perfect. There is always need, remember there are dynamics within subjects, things keep on changing. So, you need to always adjust and adapt to those changes. So training is always necessary. On top of that, I think we're also looking at a different calibre of a learner, the learners that we are teaching these days are different.

Researcher: They are not the kind of learners we have in those days, and that is why the training is important.

Mr. Andile: Exactly, they are not the learners that we previously have. So, the change in the calibre and the mind-set of the learner, it needs you to be trained, it needs you to adjust so that you understand what you are dealing with. You definitely, training, definitely we need.

(May be more training on planning more than classroom management; but more training is always welcome to improve competency).

Researcher: Okay, let's go to the question. I think that is the next question, you are already answering that. The next question says, ***do you think you need more training on IBL or your preferred approach to improve classroom management?***

Mr. Bulunga: Yeah, a lot you know, maybe there are some that I'm missing, let it be a formal training where I'll concentrate on, eh, how do you give learners activity and then after that, what do you do next, in a formal way, and then, only on, you know, in a formal way, only on that, not to do a lot of things at the same time.

Researcher: Okay

Mr. Bulunga: You understand what I'm saying?

Researcher: Yeah, I got you

Mr. Bulunga: Um, like if is this IBL, what is IBL? and then you can put learners in, we don't do those kinds of things, you can put learners on groups, give them the activity, after that you mark the activity, you can give them the topic to present in the class, like that, that kind of workshop, it will assist maybe

Researcher: So, what you are saying now is, if you, um, you are talking about, you looking forward to see a kind of training where they specifically concentrate on inquiry-based learning

Mr. Bulunga: Um

Researcher: And they start to give you training on how to what you can do to make sure that the learners is more engaged in the class

Mr. Bulunga: Um, more engaged, what about the learners who are underperforming, learners

Researcher: How do you handle them?

Mr. Bulunga: How do you handle those who are underperforming, yet there are those who are performing, you can give them extra activity, what about these ones? Who are underperforming? Um, what do we do now, so that we don't leave the others like that?

Researcher: Okay, okay

Mr. Bulunga: Formal, formal um

Researcher: Not just

Mr. Bulunga: Formal training only on one, um, inquiry-based learning, this is for, what do you do and like that, work activities, you understand? Like after doing that, they check the way of, a formal workshop

Researcher: A way of formal workshop

Mr. Bulunga: Where you give certificates, you see

Researcher: Um, at the end of the training, I got you

Mr. Bulunga: Um, um

Researcher: But that has never been done. Okay, I understand, but in case, let's look at the question, do you think you need more training on IBL or your preferred approach? No, this, the way I want you to answer this question now, from your, I don't want you to answer it because if I'm asking you to give me the answer, based on this one, I'll be making a mistake, because from the last one, you've not really had a formal kind of training.

Mr. Bulunga: Um

Researcher: But if you look at the way you are teaching now, which area do you think you need training to be able to handle?

Mr. Bulunga: You have seen how I teach

Researcher: Or do you think you need more training?

Mr. Bulunga: Yeah, at least you have seen how, a bit, you see how I teach, I use projector neh?

Researcher: Yeah

Mr. Bulunga: I think that now using a smart board, do you have smart board? In your class, do you have a smart board?

Researcher: No, I don't. I know the smart board you are talking about

Mr. Bulunga: You have you seen it?

Researcher: I've seen it

Mr. Bulunga: In the class I do, we do have smart board in the class

Researcher: Okay

Mr. Bulunga: You see in that class, is at the back there

Researcher: Okay, you have it there

Mr. Bulunga: Where you were sitting, it was opposite you that side

Researcher: Okay

Mr. Bulunga: So, I need training on the smart board, you know, I've watched a lot of videos, um videos, where they teach using smart board. You can be able to do whatever you want to do with the board

Researcher: With the board

Mr. Bulunga: And then, that I think it will make, it will produce more

Researcher: More attractive

Mr. Bulunga: More attractive, more results.

Researcher: Enjoyable and interesting

Mr. Bulunga: Um, so that is the only way that I need that one, because now, I've seen that this one, this method of mine is working a lot for me, you see. So, I wish that teachers can use it

Researcher: Be trained on the use of smart board.

Mr. Bulunga: But I wanted to tell them, but they didn't want to listen during marking. And then now, even if you want to talk about the results, you, starting with the questions, I know that this one, my learners got it correctly. And they said um, learners are failing, I'm telling them not mine. So, they think that it is less strategic, I give them strategy, they don’t teach them. So, but, if they can train me with a smart board, you know, basic, what did you call it?

Researcher: IBL

Mr. Bulunga: IBL using smart board

Researcher: Smart Board, okay

Mr. Bulunga: Um, smart board to explain um

Researcher: Using smart board

Mr. Bulunga: Um, because it's not even in my lab, it's going to be very easy. Very easy, because I've seen the videos, where they use smart board, when I watch it, I understand better, what about learners.

Researcher: Okay

Mr. Bulunga: But I do need that training.

Researcher: Using the smart board?

Mr. Bulunga: I think I'll move to 80 now, 80s, where learners are getting the rest 70 most of them, I’m going there, you see, from 60 to 70, from 70 to 80 average. And that means that position one in the district got average 80%, position two got 71%, position three which is me 69.9% that’s 70%.

Researcher: Okay, that’s good, it’s good you mentioned this smartboard, because one of your learners said that, they would like that they have um, the projector, the images that they have on the projector were, um there is a need for the teacher to always allow them more time, these are the visual learners now, you know, some learners they are more on the visual side than those learners that are taking notes. So, they want that visual to remain a little bit on the board until you move, so that they are able to catch up.

Mr. Bulunga: Um

Researcher: Because if they, they don't have that opportunity of being in the science lab, at least, the images that they have, appearing on the slide on your projector, should be able to a little bit clearer, giving them that opportunity to be able to relate what you are saying with the image.

Mr. Bulunga: With the image, um

Researcher: And that is where, when you talk about, I didn't remember, now you talk about, you need training on the use of smartboard, that came to mind, that at least that also will help your learners

Mr. Bulunga: Um

Researcher: To be able to make good progress

Mr. Bulunga: Yeah, because sometimes when you teach, a period takes 30 minutes.

Researcher: Hmm

Mr. Bulunga: Now, if you, like in one picture, then you need to move to the other slide to make it 30 minutes, you understand?

Researcher: Um, exactly

Mr. Bulunga: Like for instance, I think they were talking about genetic engineering, during the last teaching I was using pictures. Like I’m telling them, which genetic engineering can be able to alter the genes? Uh, can be able to alter the genes of the chicken, to make chicken to be featherless, so it should, you see this chicken is featherless, we can be able to produce that chicken without feathers, you see. And then I put a caption of a scorpion there, you see with a scorpion venom, you can be able to take a value from a scorpion put it in the cabbage, that will discourage, you know, bugs to eat the cabbage

Researcher: Because the venom will kill them.

Mr. Bulunga: You see, when they look at it, they have to capture it, but you cannot stay there for a longer period of time because of time

	Researcher: Yeah, because of time. Exactly like I told them too, I said, IBL is time consuming
	Mr. Bulunga: Um
	Researcher: And like some of them say, you are very fast.
	Mr. Bulunga: Um
	Researcher: Uh, I said, you need to, you need to cover your syllabus, because, we have, there is a question like that too here
	Mr. Bulunga: Uh, the book is very thick and then by September you have to be done. Then these ones now we are separating. You cannot, like the learners who are faster, whether you ask, we cannot just wait for you, that is why we are separating, when these ones are slow, we group them separately, we give them extra books
	Researcher: So that these ones can move at another pace, these ones can't, I got that, that's interesting.
	Researcher: Sixteen says, ***do you think you need more training on IBL or your preferred approach to improve classroom management?*** You see now we put classroom management.
	Mr. Chipo: Yes, training, training is always necessary, I'll say, training is always necessary.
	Researcher: Sorry, before you go ahead, how many years teaching experience have you now?
	Mr. Chipo: Twelve
	Researcher: Twelve! Wow.
	Mr. Chipo: I have twelve years teaching experience.
	Researcher: Okay, go ahead with this one.
	Mr. Chipo: Alright, like I said, you know with the 21st century and the new things that are coming, there is always room for improvement, always the new way to improve.
	Researcher: Yeah.
	Mr. Chipo: so, obviously, there is, like you, someone who is doing research, like we are doing now, you need to, may be to come up with some strategies that should be implemented, so, I can't say, I am fine, I can't be trained, no, I need training, I can't say, my classroom management is the best, I also need to work on it
	Researcher: Thank you sir.
17.	**Researcher:** ***In which area do you need more training and why?*** you've already explained,
	Mr. Andile: Planning, assessment. I know I'm happy with the way in which I assess my kids, I give them a lot of assessment tasks, I give them quizzes and so on. But like I'm saying things are changing. So, we definitely always need to learn new techniques of assessing these learners, our subject content keeps on changing our questioning techniques themselves they change, for example, in Life Sciences, we used to have question four as an essay question out of twenty. Right now, they've taken that out. So, the paper itself, it has been restructured. So obviously in terms of those assessments you need, you always need training to say, okay fine, now that we've taken out the essay, okay, how do we balance the paper so that it's evenly distributed in terms of the cognitive levels that we need to assess to the learners.
	Researcher: Okay, good.
	(Planning and assessment. To keep up with the ever-changing standards as well as the calibre of learners in our classes).
	Researcher: Okay, because now. Let's look at the next question says, ***in which area do you need more training? You already mentioned?***
	Mr. Bulunga: Um
	Researcher: You said um, the use of smartboard. You think you don't need training in, you don't need training in class management.
	Mr. Bulunga: I know I'm fine with that one, like you know indiscipline is something, I don't have that.
	Researcher: You don't have problem of indiscipline?
	Mr. Bulunga: And that is, eh, no, the class is kept very quiet when I'm. You saw them there?
	Researcher: Um, I observed

Mr. Bulunga: They concentrate, they concentrate a lot when I'm in the class, because they want to know what is coming next, every time you tell them, entice them.

Researcher: Okay

Mr. Bulunga: Make it very nice, so that it is interesting. Everybody gets shhh. They want others to be quiet so that they can listen. So, you need to sell your subject in such a way that learners like it, and they want to listen to hear.

Researcher: There won't be need for you to be having headache over, hey, no I ask you to do this, what are you doing? There's no such?

Mr. Bulunga: Um, eh, I don't have a problem with that one, and they are all quiet in my class.

Researcher: And they are all participating, I saw it.

Mr. Bulunga: Yeah, because I don't concentrate on learners who are participating. So, if you are not concentrating, I'm going to ask you, to check whether you are there, so that everybody must participate

Researcher: Eh, that also will make them to participate because

Mr. Bulunga: I don't like who are lifting up their hands like you see in the class I said Thato

Researcher: I remember you called a learner

Mr. Bulunga: Even if she wasn't

Researcher: She wasn't raising her hand, I remember it's, she was the last one you called by the edge, close to the door, I saw, and she got the answer. I took that, I took note of what you mentioned now during my observation. Because, I have seen a situation where, um, when teacher kept on just attending to those who are raising their hands, others will just leave the responsibility to those who normally raise up their hands

Mr. Bulunga: And they can't even think, they can't even think

Researcher: And they won't participate.

Mr. Bulunga: Um

Researcher: So, it is good, spontaneously, the lecturer just, teacher will mention those who don't raise your hands, mention their names to say, okay, because you want to bring them into the game, also so that they can participate.

Mr. Bulunga: Yes

Researcher: That is interesting. I took note of that, I observe that during your, the lesson observation.

Researcher: Seventeen, ***in which areas do you need more training? You just mentioned that now?***

Mr. Chipo: Yeah.

Researcher: Classroom management is one of them?

Mr. Chipo: Yeah, classroom management.

Researcher: Classroom management is one aspect where we will always need training because, every year, you may not be lucky, you'll have one difficult learner.

Mr. Chipo: Yes.

Researcher: Where, perhaps, you know some of these parents even take us the educators as nannies.

Mr. Chipo: Yes.

Researcher: Where, once the child leaves home, they are happy, eh, I am relieved. Now is the problem of Mr. Chipo

Mr. Chipo: Yes

Researcher: Let him solve the problem between 8 and 12 o'clock, so, classroom management is one area where we always need training, and but I don't know if you have why to, is it the only aspect you need training? Classroom management?

Mr. Chipo: I think my filing is not bad, I think I need, may be on lab maintenance, lab maintenance.

Researcher: Lab?

Mr. Chipo: Laboratory, laboratory maintenance.

Researcher: Laboratory maintenance, yeah.

	Mr. Chipo: I think I’ll need some training on that. **Researcher:** Even before lab arrive? **Mr. Chipo:** Yes, even if I am to convert this into a lab, I need some kind of training. **Researcher:** Okay, oh I got it, even if you were to use this place? **Mr. Chipo:** Because this table, this class, I can, you can turn any class into a lab, but with the minimum that I’m having, I think, I think I’m not using my scientific knowledge much. **Researcher:** I got that. **Mr. Chipo:** But remember also, the problem that we have, is that of time, the curriculum emphasises, and doesn’t engage with practicals. **Researcher:** Time management? **Mr. Chipo:** Time, yeah, time management, let me say time management. **Researcher:** You had, you ask that question at the right time, that response was the right one, because the next question says.
18.	**Researcher:** Eighteen says ***how would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class?*** How will you describe the impact? In your own case, will you say it is available or not available? **Mr. Andile:** I can say I’m privileged. I can tell you my school is well equipped. **Researcher:** I'm telling you, with what I saw here, I’m really impressed. **Mr. Andile:** That was why I said I’m privileged. My principal is also a Life Sciences teacher. **Researcher:** I see, you know the moment I got into this place, I discussed, I also spoke briefly about that with the learners during the interview. When you walk into this place, you just know that this is not literature class. We're not speaking English hear, we are science here. **Mr. Andile:** But still, what I can tell you is even before she came in because she was recently appointed, but even before she came in the principal was here, when I got into this lab, it was fully equipped. the number of resources, if you check in the back there, if you check in the corner there, there are boxes, there are microscopes, light microscopes, electronic microscopes, all those models are there. There are specimens, specimens of different organisms, most of the learners if they just walked in there, the things that we are talking about there, they can see specimens **Researcher:** Exactly, that enhance their memory too. **Mr. Andile:** Exactly, you know, there are those visual learners they want to learn by. **Researcher:** They want to see, they learn by seeing. **Mr. Andile:** My projector there is always working. As long as there's a problem, I call in the IT guy, please come and check if it’s working fine. Recently, I requested the principal that I need a document reader, there is a smaller that has got a slide, **Researcher:** Slide, you just flip through. **Mr. Andile:** Still brand new there, I still need to open it and, if you open my store in there, I’ve got slides, many different slides are there. **Researcher:** Wow, you are privilege, truly you are privileged. **Mr. Andile:** Yes, so in terms of resources, I can say resources and facilities, I think there, we’ve got an advantage, what is just necessary is for us to know how to use **Researcher:** Make use of them. **Mr. Andile:** And deliver to the learners. So, in that regard, we are fine. Because we can order from our budget, we can order to say we need more recent charts, we can get them. **Researcher:** That means these resources that you have, has impacted positively. **Mr. Andile:** Positively, definitely that's a positive one. Yes, they have impacted positively. And I also want, I've said this to my learners. The only problem is our learners take things for granted. You ever seen how a learner in a rich or a child in a rich family behaves? **Researcher:** I’ve seen that a lot. **Mr. Andile:** Exactly, there is enough food there in the fridge, it’s packed, what do they do? They are selective, **Researcher:** Yes. **Mr. Andile:** I've always preached that to my learners to say, you never understand how privileged and blessed you are to have all these resources, until you go out there.

Researcher: To one school in the location.
Mr. Andile: In the location, and the good thing about me is I've gone out there, departmental camps, private camps, sponsored by the mines. I've been, because of the experience, I've been called to say, come and teach. I've gone to teach at a school where you will find inside the class like we are saying, there's no single chat related to the subject, the windows are broken, the chairs are not good, so the learners come in, but guess what? The mentality of the learners, they will come in and sit in front of you and listen to you. So, I've said to my learners, you are spoiled, you are very much spoiled because you have got all these resources, but you are not taking advantage of it. You relax.
Researcher: Perhaps the thought that it is the same resources they have, that all other schools have got, maybe they are not privileged to know that they have that privilege.
Mr. Andile: Exactly, they don't know, they don't appreciate it, once the learners begin to appreciate this and take advantage of it, I'm telling you we will excel, we will sit on 100% distinctions without moving without moving.
Researcher: Because they've got everything around here.
Mr. Andile: Yes everything, textbooks each and every learner here, if you come here beginning of the year, this class will be packed with Grade 11 and 12 textbooks, they come in, they receive a pack of their textbooks.
Researcher: They are privileged.
(Our school is well equipped, and the availability of resources and facilities makes it very easy to reach out to the learners).

Researcher: Okay, let's move to the next question, which is 18, we are almost done. It said, ***how would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class?***
Mr. Bulunga: How would you describe the impact? What impact does it has on my teaching?
Researcher: Exactly, and the progress and the success of your learners too?
Mr. Bulunga: I believe if there are resources, then um, you know, I won't be able to struggle, resources
Researcher: Okay, in your case, will you say, do you have enough resources?
Mr. Bulunga: I don't have, I think you have seen the laboratory, now I wanted to do the practical on DNA, you know, extracting the DNA um.
Researcher: From, maybe from the onion
Mr. Bulunga: Or banana or what, so we don't have those, so those things if they were there I was going to do that. And then learners will understand better, you understand, that is in the laboratory. We are talking about the projector that we are using in that class, this one is the one that we are using in the office, if I'm in the class, they (office) want it, there is nothing I'm going to use in the class, you understand? So
Researcher: Because the projector is not big enough
Mr. Bulunga: Um
Researcher: And it's not very sharp
Mr. Bulunga: Like I'm highly allergic to, to writing with a chalk, I was so, that powder is getting inside my, um, so.
Researcher: So, is it impacting on, is this non-availability, because or let me say insufficient, insufficient um learning resources?
Mr. Bulunga: Um
Researcher: Is impacting negatively, right?
Mr. Bulunga: Um, um
Researcher: On your efforts, the effort you're putting, because if it's there, it becomes effortless.
Mr. Bulunga: Um,
Researcher: You'll just move on, the learners grab, but because it's not there, so it's impacting negatively on your efforts.
Mr. Bulunga: Yes, yes, yes, they do.

Researcher: So

Mr. Bulunga: It means that, if they were there, otherwise from the average, the performance of learners will increase

Researcher: That is why I said even performance, because it means that, if they are there, it will help the learners to understand, like some of them have complained too, they said um, the lab, yeah, we know is there now, but we are not yet, we have not started using it.

Mr. Bulunga: Um

Researcher: So, they were pleading, I even advise them to approach you, and so that, in a very polite way, talk to the school authority to please

Mr. Bulunga: Um

Researcher: Speed up, that of the lab, so that, they can at least, they can have a feel of it before they get to the university

Mr. Bulunga: Eh, they have to start in Grade 10, the other ones, they started in Grade 10, eh, their performance becoming better now, when they are in that Grade 12, and they are used to the lab and stuff like that. Because at Grade 12, or you stuck there.

Researcher: Hmm

Mr. Bulunga: Grade 8, Grade 9, Grade 10, Grade 11 and Grade 12, they are used to the lab now, so when you are in Grade 12, you don't struggle, now they know everything about the science lab

Researcher: Exactly

Mr. Bulunga: Now, it become easy in Grade 12, so going to have a lab practical on Sunday after school, because they are lacking, you know this practical path of Life Sciences

Researcher: That's true. Alright thank you sir.

Researcher: ***How would you describe the impact of availability or non-availability of learning resources and facilities on your preferred teaching and learning approach, considering the size of your class?***

Mr. Chipo: Alright, now, like you saw my class, it was packed, I can't do, it's a problem, inquiry-based learning, you need every learner to have an opportunity, they have to express whatever they know, but in a big class, it's one problem, you can't give each learner an opportunity, because the class is too big, right? Then, okay, like we were saying, the learning resources are limited, so, you end up only going for the lecture method, if you are teaching a very good class. Even if you say, inquiry-based learning, you are going to sample, you are not going to give each learner, an individual attention, but you will sample just few.

Researcher: So, the facilities or lack of, unavailability of science lab has impacted negatively?

Mr. Chipo: Negatively, yes.

Researcher: Is the school planning to get you, even a small lab to start with, is it in the pipeline?

Mr. Chipo: Yeah, you know this thing is always in the pipeline forever.

Researcher: But I think with a little push, it will get out of the pipeline and become reality.

Mr. Chipo: It's not easy.

Researcher: And the lecturer, the educator is the one being punished for this.

Mr. Chipo: That is the system

Researcher: Because at the end of the day now, I'm being punished, if I don't have lab to use, to show my learners especially for the visual learners.

Mr. Chipo: Yes.

Researcher: That want to see for them to really understand, then it becomes a problem

Mr. Chipo: There should be hands-on

Researcher: Exactly, this is science, it is not Literature.

Mr. Chipo: There should be hands-on, that's why you see when they go to tertiary education, they struggle, because the teaching method is different, that gap, there is a big gap, the way we teach, and the way things are conducted in inquiry-based

Researcher: And that is another problem that will lead to dropout of science learners in the university, because it becomes very strange.

Mr. Chipo: The teaching methods are completely different, we spoon-feed them here, we give them

	knowledge. **Researcher:** There, they won’t have the opportunity. **Mr. Chipo:** Now, that’s where the inquiry comes in, and they are not used to look for their own information **Researcher:** At a point, while I was having the interview with the learners, I had to tell them to please download videos online, download videos on, if you can do that, if only I have this thing, I would have given you enough videos on laboratory, so that at least, they can start to see how they look like, they don’t, it doesn’t become very strange to them when they get to university. **Mr. Chipo:** Yeah and are used to. **Researcher:** And they start to know the names of the apparatus that are used in the science lab. They don’t get to the university and see they just look as if they are in a different world. **Mr. Chipo:** Yeah. **Researcher:** Alright, my brother, let’s move to the nineteenth, we are almost done.
19.	**Researcher:** Nineteen, ***how applicable is IBL approach. I know IBL now, that's your preferred approach in completing the Life Sciences syllabus within the specified time frame?*** **Mr. Andile:** Um, I can still say, more contact time is needed, especially when it comes to the IBL, because remember now, you are not moving at the pace that you really want to move at. Content versus time allocated, you will need to move very fast. So, more contact time is still needed. So that we can be able to complete the syllabus on time and then allow sufficient time for revision because there's a contact subject like Life Sciences, you will always require more time. So, the IBL is still applicable because you cannot just cruise, you can't do that. **Researcher:** You will waste your time. **Mr. Andile:** You’ll waste your time, yes, you cruise, you are talking to yourself, by the time you want. **Researcher:** You will have to come back again. **Mr. Andile:** You will need to come back again. So, obviously the IBL is the most applicable method that you will need to use. Because if you prefer the lecture method, teacher centred, what are you doing? You are talking to learners, and they will sit and keep quiet. **Researcher:** They will listen and go without nothing. **Mr. Andile:** Without understanding anything, so, definitely you still need to check, get some feedback from them. **Researcher:** But, have you, do you normally complete the syllabus before exam? **Mr. Andile:** Yeah, **Researcher:** That's because you requested more contacts. **Mr. Andile:** We have requested more contact time. Can you see right now today is a Saturday? **Researcher:** Saturday and you have to engage them. **Mr. Andile:** We have engaged them. Then on top of that. We, we don't have a life my brother, you need to be passionate about the profession. Every Monday, every Wednesday, Grade 12 are in class until five o'clock. **Researcher:** Good Lord. **Mr. Andile:** Yes, our normal teaching time is from seven until two o'clock. From two o'clock exactly, we proceed up to five o'clock. So, Monday and Wednesday, you cancel any other live events that you have. **Researcher:** That you have for yourself. **Mr. Andile:** Yes, then you come into class and teach. So, it's an hour, an hour an hour. So, there are three subjects per day, if you are, we call it the graveyard session, if you are in the graveyard session, you are teaching them from four to five, by four to five when they are walked in here, they are tired. **Researcher:** They are tired. **Mr. Andile:** But what can we do? We have to sit with them, if we do not do that, unfortunately, we can't finish the syllabus. So that's what I'm saying, okay, we need the Saturday, not all Saturdays, no. But then, also mid-week extra classes have also been helping us too, to increase the contact time. **Researcher:** Thank you so much sir. **(More contact time is needed as we also need to give the learners the chance to give their**

opinion, a very extensive content subject).

Researcher: Now, 19 says, ***how applicable is IBL approach or your preferred approach in completing the Life Sciences syllables within the specified time frame?***
Mr. Bulunga: Um, this one, I don’t understand
Researcher: Okay, with this one, it is known that this strategy, where you engage learners, learners are engaged
Mr. Bulunga: Um
Researcher: It is time consuming, because you will not be able to, if you are not careful, you're not able to finish a topic in a day quickly, because you want to give all of them, you want them to be busy, you monitor this person, you move to the next person, especially when you have a large class to attend to, before you go round once, you have spent almost 15 minutes
Mr. Bulunga: Um
Researcher: You understand? So, this approach, this question now is saying, does this approach allow you to be able to complete the syllabus at the end of the year? Each year?
Mr. Bulunga: It doesn't allow me, because I have to keep on switching to, you know, like eh, teacher-centred um.
Researcher: Yeah, teacher-centred is fast it makes you
Mr. Bulunga: Where you just, they keep quiet, you just teach and teach and assess them.
Researcher: Yeah
Mr. Bulunga: So, it doesn't at all, so you need to do like that.
Researcher: So, what do you think you can do more to make sure that you are at least, even if you don't cover it fully, but you are almost covering it?
Mr. Bulunga: Extra classes, as in when you do extra classes
Researcher: Extra classes, extra classes
Mr. Bulunga: When you do extra classes, during the holidays, you see after school, you know, with Life Sciences, I do morning classes from half past six until half past seven
Researcher: Half past six in the morning?
Mr. Bulunga: Yeah
Researcher: You teach half past six in the morning?
Mr. Bulunga: Yeah, but I don't start new topics, you know in the morning we just repeat what we have already taught. So, you just go there, um, in the morning
Researcher: 6h30 in the morning?
Mr. Bulunga: I must be here, I put the speakers there
Researcher: There’s work to be done in your school
Mr. Bulunga: Half past six yeah, half past six, it enhances the performance sir. There I want to assert in Rustenburg position one, Bojanala position one, um.
Researcher: Okay, if not that, they won’t move to that position.
Mr. Bulunga: That is why, so in the morning, we are here, but now its winter, I've stopped. There is this class who are doing Mathematics only, but with Life Sciences because it's dark, so, I’ve stopped, and I have moved to the management position now, I’m acting HOD of Life Sciences, now in the morning we have to prepare for management
Researcher: Okay
Mr. Bulunga: Um, I take them for the tea, but half past six, they were here
Researcher: They were here attending classes
Mr. Bulunga: We push, push, and push
Researcher: But with all those intervention puts in place, were you able to cover the syllabus.
Mr. Bulunga: Yeah
Researcher: Okay, you were able to, because, if not for those interventions you won't be able to cover it
Mr. Bulunga: Um, we finish it before, because preparatory examination is in September, they have to be done with everything, so that we can have also enough time for the revision
Researcher: For the revision um, which is good, thank you. So, this in a nutshell, this intervention

	put in place helped you to be able to cover the syllabus? **Mr. Bulunga:** Um **Researcher:** Nineteen says, ***how applicable is IBL approach or your preferred approach in completing the Life Sciences syllabus within the specified timeframe?*** **Mr. Chipo:** I think we. I spoke about this. **Researcher:** I thought it was the next question before I said, we have moved to the right question. **Mr. Chipo:** I answered this. **Researcher:** Yeah, this one is not feasible. **Mr. Chipo:** The problem is, okay with Matric where there is external examination, it doesn't work. You don't use a time-consuming method if you are having external examinations. **Researcher:** I don't get that. **Mr. Chipo:** What I'm saying is, inquiry-based learning, if I don't give my learners time knowledge, the syllabus coverage on time, then, what it means is, I will be forced to go back, because I'm going to use a lot of time inquiring and then I realised, but they are not given external examination Umalusi, if I'm going to assess myself, it's better, you understand? **Researcher:** I got it now. **Mr. Chipo:** Teaching, you try to implement teaching methods that are fast, when it comes to being examined. **Researcher:** In order to be able to meet up? **Mr. Chipo:** To beat, you have to beat time. So, inquiry-based learning, okay. **Researcher:** Is time consuming? **Mr. Chipo:** Like a said, at what stage do you do inquiry-based learning? Is not a method that you do, you can use in isolation. You have to infuse with other methods, then you use it at later stage, like I have said, the learners that we have, they don't look for information themselves. We as teachers, we give the information, of which inquiry-based learning is not about that, learners must look for information, then as a teacher you go and add one, but are our learners inquiring knowledge? Are they inquiring contents? They are not. We have the kind of learners that we have to work to teach, you see where I ended now, I'm going to take it from there, right? **Researcher:** Know that they'll come to class, the other aspect that you've left, they'll come and be the one to tell you, in this aspect is like this, then you'll know that they have done the work outside class. **Mr. Chipo:** If it was that, I was going to inquire, but we don't have those kinds of learners now, right? **Researcher:** Is there no plan to build the next set of learners that are coming behind, to fit into that inquiry that is ideal for us? **Mr. Chipo:** To start with, the curriculum is not continuous, you find that, Life Sciences Grade 10, it's a kind like a different subject on it on, you understand? It's different topics, 10, 11, 12 is different topics, so the topics that we are doing in Grade 12, very few things were done in the lower Grades, if they were done may be, what are we doing now? Junior Grades, its new things. **Researcher:** Thank you sir.
20.	**Researcher:** Now, the last question, which is question 20 said, ***what would you recommend to improve teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education?*** **Mr. Andile:** Right, this is a beautiful subject anyway. **Researcher:** It is, it is. **Mr. Andile:** Yes, it is a beautiful subject. There are basics that learners need to master. If we, if we can do that, like the question says from elementary level, and then if we build that proper foundation, they are what we call biological skills. If you go down to NS, learners are taught the scientific method, to say, learners would identify phenomena, question a phenomenon, hypothesise after hypothesizing, then check the variables, create variables, then from there, you can be able to conclude what you have hypothesised. So, the scientific method is a very crucial one, where learners are taught to do hypothesis testing, that's one, biological skills, it is a foundation, where learners are taught to gather information, and to present information in various ways, how to present information

in form of tables, in form of graphs, line graphs, bar graphs, histograms, pie charts. For me, that's a foundation. Once you provide that necessary foundation to the learners when they come in knowing the scientific method, knowing the biological skills, they have got the start-up that is necessary for them to proceed, because if you check what I've just mentioned right now, you will go a long, long way from Grade 10, 11 up to Grade 12 into the final examinations with those skills. I've mentioned before, the concept of the terminology itself. What makes most of my learners scream sometimes when I'm teaching here is, when I bring in a new biological term, then they are like, “wow”, you heard when I mentioned amniocentesis.

Researcher: Yes, I saw their response.

Mr. Andile: Amniocentesis, they say, even when I write, they say “ooooh sir” make it fun, whatever I've done, I've tried my best to use a quiz.

Researcher: Okay

Mr. Andile: Learning should be fun.

Researcher: Yeah.

Mr. Andile: If we make learning fun then our learners will get involved, I've done this in class where, either I give them to say, before we start 15 minutes, everybody sit down, take a worksheet, 15 questions, biological skills. Okay, quickly, I’ve got some chocolates in my drawer there. Right? Who got 15 out of 15, Yes, I throw chocolate around. Right, why? Number 2

Researcher: That’s interesting.

Mr. Andile: If I’ve got time, when I get into the class, I say, alright, boys and girls split. Girls this side boys that side, biological terms, let’s start.

Researcher: That’s interesting

Mr. Andile: You are getting points, alright, you are getting points. You know, it drives them, it gives them that motive to say, the girls cannot beat us and I’ve also assured the boys to say, during my days in school, I never allowed myself to be beaten by a lady.

Researcher: Beaten by a lady.

Mr. Andile: You know that story. Okay, we are not being sexist boys, but you got what I’m saying here, but, if you check right now, you know, most of my girls’ children, they are intelligent, most of my boys, I'm disappointed they won't beat the girls. It's a general trend here in South African.

Researcher: Now it’s not even part of my questions, but I’m forced to ask this one. You know during my gathering, my literature review, I spoke about the notion, that we use to have those days, where it is believed that um, by certain group of people that science is meant for boys, but the trend is twisting.

Mr. Andile: The trend is changing, you are right, you are very right.

Researcher: Is twisting, it’s going the other way round.

Mr. Andile: During our days in school, I can tell you to say, you would find boys sitting in science class with two or three girls.

Researcher: Girls.

Mr. Andile: and the two or three girls sitting there.

Researcher: They are hot.

Mr. Andile: Razor sharp.

Researcher: They are hot

Mr. Andile: They are hot, exactly.

Researcher: Even in the university, when we go for parties those days, I remember, you don’t find these science learners attending parties, they don’t have that time.

Mr. Andile: Yea, but now I can tell you, to say, the trend is changing, when we do our honours even here, look at top ten performance, you would fine, I’ve been screaming, I’ve had meetings with my boys in this school to say, boys you are going to change this. You find eight girls, two boys. Nine girls, one boy, top ten. Grade 10, Grade 11, Grade 12.

Researcher: Stand by Unisa gate, I was having that discussion with one of my friends, and I said there is no need for us to argue over this, let’s just walk to Unisa gate, by the entrance, and let us just sample. How many males to females go in, and to his surprise, his amazement, if you allow me to put that way, because he was amazed. We had, when we were almost counting 15 girls then we had our first boy, when we were counting almost another next 10 girls then we had another 1 boy.

So, that told me that we have more girls going to school than boys in South Africa.

Mr. Andile: Yea, it’s a worrying trend, it’s really a worrying trend.

Researcher: My concern is this, now, it means that, in the future, we are going to have more female scientists, or more female educated personnel than the males.

Mr. Andile: True, yes than the males.

Researcher: Thank you so much for your time.

(Basic biological skills should be drilled to learners as a foundation to the subject as well as more hands-on activities to improve the learners’ understanding of the scientific process).

Researcher: Thank you sir. The last question is, ***what would you recommend to improve teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education?***

Mr. Bulunga: Hmm, um, make, you have to make, eh, Life Sciences practicals

Researcher: Okay

Mr. Bulunga: Practical what, what, I told about, when you teach um, eh, plant hormones

Researcher: Okay

Mr. Bulunga: Use auxins, take learners outside don't just put learners in the class make it very, very practical you know, I believe that these learners like Life Sciences because now, I make it very, very, very practical. When you teach hormones like auxins, take them to, show them the guy cutting trees there

Researcher: Okay

Mr. Bulunga: Who is doing hash and then take them there going up and down so that they can see, is part of the lesson

Researcher: Okay

Mr. Bulunga: why is this guy cutting this um, these trees, removing the auxins, now when he removes the auxins instead, now why is auxins on the top, when it is here at the tip? he’s actually removing it. Why is it here? Now you explain everything when you are outside, not only, always in the class. It’s life, make it lively. If you are talking about codominance, take them to a dairy, um, where there are cows, with black and white, where there is a bull, take them outside and show them that these things are practical.

Researcher: Yeah

Mr. Bulunga: Like I told you about, types of dominance on the field

Researcher: Yeah

Mr. Bulunga: I don't stay in the class. Okay, I'm going to the class, when I start the lesson, today we are going to do types of dominance, let's go outside and then you go and have the lesson outside. You talk about um, what do you call this? Um, the ovipary, vivipary ovovivipary, these type of reproductive strategies

Researcher: Okay.

Mr. Bulunga: Take learners outside, you take them outside, if you, mutualism, commensalism, don't just keep learners in the class, do practical part of it, go under the tree, show them the nest, this is a nest. Now, the nest, the bird builds a nest on the tree, and then, when it builds the nest on the tree, what kind of relations is that? Symbiosis is there

Researcher: Okay

Mr. Bulunga: Then you showed them, um, show them the weaver bird that is building too much of the, um, you know, the courtship behavior.

Researcher: Yeah, courtship behavior.

Mr. Bulunga: Show them that this is log of nest, the male is the one that is building the nest for the female, if the female doesn't like it, it’ll will find others, there’s a lot of nests there, the other practical aspects

Researcher: Yeah

Mr. Bulunga: So, you don't just keep them inside the class, so by that

Researcher: They enjoy it

Mr. Bulunga: They are enjoying a lot, show them, um, don't bombard them with words when they are writing

Researcher: They will get bored

Mr. Bulunga: Show them pictures, show them videos, I do have videos, um, I have speakers there, during the revision, we do that, show them videos, stuff like that, it becomes very, very easy and it is easy for them to remember

Researcher: Okay, interesting, easy to remember

Mr. Bulunga: Eh, use mnemonic, make it very lively

Researcher: Interesting

Mr. Bulunga: Yeah, interesting, yeah, because I did realise, come up with the new strategies, if you see that this one is not working, change the strategy, come up with something else, um

Researcher: To keep them active

Mr. Bulunga: Um

Researcher: To keep them going.

Mr. Bulunga: Because people just, they like keeping learners inside the class for most of the time. And then, once you said, let's go outside, they become happy, they know at least now, they are outside the classroom, most of the time, we must go outside.

Researcher: Hmm

Mr. Bulunga: Take them outside, take them to the laboratory and website, if there was a lab, because it was going to be very nice and easy. And then like um.

Researcher: Hmm

Mr. Bulunga: Here, we are having Wi-Fi also, don't just teach, eh, if we have something that requires you for the learners to see, like in Grade 11, there is what you call a predation, predator, prey, competition, this kind of thing

Researcher: Yeah

Mr. Bulunga: Show them a lion chasing Impala. Just go to Google and show them, Google, they concentrate, they liked it that way.

Researcher: Um

Mr. Bulunga: These are the type of the learners that we have now

Researcher: Exactly, the visual learners?

Mr. Bulunga: Yes

Researcher: Because of technology

Mr. Bulunga: Use WhatsApp group, take a learner, and make a lesson or prepare peer teaching. Take one learner, the one that you think that is performing better ask them to prepare a lesson for the learners, to present it in front of the learners, alright. Like you saw these flowers, I ask one learner to go and to take presentation with the phone and then send it to me and I sent it to the area office, then they can be happy like that, this is what they like.

Researcher: Um

Mr. Bulunga: And then this is um, we have sometimes when we video it, and then we send it to, while he is now giving the lesson, he said, this is red flower, and while is given us a red and white flower, which is a codominance

Researcher: Yeah

Mr. Bulunga: Eh, so always make it interesting that this exactly that.

Researcher: Yeah, exactly. Thank you so much, sir. I really enjoyed it

Mr. Bulunga: You make it very practical, so most of the time when you plan, plan with them, whatever you are doing, do it with them, these flowers which I have planted outside, I planted it with them. Their ferns, we have done it, when we were in Grade 11, then, we have planted the fern together, they have been able to see the fern, the carnation of the fern, the sore and sori, all those things.

Researcher: Hmm

Mr. Bulunga: So, let them see, see, see. If you teach, um, what do you call this diffusion, take an aroma and go with that in the class, spray it and see.

Researcher: And see, when you spray it in class, when they stay very far, and you ask the person here, do you perceive it

Mr. Bulunga: Um, it is higher here, then, it will disperse

	Researcher: Lower there, yeah **Mr. Bulunga:** And stuff like that **Researcher:** Yeah **Mr. Bulunga:** So, make it lively and interesting **Researcher:** Yeah, practical. **Mr. Bulunga:** Um **Researcher:** That's good **Researcher:** Now the last question is, ***what would you recommend to improve teaching and learning of Life Sciences and to increase the number of enrolled science learners both at the secondary and university education?*** **Mr. Chipo:** Obviously, number one, more practical activities, hands-on. Learners should. **Researcher:** More Practical? **Mr. Chipo:** There should be time for practicals, time for hands-on, demonstration methods. **Researcher:** hmm **Mr. Chipo:** Right? That one always, is something that you need to keep learners interested, because we do teaching, we do a lot of, um, okay, obviously, we need to, to use more ICT, like we were talking about videos, now, we don't have lab, we don't have time, so what do we do? At least we have projectors, I can do that, I have it, I have videos, I can show them, to see the videos or to see how the experiment is supposed to be done. **Researcher:** Okay sir. **Mr. Chipo:** But now, they will be seeing it done by somebody. You know, it will be better if the learners are doing it themselves. **Researcher:** Themselves. **Mr. Chipo:** Alright, so, we can say, ICT, I think it's very important, it also, I think there is somewhere we have also ICT in classroom, how do we, how do we increase learners' retention? I think that one, ICT also, it's something that makes the subject interesting. **Researcher:** Okay, which eh. **Mr. Chipo:** I think it's eleven, question number eleven, will it be able to prevent learners, right? **Researcher:** Yeah. **Mr. Chipo:** ICT **Researcher:** Use of ICT. **Mr. Chipo:** Yes, videos. **Researcher:** Videos **Mr. Chipo:** Videos, it makes the subject interesting, that one, it also helps **Researcher:** That's true. Oh, you've really done well, thank you so much sir, for your time.
21.	**Researcher:** I don't know if you have, the last part says, talks about, suggestion or questions you have for me that might be helpful to me. **Mr. Andile:** Unfortunately, I did not have any question, when I went through this, what I had to say, is thank you for the opportunity, I enjoyed, I like it so much, especially, when we sit with people of who studying further, we analyse the subject like this and we discuss. I think even for my learners also, it's a very good learning curve, after that some boys asked, "why did you exclude us" No, I looked for you yesterday, I couldn't find you. **Researcher:** Couldn't find you, they want to be part of it, I see. **Mr. Andile:** Learning should go on, and we need to make sure that, we keep on improving. **Researcher:** Exactly, **Mr. Andile:** We keep on improving the strategy of delivering the content to our learners. **Researcher:** Certainly, the findings of my research work will be sent to you, so that by extension, you will also communicate the school, because, for every school, I still have two other schools that I need to attend to. **Mr. Andile:** Alright. **Researcher:** The moment I am done, I'll start working with my supervisor on the data I have collected today, so that, henceforth, if there is any other information that I need, it will be over the

phone, because, most of the things you have given to me, are just, just full, rich information you have given to me, very rich information which I'm very appreciative of it, I'm so thankful of what you have done. So, thank you my brother, so much. Then, let's now close this interview.

Mr. Andile: Yes.

Researcher: Then we can then proceed.

Researcher: Thank you so much, sir. The last one is not a question. It is not a question for you. But the question for me in this case, I'm looking at you, if you have any question, you'd like to ask me, because you've given me suggestions. But if you have a suggestion for me also on my research, that you can give me, that will guide me, it is an opportunity for you to please give me, but if there's a question also, you'd like to ask me, maybe on this research or my question or my research topic or area of research.

Mr. Bulunga: Hmm, okay, a few questions.

Researcher: Okay sir.

Mr. Bulunga: Your location of a study, you said these three schools only in Rustenburg?

Researcher: Yes sir, only in Rustenburg.

Mr. Bulunga: So, you're looking at three schools?

Researcher: Three schools.

Mr. Bulunga: So how did you select it, is it at random, random selection?

Researcher: It was um, I went online.

Mr. Bulunga: Um

Researcher: I know of one school

Mr. Bulunga: Um

Researcher: Because when I was here, we normally go to the place, we use their field for our own learners, not their learner now.

Mr. Bulunga: The time when you were here?

Researcher: When I was here, in our campus here, because I was transferred, I was here before I was transferred to Nelspruit.

Mr. Bulunga: Which campus is that?

Researcher: Brooklyn City College.

Mr. Bulunga: Oh, Brooklyn, okay.

Researcher: Before I was transferred to Durban and then to Nelspruit.

Mr. Bulunga: Um.

Researcher: But that's, because, when I prepared the, when I was preparing my research, preparing my questions and all of that, I was here in Rustenburg.

Mr. Bulunga: Um

Researcher: So, what I did was okay, let me take that first school that we normally use their field, because I see, its well organise.

Mr. Bulunga: Um

Researcher: I know that I'll be able to get information that I need from the school.

Mr. Bulunga: That's Gxxxxxxxxx?

Researcher: Yeah, Gxxxxxxxxxx

Mr. Bulunga: Okay Researcher: We were using their field for sports.

Mr. Bulunga: Oh.

Researcher: Yeah, when I was here before I was transferred out of Rustenburg.

Mr. Bulunga: Um. Researcher: So, from there, then what I did was to now look at school that I can take randomly, I went online, I went to the number of schools that we have by um this, this area, because it has to be within this area.

Mr. Bulunga: Um.

Researcher: Then, even also, before I finished making my choice, I also spoke with the Gxxxxxxxx teacher, the educator, if there are schools that he knows that we can also add to it.

Mr. Bulunga: Um

Researcher: So, this is how I was able to, all the, these are parts of what I put together to be able to pick these schools.

Mr. Bulunga: Um

Researcher: So, it's not as if I know whether you have lab or you don't have lab, you see, because, I really want to have schools like yours.

Mr. Bulunga: Um

Researcher: You understand?

Mr. Bulunga: Um

Researcher: And I was lucky to have school like yours that the lab is not already in place. Even the second school Mxxxxxxxx, the lab also not already in place, the learners were lamenting, but the Gxxxxxxxxx, like I said, is well equipped.

Mr. Bulunga: Um

Researcher: The lab is up and running. So, and the learners, if you see, last year in the Life Sciences, the last exam in Life Sciences, I think he got five distinctions.

Mr. Bulunga: Um

Researcher: And that tells me that, because the learners were able to see most of those things physically

Mr. Bulunga: Um

Researcher: They were able to see the lab and that also helps the learners to, that was why I believe one of the reasons why he was able to have good results from learners

Mr. Bulunga: Um

Researcher: Yeah

Mr. Bulunga: Yes, I was looking at the person and the schools you have chosen, those are performing schools.

Researcher: Yeah

Mr. Bulunga: So, the question was, how random it is like, but, it’s, when now

Researcher: But your school and Mxxxxxxxx are on par.

Mr. Bulunga: Yes

Researcher: They are not better than you

Mr. Bulunga: That is what I’m saying, now, I regard my school as position one in Rustenburg

Researcher: The last one is in form of a suggestion, which you have given me a lot of suggestions here, but I don’t know if you have any question or you still have more suggestions that you would like to give me and this one is to help me improve on my research or looking at my topic if there is a question you feel that.

Mr. Chipo: Effectiveness of Inquiry-Based Learning in Teaching Grade 12 Life Sciences, ah, the topic is fine, Inquiry-Based Learning in teaching, yeah, to me, its fine.

Researcher: Okay, is there any question you would like to ask me?

Mr. Chipo: Ah, related to this or something else? So, have you taught Grade 12?

Researcher: Yeah, I have, a lot.

Mr. Chipo: And what method do you use?

Researcher: I use inquiry-based, but it is difficult to cover the syllabus like you have said, very difficult, it’s very difficult, sometimes we have to give them homework to go and do, so that when they come to class it becomes easy for us to move very faster.

Mr. Chipo: But is it done?

Researcher: No, it’s, the problem we normally have is the same problem you just highlighted, learners who will not participate in that homework pull us back.

Mr. Chipo: Yes.

Researcher: You can imagine, just imagine, you have just finished a topic, especially when you are treating Nervous System, you see from Nervous System, the next topic to the next topic, they have the kind of chain.

Mr. Chipo: Yes.

Researcher: That you need the knowledge here to understand the use.

Mr. Chipo: Yes, that’s true.

Researcher: When you get to Hormones and balancing, you know, Negative Feedback Mechanism, when you look at all those lines, they have a way of holding themselves, a learner missed this class and comes here, and when you try to use the concepts in the last topic to explain something here, the learner now looks at you, what nonsense are you saying?
Mr. Chipo: Are you saying that the learner missed the concept, or they are not attending?
Researcher: They didn't attend class, you understand? Because when you attend class, at least you have an idea, even if it's not properly grasped, but at least you have an idea of oh, this is what David is saying. But where the learner didn't attend, and you are trying to say, you said you want to improve your Matric, they give all manner of excuses
Mr. Chipo: Yeah, those ones, I know them. They have problem, second chance.
Researcher: Ah, second chance, why are you calling them second chance?
Mr. Chipo: No, we call them, second chance, so, there are teaching NC or NSC?
Researcher: No, we have the Nated by the side, that is the Nated, that is Business Studies department where you do Business Management, Public Management, Marketing Management, then the Engineering aspect, these are the Nated, then by the side, we also have the Matric rewrite.
Mr. Chipo: Okay.
Researcher: Which we try to improve their marks, so that, they could gain admission into the university.
Mr. Chipo: Yeah, I see, that's why I was asking, are they doing National Senior Certificate?
Researcher: Yes.
Mr. Chipo: or Senior Certificate.
Researcher: No, National Senior Certificate, the same examination they wrote, they join to write the examination in November-December.
Mr. Chipo: Not in June?
Researcher: Not in June.
Mr. Chipo: Oh, you don't have June?
Researcher: We do the June too, but the June, they are not few, in June we may just find like five out of all this number I gave you, out of ninety-two learners, only five learners for June examination.
Mr. Chipo: No, here, majority is June.
Researcher: They are the real second chance.
Mr. Chipo: Yeah, they are the real second chance.
Researcher: Thank you so much for your time, I really appreciate, so this is it, we have come to the end of the interview.
Mr. Chipo: Okay.
Researcher: Thank you, I want to reiterate again, thank you for your time, and the opportunity you have given to me, to be able to do the data collection.
Mr. Chipo: I understand.
Researcher: This I can assure you, the findings of the research work at the end, I will send them to you, we will communicate.
Mr. Chipo: Oh, I know that, that you.
Researcher: From time now, is just communication over the phone.
Mr. Chipo: Yes.
Researcher: I'll be in Nelspruit, and we'll just talk over the phone
Mr. Chipo: Okay
Researcher: There won't be need for me to come down for this purpose
Mr. Chipo: Yeah
Researcher: I may just need to ask one or two questions, which books do you use, which textbooks? **Mr. Chipo:** Okay
Researcher: You know, and I may also require that you just snap this wall for me, snap this wall
Mr. Chipo: Okay
Researcher: With pictures of these signs of, you understand?
Mr. Chipo: Okay
Researcher: So that, I can have a record of them, that, okay, this is how the class look like, because, in most cases, we want when the learners come to the class, they are tuned into, start to

feel that no, this is science class

Mr. Chipo: Yeah, we are in a science class

Researcher: It is not Geography class, you know? So that is another aspect where I will need you to give me information over the phone, so we discussed that. But before we even get to the part where it becomes research, a dissertation, the transcribed message I'm going to get from this audio recording, I will transcribe and send to you

Mr. Chipo: Okay

Researcher: You need to go through them and see that what we have mentioned, is the actual thing you meant.

Mr. Chipo: Okay

Researcher: Not something different, so we don't put into our dissertation, not what the participants actually say or meant.

Mr. Chipo: Alright

Researcher: You understand?

Mr. Chipo: Yes

Researcher: So, I'm going to do that aspect, then I'll, then, after you have done the correction, you'll give me go ahead that everything is in order

Mr. Chipo: So, it will be in audio or?

Researcher: No, it will be, I'll transcribe, it won't be in audio

Mr. Chipo: Okay

Researcher: It will be paper, that is, the purpose of taking this one, is just to make sure that I don't leave vital information out

Mr. Chipo: Alright

Researcher: So, that is the purpose of recording, because at the end of the day, we want to have all the information you've given us, that are going to help us to solve our many problems in the research. So, thank you so much sir for your time

Mr. Chipo: Alright, thank you.

Researcher: I really appreciate, I close this research now, this data collection. Thank you, sir.

Mr. Chipo: Alright

Researcher: Alright sir.

Appendix X: Learner's Interview Guide

The Interview Guide (Learner)

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

The Research Interview Guide

Presented to Unisa College of Education

Ethics Review Committee

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By

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Under the Supervision of

Prof. H. O. Mokiwa

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Introduction

1. **Introducing myself**

I am Naiye Olufemi David, a Master of Education student in the Department of Science and Technology Education, from the University of South Africa, and doing research towards a M. Ed in Natural Science Education.

2. **Restating Purpose, Context, and Intended Use of the Interview**

The purpose of this interview is to find out your perception about the effectiveness of Inquiry Based Learning approach used by your teacher in teaching Grade 12 Life Sciences, and the challenges encountered in using the teaching approach. Furthermore, how the approach motivates you to learn and understand the concepts of Life Sciences and other science subjects. I intend to use the information you provide me to validate data collection from your teacher, literature review, lesson observation and document review. It is envisaged that the research findings will provide support for Life Sciences teachers to become effective facilitators, improve teaching and learning and better execution of scientific tasks, motivate, build and develop learners' interest to learn Life Sciences and other science subjects, encouraging them to becoming critical thinkers, researchers, and lifelong learners, minimise or eliminate dropout among science learners, increase the number of science learners' enrolment into university education and the number of competent and employable graduates and or scientists.

3. **Assuring Confidentiality**

I assure you of complete confidentiality of any information you share with me, and the use of pseudonyms instead of actual names in the transcript and the report

4. **Permission to Tape**

I would like to tape the conversion for recollection of our discussion. Can you give me the permission, if you agree, to tape this conversation, if the answer is yes, I set the tape on; if the answer is no, I take notes during the interview in the spaces I have left between the questions in this guide.

5. **Any Questions**

Before we start, first, do you have any questions about the purpose of the interview, confidentiality, tape recording, or any other thing you would like to ask me? Do you understand all the questions in the interview guide when you read them at home?

Interview Questions for Learners

1. How effective is the teaching approach used by your Life Sciences teacher on your learning success?

2. Describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities.

3. Does the approach encourage you to engage in group tasks and scientific inquiry before and after classroom learning activities?

4. What are the challenges you are experiencing with the teaching approach used by your teacher?

5. Do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?

6. Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?

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7. What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?

8. Any suggestion or questions on the interview or the research topic

Conclusion

1. **Summary check**

Before we conclude, let me go through what you have shared with me:

1.1 Your understanding of the statement ________________________________ and position ____________________________ in question number _____________ is ____________________________________. Did I understand you correctly?

1.2 You believe that ________________________________ (one of the statements in the interview questions) because ___________________________ (reason for the statement in the interview question). Did I understand you correctly?

1.3 Have I left out something you feel is important in this discussion or I have misunderstood you? Please feel free to make corrections, delete statements or add anything.

2. **Closure**

Thank you very much for sharing with me, your perception about the effectiveness of IBL approach used by your teacher in teaching Grade 12 Life Sciences, and the challenges encountered in using the approach. In case you feel you still want to talk to me about anything you might think about after this discussion, kindly contact me through the details below:

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Appendix Y: Learner's Interview Transcripts

QN	Mr. Andile, Mr. Chipo and Mr. Bulunga (Learner's Interview Transcripts)
1.	**Researcher:** It is afternoon. Good afternoon, everyone.
	Learners: Good afternoon, sir,
	Researcher: We are going to have this interview, in a process where, once I asked a question. I'll get response for question one from learners A, B, C, D, E and F, then I'll move to the next question, then we'll do the same thing until we pick the last one, which is the seventh question. There's a particular box that also allows you to suggest anything you want to suggest to me based on these, because I may not see everything, your suggestion may help us to see how we can improve teaching and learning of science, especially Life Sciences. Is that okay? Now, the first question, I will take the response first from learner A, then in that order, then the next again. The first question is this, ***how effective is the teaching approach used by your Life Sciences teacher on your learning success?***
	Learner A: Mr. Andile learner A. It is very effective, when he teaches, he usually informs us about the topic beforehand. So that we can write notes and during class, he will explain thoroughly while making examples, and he accommodates all learning style needed to learn. So, it helps me remember and understand the work efficiently.
	Researcher: Okay, thank you so much. Yeah, let me listen to your response.
	Learner B: Mr. Andile's learner B. It warms up my brain for learning, it provides a deeper understanding of the work and makes learning rewarding, it also fosters curiosity, which leads to better understanding, it gives me an opportunity to take ownership and responsibility of my learning and creates a love for learning.
	Researcher: Good
	Learner C: Mr. Andile's learner C. I haven't seen as much improvement since it has been the beginning for me, but so far, it is working good for me as he allows us to write notes before read through and then add additional notes which helps me understand the work clearer.
	Researcher: Okay, learner D?
	Learner D: Mr. Andile's learner D. The teaching method the teacher uses is very effective, because he allows us to write notes before explaining the work thoroughly making it easier to understand what he teaches and gives me a better understanding of the work.
	Researcher: Okay, learner F, E?
	Learner E: Mr. Andile's learner E. It is effective in that, it encourages us to write and do research on notes before he teaches the topic. If I come across a piece of information or a question while doing my research and which I do not understand, I can always ask him the following day in class.
	Researcher: Okay, good.
	Learner F: Mr. Andile's learner F. It is effective plan in a way that, when the teacher explains the work concept plan to understand this, he often really discusses of the definition.
	Researcher: Okay, thank you so much.
	Learner C: Sir, my daddy is calling me
	Researcher: Okay, please before we get to you. Okay, now let's move to the second question.
	Learner A: it is very effective, when he teaches, he usually informs us about the topic beforehand so that we can write notes and read through, then during class he will explain thoroughly while making examples and he accommodates all learning styles needed to learn, so it helps me remember and understand the work efficiently.
	Learner B: It "warms up" my brain for learning. It provides a deeper understanding of the work and makes learning rewarding. It also fosters curiosity which leads to better understanding. It gives me an opportunity to take ownership and responsibility of my learning and creates a love for learning.
	Learner C: I haven't seen its effectiveness as of yet, since a am adapting to the new learning approach used by my Life Sciences teacher.
	Learner D: The teaching method the teacher uses, is very effective because he allows us to write notes before explaining the work thoroughly making it easier to understand what he's teaching and gives me a better understanding of the work.

Learner E: It is effective in that it encourages us to write and do research on notes he teaches the topic. If I come across a piece of information or a question while doing my research, I can ask him the following day in class.
Learner F: It is good that I am able to know the concept explained in class

Researcher: Good morning, everyone.
Learners: Good Morning
Researcher: Okay, I want to thank you for giving me the opportunity to have this interview with you. And also, I want to thank you also for giving me permission to tape record the interview, okay. So, um, it is not ethical for us to use our real name, the participants real name in our in our data collection. That is why we are using pseudonyms for this purpose. So, but like I've said earlier, like I've explained earlier, I will take the first question, I will read out the first question, then you will respond by saying learner, um, Mr. Bulunga's learner A, you are Mr. Bulunga's learner B, Mr. Bulunga's learner C, E, D, and F in that order. Then we'll go back to the next question, which is question two, then again, she responds, then we go to three in that order until we pick the last one. Can we go ahead now?
Learners: Yes
Researcher: Okay, the first question is, ***how effective is the teaching approach used by your Life Sciences teacher on your learning success?***
Learner A: Mr. Bulunga's leaner A, his teaching is quite interesting and when he teaches you, he uses certain examples for you, in order to understand.
Researcher: Okay, thank you so much. Mr. Bulunga's learner B?
Learner B: It's very effective, because it helps in solving knowledge explosion.
Researcher: Okay, go ahead.
Learner B: It accommodates all types of learning styles.
Researcher: Thank you. Learner C?
Learner C: His teaching approach is very effective, because he uses a projector, so you get to see, you get to see what he's talking about, which makes the lesson better.
Researcher: Okay, the use of projector also helps you to understand, because you see what he's talking about on the projector that is good. Learner E? Learner D?
Learner D: Mr. Bulunga's learner D. His teaching is very effective because he likes to do many examples.
Researcher: Okay.
Learner D: He does examples
Researcher: Okay, example. Thank you.
Learner E: Mr. Bulunga's learner E. Um, his teaching is effective in a way that some lessons you just need to listen attentively. And you don't have to study what you've heard.
Researcher: Okay, thank you so much.
Learner F: Mr. Bulunga's learner F. His lessons are effective, because he uses projectors, he takes actions. And if you don't understand, it takes his time to tell you more about the topic.
Researcher: Oh good, thank you. That is to say that he also spends more time when you don't understand, he'll go back to re-explain to you.
Learners: Yes
Researcher: Okay, thank you so much. Let's move to the next question.

Researcher: Okay, we are about to start. Thank you for giving me the approval to take, to record, to audio record this interview. So, like I've explained initially, we are going to start from the first learner up to the last learner in that order. Then we'll move to the next question, we come back again to the first learner in the same order, like we took from the first time, so I will like you to respond by saying, if I ask the first question, I expect you to say, Mr. Chipo's learner A, so that I'll be able to know which learner, when I'm checking the recording, I'm getting that response from. Are we together?

	Learners: Yes.
	Researcher: All right. The first question here is, ***how effective is the teaching approach used by your Life Sciences teacher on your learning success?***
	Learner A: Mr. Chipo’s learner A. The teaching approach is very effective because he engages with every single learner and helps him or her to improve on their weakest point. Our teacher also gives us a lot of time on a topic until all of us understand it.
	Learner B: Okay, Mr. Chipo’s learner B. It’s highly effective because the teacher engages from one learner to the other, to work out or assess one’s weakness in Life Sciences. He also makes sure that all learners had to understand the topic before moving on. Therefore, we get different approaches on how to answer during the examination.
	Researcher: Thank you. Learner C?
	Learner C: Mr. Chipo’s learner C. It is both effective and helpful because as learners we are able to get a face-to-face teaching individual learning, so that we understand more on the topic, he allows us to interact with the other learners so that we help one another if we don't understand a certain topic that he has taught us. The teacher also explains to us in an understandable explanation and ways so that we are able to grasp the information.
	Learner D: Mr. Chipo’s learner D. I like to say, it's very effective because, eh, he also he always helps us when we are struggling. He, he when we like behind too, he always goes back with what we were learning and explain it so that we can like comprehend the topic when we move on. And he always also motivates us to interact with our friends if we are having trouble. So that's what I like to say to my own
	Researcher: Thank you, okay
	Learner E: Mr. Chipo’s learner E. I would say that it is really effective. The teacher interacts with the learners, so rather than to just stand in front of the classroom and teach, he approaches the learner with a certain problem. And by approaching the learner, the teacher can tackle on the problem the learner has on one-to-one conversations, because most learners are actually nervous of saying their answers out loud. So, when the teacher approaches the learner, the teacher can take on the learner’s problem, one on one, you know, making the learner feel more comfortable and more, making the learner comprehend the topic much better, you know, yeah.
	Researcher: Thank you, before we go to you, learner F. I picked that up from what I saw, and I mentioned that earlier, I saw that shy learners in the class prefer that they come to them to get answer.
	Learner E: Yeah.
	Researcher: Okay, I want us to please be calm, let's take your response. Okay, let's take response of everyone. Okay? Don't worry. It is not. We're not going to report to your lecturer or whatever or penalise anyone. We just need to know where we have weaknesses so that we can improve on them. Okay, learner F, let's take you.
	Learner F: Mr. Chipo’s learner F. I believe that the teacher’s approach is very effective because he engages us as learners and this helps us because, I don’t know how to say it this, but it.
	Researcher: Okay, let's move to the next learner, learner G.
	Learner G: Mr. Chipo's learner G. So, I think that the teacher’s approach is very effective his teaching style, as everyone has mentioned that he pays attention to each and every single learner so that he identifies the problem of that specific learner, so that he knows how to tackle learning difficulties. I've noticed that, as like he explained, especially difficult topics, he would start off like with simple examples, and like simple methods so that it's easier to understand that difficult topic and then built up on that, so that we are able to understand the exam type of questions.
	Researcher: Thank you so much.
2.	**Researcher:** The second question says, ***describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activity?***
	Learner A: Mr. Andile learner A. In Mr. Andile’s class, we are free to ask for re-explanation or any questions, this helps improve my communication skills because he gives everyone a chance to answer questions and to ask. This motivates me to actively participate because I know my questions will be answered.
	Learner B: Mr. Andile’s learner B. My teacher brings the explanation to life. For example, when

we did DNA replication, my teacher demonstrated the unwinding with his hands. He illustrates the work with drawings, tables and graphs. He does not rely on the same volunteers to answer questions in class, he gives everyone in class a chance to speak so that when they are wrong, they take responsibility of their learning.

Researcher: Okay, thank you so much. Let's move to learner D, we'll come back to her when she's done.

Learner D: Mr. Andile's learner D. It motivates me to get a head start on the work we are going to do, in order to understand the concepts, I didn't understand at first making it easier to grasp information.

Researcher: Okay, let's now, let's take you.

Learner E: Mr. Andile's learner E. Since we research the topic before it is taught in class, when he asks questions in class regarding the topic, you may already have the answer which encourages you to answer the questions to participate in class.

Researcher: Okay, good.

Learner F: Mr. Andile's learner F. The teaching approach motivates me to be able to concentrate more in class and be able to understand the work explained in class.

Researcher: Okay, thank you, we come back to you now. Learner C.

Learner C: Mr. Andile's learner C. It motivates me to want to do more research on the topic that we are doing as it increases my researching style.

Researcher: Good, alright, thank you so much. I'm impressed with what I'm getting so far. But like I said, I want us to move so that at least we can cover these, and I will let you, I know you may have some other classes or you need to go home to rest.

Learner A: In Mr. Andile's class, you are free to ask for re-explanation or any questions, this helps improve my communication skills because he gives everyone a chance to answer questions and ask. This motivates me to actively participate because I know my questions will receive answers.

Learner B: My teacher brings the explanation to life. For example, when we did DNA replication, my teacher demonstrated the unwinding with his hands. He illustrates the work with drawings, tables and graphs. He does not rely on the same volunteers to answer questions in class, he gives everyone in class a chance to speak so that when they are wrong, they take responsibility of their learning.

Learner C: It motivates me to want to learn more, do further research

Learner D: It motivates me to get a head start on the work we are going to do in order to understand the concepts I didn't understand at first making it easier to grasp information.

Learner E: Since we research the topic before it is taught in class when he asks questions regarding the topic you already have the answer which encourages you to answer.

Learner F: Concentration in class, able to understand the work explained in class.

Researcher: The next question is question two, it says, ***describe how the teaching approach motivates you to develop new scientific skills and participate actively in lesson activities?***

Learner A: Um, this teaching approach motivates me knowing more about the things that he's teaching, and referring them after you know, and in order to get more knowledge about the things that we learn.

Researcher: Okay, thank you.

Learner B: It motivates me in a way that it makes me inquisitive.

Researcher: Okay, inquisitive in the sense that, it makes you to want to go out to go and find out that is the more you get that motivation. Okay, you want more, even after class you still want to, what did they say? I want to go and find out, that's what you mean, right?

Learner B: Yes sir.

Researcher: Alright, thank you.

Learner C: It motivates me to go and do more research on the topic, if you are talking about the female reproductive system, I'll go and research more about the female reproductive system and the whole process.

Researcher: Alright.
Learner C: It motivate me to learn more.
Researcher: More, thank you so much.
Learner D: Mr. Bulunga’s learner D. Um, his teaching approach motivates me in a way that I want to learn more of what I’ve learnt in class.
Researcher: Okay
Learner E: Mr. Bulunga’s learner E. His teaching approach motivates me in a way that, um, after lessons, I research what I've been taught and observed experiments on what I've been taught
Researcher: Okay, thank you so much.
Learner F: Mr. Bulunga’s learner F. The way sir, um, solve his work, helps me to be more devoted.
Researcher: Okay
Learner F: And when I get home, like I go to internet search about whatever we did in the class, in order to enable me to understand.
Researcher: Okay, what you mean to say is that that motivation gets you even to become more devoted to Life Sciences?
Learner F: Yes
Researcher: Alright, thank you so much. Now, let's move to the next question.

Researcher: Then I’ll go back again, we start all over again from learner A. But before that, I need to read out the question so that you can respond to the question. The question number two says, ***describe how the teaching approach motivates you to develop new scientific skills, and participate actively in lesson activities?***
Learner A: Mr. Chipo’s learner A. I am a very shy person, but my teacher gave me the confidence to speak up in class and also help other learners who are struggling. This teaching approach motivates you to engage with other learners and express your thoughts about each topic.
Learner B: Mr. Chipo’s learner B. I believe that he motivates us to think outside the box as much as we can, therefore we can, we can be able to think, like the questions in the examination are going to be hard, or hit us hard, therefore, I believe is an excellent approach because it allows us to think as many as possible, it also allows us to engage from one to other, remain as we are a team and we should help each other.
Researcher: Okay, thank you so much. Let's move to the next
Learner C: Mr. Chipo’s learner C. The teaching approach, it motivates me to research more about the topic if I'm not understanding. The teacher also allows me to ask him questions in his free time so that I can get more information about the topic, which I don't understand. He also encourages me to use past papers so that I can see what will be asked in exam so that I can understand and also focus on that main topic, so that I will know how to tackle the question.
Researcher: Thank you. Learner D?
Learner D: Mr. Chipo’s learner D. Um, it helps me to do research on, it motivates me to do the research on things I’ve really comprehend. It also motivates me to engage with other learners, so that we can always help each other with our assignments and our school projects.
Researcher: Thank you
Learner E: Mr. Chipo’s learner E. Okay, um, this teaching style motivates me to develop new skills. For example, hypothesis, when the teacher approaches us, and one on one, especially when he approaches us and gives us solutions. It is easier for me as the learner to actually come up with a hypothesis and that conclusion helps me, like I said, create a new hypothesis and therefore strengthening my scientific skills. And, when it comes to the lessons, since I had the conclusion, I had the conclusion that the teacher came up with, I have a better understanding of what's going on. And therefore, I can freely participate and give my opinion when there's a lesson, when there's a lesson, you know, yeah, it makes me feel free, yeah.
Researcher: Okay, learner F?
Learner F: Mr. Chipo’s learner F. this

	Researcher: Go ahead. **Learner F:** The teacher’s approach motivates me to actually want to learn more, eh, it builds up my curiosity you know, you see, and when the teacher does engage us the learners, I believe that it develops our communication skills, you know, so, I believe that this, his learning approach is very motivating for learners so. **Researcher:** Okay, learner G? **Learner G:** Mr. Chipo’s learner G. He's learning, his teaching approach. Although he engages with each learner, he doesn't necessarily spoon feed us, so, that gives us, that motivates us to do your own research, your own, find your own methods of learning a topic other than just getting information from the teacher with that like develops my scientific skills well.
3.	**Researcher:** Now let's move quickly to question number three, which says, ***does the approach encourages you to engage in group task and scientific inquiry before and after classroom learning activity?*** **Learner A:** Mr. Andile’s learner A. Yes, it does encourage scientific inquiry before classroom learning activities, as he usually prefers, we go through our textbook beforehand to understand the concept which makes it easier when he is explaining in class, even after classroom learning, we receive worksheets which I usually look forward to, because I know that I understand the work from the worksheet. **Researcher:** Okay. **Learner B:** Mr. Andile’s learner B. Yes, we always discuss the work as if we are chatting. For example, now me and my friend speak in scientific vocabulary. **Researcher:** Learner C? **Leaner C:** Mr. Andile’s learner C. Yes, he has encouraged me to not be afraid to get corrected, in terms of asking questions and worksheets. **Researcher:** Okay. **Learner D:** Mr. Andile’s learner D. Yes, it encourages me, because the more work you learn beyond the classroom learning activities, the better you become, so it encourages me to be involved in group tasks that involve academics, so that I can also succeed in other fields too. **Researcher:** Okay, thank you. **Learner E:** Mr. Andile’s learner E. Yes, it does encourage me to engage in group tasks because, when we are given worksheets and questions in class, if I do not fully understand, I can always go to my peers and check with them if the answers I have and the answers they have correspond. **Researcher:** Okay **Learner F:** Mr. Andile’s learner F. Yes, it does help me, because I have gained a lot of confidence, when it comes to asking questions in class on being able to correct the others. **Researcher:** Okay, thank you so much. **Learner A:** Yes, it does encourage scientific inquiry before classroom learning activities, as he usually prefers, we go through our textbook beforehand to understand the concept which makes it easier when he is explaining, even after classroom learning, we receive worksheets which I usually look forward to, because I know that I understand the work. **Learner B:** Yes, we always discuss the work as if we are chatting and we (me and my friends) speak in scientific vocabulary. **Learner C:** Yes, he has encouraged me to not be afraid to get corrected, in terms of asking questions and worksheets. **Learner D:** Yes, because the more work you do beyond the classroom learning activities, the better you become so it encourages me to be involved in group tasks that involve academics so that I can also succeed in other fields. **Learner E:** Yes, when we are doing worksheets and I come across a question or activity I don’t fully understand I can ask my teacher or my peers so that we can compare our answers. **Learner F:** Yes, I have gained a lot of confidence. **Researcher:** The next question is, ***does the approach encourage you to engage in group task and scientific inquiry before and after classroom learning activity?*** The question is this,

I will, let me re-explain so that you'll get it.

Learner A: Yes

Researcher: Now, inquiry-based learning or the approach, sometimes, um, does this approach allows you to, to prepare before the next class, or to do some findings about the topic to be taught the following day, before that day? And after the class? Does this approach make you go out there again to go and find out something that will make you understand even better what has been done in class? That's why I'm saying that, are there activities that takes place before the class and after the class. You didn't get that?

Learner A: Um

Researcher: Okay, let me let me put it like this. Does the approach encourage you to engage in group tasks? And scientific inquiry before and after classroom learning activity? Does the system, does this style, method used by your teacher? Does it allow you to want to go and prepare before the class because I know that my teacher may ask me a question. On the next topic. Let me go and do something before the next class. Let me go and find out about the topic because he told me after during our last topic, that in our next class, we are going to do this topic. So, does this strategy allows me, does it make me, does it encouraged me to go and learn before class? And after class? Do we get the question now?

Learners: Yes

Researcher: Okay, can I take you?

Learner A: Yes, it encourages me to discuss the topic and do scientific inquiry, because his teaching strategy is to, it helps by learning now, and when you get home, your research more about the topic we are doing

Researcher: Okay, that is what I want to get.

Learner B: Yes, it encourages me to engage in group tasks, to share what's in ugliest part, what is going to be taught class, and after we talk about what we had in class, we discuss.

Researcher: Okay, alright, okay, thank you.

Learner C: That approach encourages me to engage in scientific inquiry before the lesson because, because while the teacher is teaching, he likes asking questions. So, I, I want to be prepared for when he asks, when he asks us a question, I can be able give him an answer.

Researcher: Okay

Learner C: And after the lesson, it does encourage me to engage in group tasks, because our wish is memory shared. So, we share what we had in class, and I explained to the other learners to understand.

Researcher: Okay. If I may also ask this question. I'm asking you now, do you, because when I was looking at the, this morning, when I was checking, when I was observing the teaching approach used by your teacher, I observed that there was a point where he asked you guys to collaborate, to work together to discuss. That is effectiveness of inquiry-based, because now you are inquiring information from the next person, what is your understanding about this, the person gives his or her own idea, and then you now also see your own idea. And both of you are able to put your information together this oh, this is the best thing, this is the right answer. So that is collaboration that is class participation. That is what I am looking for, in my research. We want to see if teachers are doing that, and I saw it happen in your class. So, when we talk about after class, do you also have the kind of collaboration even after your class?

Learner C: Yes

Researcher: That is what I'm trying to find out, you see, that is the question, either before or after, it is not, we're not looking for a period where, only when your teacher says do it, then you do it. Maybe he gives you an assignment then on your own. You sit back and say no, from this assignment our lecturer gave us or our teacher gives us, there's a need for me to go and do it with my friend, our group guys, so that we can look into it together. Okay, can we go take you now?

Learner D: Mr. Bulunga's learner D. Yes, it encourages me to engage in group tasks before the lesson, because Mr. Bulunga likes to ask questions randomly to see if we have a basic of the topic and it also allows me so that after the lesson, I understand more, and it helps me so that when I prepare for the test or for the exam, I am, I have more knowledge because I prepared and he explain everything, then I understood him.

Researcher: Thank you so much, right?

Learner E: Mr. Bulunga’s learner E. Yes, I am encouraged to engage in group tasks, because after lessons, I'm encouraged to find information of perceptions from my classmates because they might understand the topic better.

Learner F: Mr. Bulunga’s learner F. Yes, we do um, meet and talk about our work, since sometimes sir tells us a topic before we leave. So, when I get home, I'll go my friend, talk about the topic, even tomorrow before class we talk about it, so I’ll say yes, it helps me to do group work.

Researcher: Okay, yeah good. Thank you, I'm able to see that you guys have, um, you engage yourselves before class and after class, which is something we want you to continue, we don't want it to stop it. You understand? Is a very good idea for learners to even have a group, you understand? Sometimes, you see, we have study groups, where some people choose their own group, and when they have an assignment, they have an opportunity to sit together and go through it even before they go home. And after class, when they come back also, before class, they can still check and see. And it helps you guys to improve in your studies. Because what you know that I don't know, during our discussion during the collaboration, I will be able to have that idea, the idea that I have that you don't have, during that collaboration, you also be able to have the same idea. So that is what we are looking out for to see that, at the end of the day. We have a system where there's a support from learners, there's a, whether the support from the teacher, from the learner also, and also from the school. You understand? Okay, now let's move to the next question. We are getting close.

Researcher: Thank you so much, now, we'll go back to the next question, which is question number three. And we'll start in that order again, we are getting close. Question number three says, ***does the approach encourage you to engage in group task and scientific inquiry before and after classroom learning activity?***

Learner A: Mr. Chipo’s learner A. Yes, the teacher approach encourages me to engage in group task, before and after class activities. Some of my friends always ask me for help to help them in where they are lacking. So, we have study group that helps us to help each other.

Learner B: Mr. Chipo’s learner B. I believe, it does, the teacher’s approach, it does, because we are used to engaging in class together therefore, where one of us, like we are not able to answer the questions as we can, we can be able to go to the other learner. I believe that the teaching approach, the approach, it encouraged us to work together as learners because he always tries to motivate us to think out of the box and be able to help one another because as we are from different family backgrounds, some of us are lacking confidence and can’t be able to ask where we cannot understand what's going on, therefore, he helps us to engage with one another.

Researcher: Okay, what, I’ll come to you. I want to get clarity, from your response, that, this teaching approach, because of some learners who, some learners who have, who came from different family backgrounds, shy learners, if I may put it the way you have put it, then um, this approach allows them to even engage themselves, before class, and after class, because in actual sense, most of them are not very active in class because they are shy, but they are always coming to have this class activity again, before and after class. Is that what you're saying?

Learner B: I'm saying that as I am, I’m not the one of the shy learners, but as maybe my friend is the shy learner.

Researcher: Shy type?

Learner B: Yeah. If she can observe how, in class, we are able to help one another that gives her that mindset that okay, I can be able to go, stand up from my place and go to another place and ask for a question. Therefore, if she sees us, that we don't love one another, by helping each other, it won’t boost up her confidence to answer more or talk more in class.

Researcher: In class, okay, I got that now. Learner C?

Learner C: Mr. Chipo’s learner C. Um, yes, it does, but as learners, we are able to form study groups, so that we can meet up a certain time to go over what we do not understand, and we can help each other a type of question. We also interact by sharing our understanding in a topic to share different resources. So, if a certain learner doesn't have a certain textbook, or certain past paper or certain question, were able to share so that they can see and understand more so that they can read more about the question and then they'll understand it more.

Researcher: Okay, that's to say that this approach used by your lecturer, allows you to have activity before class and outside, after class, that is outside the classroom activity.

Learner C: Yes.

Researcher: Alright, thank you, I got that.

Learner D: Mr. Chipo's learner D. I'd like to say from my point, it does, because when I have trouble with my Life Sciences' schoolwork, I always engage with my peers so that they can help me understand the topic better. And this is commonly done by everybody, everyone else in my grade. And there are certain group charts that we always create, and um, in those group charts, we always help each other with our school works and our assignments. And yeah.

Researcher: I like that. You have WhatsApp group, where you discuss about Life Sciences?

Learner D: Yes sir.

Researcher: Who introduced it? Is it your lecturer or you decide that you should do that on your own?

Learner D: We did it as our, as friends and classmates.

Researcher: Oh, that lovely.

Learner D: So, we have to help each other.

Researcher: And you get help from that group every time.

Learner D: Yes, sir. Actually, I just want to say that we always help each other

Researcher: From, in that group?

Learner D: Yes sir, if we don't understand better.

Researcher: is a good idea, I love that, in as much is not the group for gossip.

Learners: Hahahahaha

Researcher: Are you okay? Let's take you, learner E?

Learner E: Mr. Chipo's learner E. Yes, the approach does encourage me well, first and foremost, due to, what we got from our teacher, and how, the way he interacts with us, it actually gives us a better understanding of what's going on and therefore from my perspective, that actually motivates each and every one of us to go talk to the other learners, because not only are we doing this for grades, we're doing this because, we understand and we enjoy doing this, you know, it's eh, I probably shouldn't say this, but it feels unease, you know, when you interact with other learners and we find out each other's flaws you know, as the teacher doesn't. Yeah.

Researcher: Yeah, I like that. You talked about, you are enjoying doing it, because inquiry-based learning approach has been associated with excitement, enjoyment

Learner E: Yeah

Researcher: Because learners tend to take responsibility of their learning experience. So, in it, I get that excitement if, after discovering something on my own, during the research, then, only to find out that what I have discovered is the right thing. And if I have, get compliment from my teacher, to say that, yeah, what you did is fine, then I have that enjoyment, that excitement, that, oh, I didn't study in vain, okay, I got you, let's take you.

Learner F: Mr. Chipo's learner F. This, his approach encourages me because, well, Mr., I can't mention his name, but the teacher instilled in us that we are a team. So, we actually have to work together, you see, if one learner struggles in a certain topic, or with a certain question, we can actually help each other. And by doing that, I believe we can actually achieve something better.

Researcher: Right, now you talked about team, teamwork was that true? I'm hearing something that I'm impressed about. If you have a team, it means that one person doesn't win in a football match and the other lose in the football, same match, if that team is going to win, they win together, if that team is going to lose, they lose together. So, using the word team, I want you to look at that team from the aspect of a continued collaboration amongst you as Life Sciences learners. So, taking it further, even until your exam, even into the university. I will be glad to hear in the future that, you all are in science, you are doing one or the other science course in university, and you still keep your friendship where you help yourselves to learn even more. Let's go to learner G.

Learner G: Mr. Chipo's learner G. In class, we're already used to engaging with one another, so it makes it easier even outside the classroom to engage with the learners. So, if there's a question you don't understand or you came to school with incomplete homework, you know that okay, um learner A or learner B or learner C knows this topic well and understands it, and you're able to inquire from them. So, it's not just doing it alone. And yeah.

4.

Researcher: Then we move to the next question, which is question four. Question four says. ***What are the challenges you are experiencing with the teaching approach used by your teacher?***

Learner A: Mr. Andile's learner A. I am currently not facing any challenges with his teaching approach, in fact, I prefer it, and in my two years of being taught by him, I have never experienced any challenges because he makes sure that we understand the work.

Researcher: Thank you.

Learner B: Mr. Andile's learner B. I'm not experiencing any challenges.

Researcher: Good, C?

Learner C: Mr. Andile's learner C. The challenge that I am experiencing right now, is that I am still learning, it is that, I'm still adapting to the new learning technique.

Researcher: Okay, let me ask you this question. We'll go ahead with yours. But it's just an addition? You may, don't forget that I don't want your lecturer to be here. That is why I want you to really tell me what, because sometimes when we have a problem, it means that, we, there's an opportunity for us to improve. Because there's also learning in in failure, or if there's challenge or in trying to resolve challenges, we tend to learn some other things, that we may not even know of, because of, as a result of that challenge. So, that is why, I love when I have a challenge. Now, if I may ask, have you at any point in time speak with your lecturer, your teacher concerning your challenge?

Learner C: No, not really, because I don't feel like, it's a big challenge that is going to interfere with my success in the subject.

Researcher: Okay.

Learner C: Yes, because on the previous two years I've only been taught by the same teacher.

Researcher: Okay.

Learner C: So, I'm still adapting to the new teacher. That's the only challenge.

Researcher: Okay, he was not the one who taught you first, second year?

Learner C: Yes.

Researcher: Oh, I see, I see, that clicks properly. Right, let me go to your response.

Learner D: Mr. Andile's learner D. There are no challenges I am experiencing because the teaching approaches is actually effective for me as I need an energetic environment to push myself to be the best I can.

Researcher: Thank you.

Learner E: Mr. Andile's learner E. I am currently not facing any challenges that is. And, actually, I'm sort of use to the method of teaching.

Researcher: Okay.

Learner F: Mr. Andile's learner F. I am currently not experiencing any challenge from the teaching.

Researcher: Okay, thank you so much.

Learner A: I am currently not facing any challenges with his teaching approach, and in my two years of being taught by him, I have never experienced any challenges because he makes sure we understand the work.

Learner B: I am not experiencing any challenges.

Learner C: The only challenge I am experiencing is adapting to the new technique used. As for the past two years I have been with the same Life Sciences teacher.

Learner D: There are no challenges I am experiencing because the teaching he uses is actually effective for me as I need an energetic environment to push myself to be the best I can.

Learner E: I am currently not experiencing any challenges.

Learner F: No, there is no challenges I am currently experiencing with my teacher.

Researcher: Question number four says, ***what are the challenges you are experiencing with the teaching approach used by your teacher?***

Learner A: Mr. Bulunga's learner A. There are no challenges that I'm experiencing in his teaching.

Researcher: Okay

Learner B: In all honesty, I'm not experiencing any challenges

Researcher: No challenges. What about yours?

Learner C: Mr. Bulunga's learner C. The challenges I experience with the teaching approach is that sometimes Mr. is too fast. And then when he changes the slides, like it gets confusing.

Researcher: Okay

Learner C: Because I will see a slide opening and after you are doing it, he is pushing it, then they are changing it fast.

Researcher: Okay.

Learner C: It is confusing

Researcher: Okay, this is it, when we have challenge, challenge doesn't mean that, um the teacher will be penalised, or a learner will be penalised. No, we are looking for a better way, where no learner is left behind. We don't want any learner to be left behind. If the challenge is, oh, he is moving very fast, I can politely as learner in the class, I can politely raise my hand, sir, you're moving too fast, please slow down. Because it doesn't make sense to me as a teacher, that I finished teaching on time, but my learners didn't get the information or the concepts they couldn't get them. It pays me to slow down a bit so that when I move to the next topic, they can use the knowledge that they already have here to be able to understand the new concepts that we are going to present in the class. You understand?

Learners: Yes.

Researcher: Yeah, but with letter A and B we don't have a challenge is not a crime. You understand? It means that um, the pace is fine for me. Perhaps they are fast. They can write quickly, they can pick quickly, but it's not wrong for me, if I'm slow is not a crime. I didn't commit crime for being slow, it's just my nature, you understand? But it's a problem when my lecture is too fast. And then it becomes a problem on my part. Okay learner D?

Learner D: Mr. Bulunga's learner D. My problem is that Mr. Bulunga is quite moving fast when he is teaching or doing corrections in class, because for example, sometimes we do our corrections orally, so sometimes I miss what he said.

Researcher: Okay, sometimes the corrections are done orally, so but then, you will not have the opportunity to meet up, and you will not have the opportunity to get most of the information.

Learner D: Yes.

Researcher: Okay, now, this is it also, you see, um. For every challenge a learner has got, a learner is, every learner is supposed to address it, we have shy learners in the class that will never speak in the class. There are that types, we have some learners some of their challenges is, most of the practicals that are mentioned in the class, are something that they want to see, we call them the visual learners, they understand better when they see. And when the lecturer starts teaching, and they're seeing just like the slide now, as he is speaking, you are seeing the diagram on the board. So, while he is speaking, the diagram is helping you to understand what he is teaching you. If that slide move very fast, it becomes a problem because I have not really comprehended the image, I am looking in the slide. So, what we expect such learners to do is to raise your hand, or if they're the shy type, they can always approach him after class and say, Sir, may you please slow down or find out from us before you move to the next slide. Because when you find out from us in the class, we'll be able to say. Hold on please, a little, one minute more, or a second, then you'll be able to complete what you are doing, then by that, by so doing, you are already communicating your challenge to the teacher. Because it doesn't make sense to us that you don't, you have a problem, and you keep quiet. You will be losing on daily basis and don't forget in science, you need the knowledge of this topic to understand the next, especially what he started with, "Nervous System" you see they have connections, they'll be talking of feedback mechanism, they're talking about hormones, the functions of hormones, the brain, all of that, that he was saying today, there's a connection with them. So, there's a need for you to understand the topic better before you move to the next. So, I will advise you guys who have challenge on, in being too fast, to see him and request him to always ask you in the class, can I move to the next one before he moves. Not that we just assume that you already got it.

Learners: Yes

Researcher: Talk to him then you have solution, okay, alright.

Learner E: Mr. Bulunga’s learner E. The challenges I came across is keeping up with lessons, because sometimes Mr. Bulunga only teaches 10% so I'll have to revisit my book or textbooks.

Researcher: Okay, now, you see, I agree with you. If I'm also in his shoes, I'll be doing the same thing. Because there are question also, we are going to, we want to ask him, if he's able to cover the syllabus. Inquiry-based is time consuming. And it has been proving, it has been proven that is the most effective way of teaching, because the learners are engaged in the teaching and learning process. That is why is one of the very effective ways of teaching, it engages the learner to want to say okay, this is how this thing. Okay, they participate like he was asking you question in the class, like he was, he brought out people to demonstrate, you see, that consumes our time, um, that is why we are saying that um, we are still looking for a better way where we can balance that time consumption and the learners also learning. So, this also we will, you can also address it with him, because he is trying to make sure that he covers that topic for that day. So, that is why he will give you 10% and expect you to, you see the remaining percentage that you need to go and work on, that is the inquiry. That is what, that was why I asked that question initially that “do you have activity before and after?

Learners: Um.

Researcher: Because those remaining part is what you are supposed to go and do when you leave class.

Learners: Yes.

Researcher: Because if you don't participate in doing those things, you will not understand that topic very well, but by the time you go as a group, and do that remaining parts that he didn't do, then by the time you come to class, he will be able to know that you guys have done that work. If you didn't do it, he will know that you have not done it.

Learners: Yes.

Researcher: You get my point?

Learners: Yes.

Researcher: Can we move to the next person?

Learner F: Mr. Bulunga’s learner F. The challenge that I have is that sometimes I don’t hear and he speaks fast. So sometimes I will raise my hand and say sir you are reading fast. So as a class, he told us that we are failing, so we should help one another in order to succeed in life.

Researcher: Okay.

Learner F: So, I'll go to my classmate and ask. Ask him or her, what sir says, he or she will explain him, yeah.

Researcher: Okay, I got that. Um, let me address that quickly also before move, because I love the way we are treating it now. It tells me that the interview is progressive. This is it. The teacher, the teacher may be fast sometimes, like I said, because he wants to cover the syllabus. But that does not mean that you should not also address the matter with him privately. You understand? Some visuals learners see talking, becoming too fast. If there's a visual on the screen, that helps, as he's speaking, you're grabbing quickly because of the visual you're seeing on the board. Because as he's explaining, you're seeing the picture of the video, of the image of the specimen that is talking about, you are seeing that image either on the projector, then it helps you to remember very fast, but if that does not also enhance your understanding, then you still need to go and see. Are we together and discuss that with him privately. Okay, let's move to the next question.

Researcher: Thank you so much. Now we'll start again, we'll go to the next question, which is question number four. Question number four says, ***what are the challenges you are***

experiencing with the teaching approach used by your teacher?

Learner A: Mr. Chipo’s learner A. Some of the challenges I experienced with the teaching approach is that, he will take a lot of time on one topic explaining to other learners who are struggling, while I'm eager to go to the next topic, but then it is understandable because he wants all of us to pass, he does not want to leave other learners behind because we are a family so we should take care of each other.

Researcher: Learner B?

Learner B: Mr. Chipo’s learner B. The challenges I experienced is that, some of the topics need as many experimental investigations as we can possibly do. So, we can further understand and be able to apply accurate solution towards the examination. As I am, I'm an observer, so I believe in watching something to be able to get the idea or how I can possibly approach the question.

Researcher: Okay

Learner B: So, I believe that in class, all we do is like, take up as many notes as we can, but like if we could possibly have the time to watch videos. While he can elaborate on the topic, I believe that we can possibly achieve as much as we can.

Researcher: You're one of the learners who learn by seeing?

Learner B: Yes

Researcher: Visual learner, on seeing the structure of the topic or something that has been discussed in the class, so that, that thing you visualise, will remind you of what you learnt in class

Learner B: Of what I’ve learnt in class.

Researcher: And also, you can bring the picture to mind when you're writing the exam.

Learner B: Yes

Researcher: Just like you too, I like to, I can look at the map close my eyes look at the map three four times just snap it, then I draw exactly what I have snapped and put, the image I put in my mind conveniently, I’m also like you, I enjoy it when I snap it with my mind, I watch the video again and again, then, I can’t fail that exam. I got that. But okay, have you discussed that challenge with your lecturer?

Learner B: No

Researcher: Why don't you discuss with him? Just one on one. Because now you are having a challenge here. You are a visual type of learner, that need to see, that need to see the experiment, that need to see a practical, you can discuss that with him. Because we don't want you to suffer, when it comes to exam, and we don’t want something that is going to stand in your way of becoming a scientist in the future. So, you need to discuss with him, one on one, just discuss with him. And let him also take it further to the school. From what you have said, I also want to believe that you don't have computer lab, or sorry, science lab?

Learner B: No, we don’t.

Researcher: Oh, that is a big minus for you guys. What I saw in the first school, I was impressed. In fact, better than some of, I don’t want to say university, it was like, the setting is almost like what I saw when I went for my Zoology practical at North-West University. Very beautiful, when you go, you get into the lab, you just want to feel like a doctor, you want to feel like a scientist. You understand, you guys talk to your lecturer, talk to your school, don't fight the school, just say, can you help us get, even a small science lab, so that, at least it will start to prepare your mind before you get to university. Because you need to start to see them, before you get to the university. Just an approach in a polite way, talk to your school, Okay?

Learner B: Yes sir.

Researcher: I’ll also discuss with your lecturer. That is why, we don’t want you to mention your names, Okay. We don't want you to feel that you'll be victimised. It is not a crime for me to say, school please help us with a science lab, it’s not a crime. But it all depends on how you approach the school, not arrogantly. But in a very good manner, are we together?

Learner B: Yes.

Researcher: Alright, C?

Learner C: Mr. Chipo’s learner C. The only challenge I face is that I'm not a fast learner, but I am also not a slow learner, and I need more notes for me to understand something.

Interruption by the teacher Mr. Chipo on next interview arrangement with him. No, you wait for me I just need to go in. **Researcher:** No problem is fine, I'll wait for you.

Researcher: Sorry about that

Learner C. is not a problem. I need more notes to understand the topic, because when it comes to a certain topic that I do not understand, it takes time for me to have the information in my head so that I will understand and remember what it is. At the same time, I also have a problem where I do not sometimes interact with the whole class during lessons. I learnt better when I interact with the teacher, one on one, during break times when I have a free time or after school, if I'm staying after school. That's the only challenge I face with the teaching method.

Researcher: Okay.

Learner D: Mr. Chipo's learner D. My only challenge with the teacher, I'd like to say that, he should try and give us more work, specifically saying homework. So that, homework really tends to build, it helps us to learn a lot of things that we don't know. So, I like to, I'll like to say that, he should always try to give us additional work, home-work.

Learner E: Mr. Chipo's learner E. The only challenges, and I have to be honest, the only challenges I have with this teaching approach is that, the teacher is only one individual who is teaching a large magnitude of learners. So, the teacher can't always be there to assist each and every learner, and as we have to remember that we are also children, you know, we need attention. So maybe, so from my perspective, when the teacher cuts the one-on-one interaction short, and goes back to teaching, that makes me feel some sort of way, you know, I mean, I worked really hard to find the answer. But yet, I mean, I understand that you can't help everybody, but I don't know I used to work really hard on this to find this answer and yet you can't approach me and talk about it, you know, so, yeah, that makes me kind of feel shy, yeah.

Researcher: Okay, we'll come to you (Learner F) please. Could it be that you are a high-performing learner, and your lecturer feels that, I need to attend to those struggling learners?

Learner E: Yeah

Researcher: Struggling learners first before I come to you?

Learner E: Yeah

Researcher: Do you perceive it in that way?

Learner E: Yeah, yeah, even my friend, my friend suggested that, that maybe.

Researcher: That your teacher will, I'll come to you last, I know you are high performing, compared to these struggling ones. Perhaps he wants to attend to those who are really, really struggling. Because he knew that, at any time, you can grab if he re-explains in the class

Learner E: Yes, you are right.

Researcher: But, apart from that, also, I don't want you to hold a grudge against him, because, I observed, you were sitting at the edge here, right?

Learner E: Yes.

Researcher: I saw you raise your hand, he has tended to like 3, 4, 5. I'm very observant. He attended to almost all of them, when he eventually looked back, he just went straight to the board?

Learner E: Yes

Researcher: He didn't come to you?

Learner E: Yes

Researcher: So, I took note of that, and it's good you mentioned that also. But I also see, you are also one of the guys who went to the front to respond to the questions he asked.

Learner E: Yeah.

Researcher: So, you see, if I am in your lecturer's shoes, I would have done the same thing. If I am in his shoes, I would have responded the same way, because he's got limited time. And this is the inquiry-based that we talked, spoke about, it is time consuming, is not, and you need to cover the syllabus. I'm not saying that, he must neglect you all the time. But if you really know that, what you are trying, you want him to come and assist you with, is something that you still do not get answer, at his free time, you can go to him and say, sir, I'm struggling with this, may you please help me. I believe he's going to do that.

Learner E: Yes

Researcher: Okay?

Learner E: Yes

Researcher: All right. Can we take you?

Learner F: Mr. Chipo's learner F. My challenges are exactly like learner's B challenges, I'm just having, we need practicals in a way. I'm also a visual learner. So, I actually need to see something in order for me to understand it. That's really my only challenge with this approach.

Researcher: Have you guys gone for an excursion before, science excursion?

Learner F: Sir?

Researcher: Have you gone out for, have you gone on an outing for science excursion?

Learners: No

Learner A: Before COVID

Researcher: Before COVID you did?

Learners: Yes

Researcher: Okay, because from what I've seen here, in my report, as in my research now, there's always a need for learners to have excursion, go out and see, my lecturer talks about this animal, these are animals I can see, we can afford to see them, you understand? life. So, and he spoke about these particular plants. These are plants that you can go and see. We can walk in the field and look for plants where you have tall trees, short trees, with red, red color leaf, and white color leaves, just like he was talking about dihybrid crosses today. So, these are some of the things that you can politely request or at your own time, because of tight schedule. You can organise yourselves and look for someone in school to be with you when you go for excursion. You choose a date, maybe a Saturday when you are free. But also seek guidance from your lecturer, your teacher, so that, he will tell you exactly where you can get those activities that will enhance your learning or your memory. Are we together?

Learners: Yes

Researcher: Learner G?

Learner G: Mr. Chipo's learner G. One challenge that I have noticed is like learner A has already mentioned that he takes a lot of times explaining one topic, going over a topic over and over again. And sometimes we majority of the class understand and we're ready to move on to the next topic, but then we understand that we can't, because there are struggling learners who take longer to understand that topic. And so, we have to include everyone and ensure that everyone understands before we move. We're also given a lot of notes, a lot of, a lot of notes, and there isn't like enough activities and homework to put those notes into practice. So yes, we are given activities, but sometimes you find that, in an exam, you will get something that you're seeing for the first time, and I'm not saying that, we, everything that we learn in the exam has to be taught in class, but it would be nice to get insight also in the classroom. And then sometimes you'll find that we'll do practical assessments and assignments in class and you know, sir would explain it thoroughly and we'll do it in front of the class with the object and whatever. But it will also be nice for us ourselves to be, to practically do it. Like for example, a lab, a school lab, that's all.

Researcher: Okay, thank you. If I may ask, how many Life Sciences teachers do you have in the school?

Learners: We have two.

Researcher: Okay, two, but you, we had two groups today together in one class.

Learners: Yes

Researcher: So, one of the groups is being taught by the other lecturer?

Learners: No

Learners D: One teacher teaches Grade 10, and this class teacher teaches Grades 11 to 12

Researcher: Okay, but another thing again I want to add to this is, I want us also to consider slow learners, we must, don't forget that every teacher is a parent, and they are also counsellors, apart from the teaching responsibilities. You can imagine, if a father gives food to the children and three of them are still hungry, because these big boys, just one cut of the pap is almost gone, and left very little pap for the other children, the father would want to make sure that these guys also, they are full, so that is what the role of a father is, he is playing role of a father, not to leave a child behind, that is the way you need to bear with him, but at the same time, he will see how the balance is being achieved, so that we don't also make you start to sleep, I know this, I want to go

	on, meanwhile there is someone who is struggling in the class. Okay. Let’s move to the next question, which is five. We just treated five? **Learners:** No, four. **Researcher:** Okay four.
5.	**Researcher:** Now, let's move to question five. Question five says, ***do you think you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skill?*** **Learner A:** Mr. Andile’s learner A. Yes, I do get enough support from my Life Sciences teacher in interpreting important questions, like examinable questions, he will usually tell us what is examinable and what is not. The atmosphere created in the classroom is of freedom without judgement. So, it enables me to communicate with my classmates and give answers. **Researcher:** Okay, B? **Learner B:** Mr. Andile’s learner B. Yes, it gives everyone a chance in communicating and making predictions. **Researcher:** Good. **Learner C:** Mr. Andile’s learner C. Yes, because my Life Sciences teacher encourages me to want to learn more and to understand such a question that I don't understand in class. **Researcher:** Okay. **Learner D:** Mr. Andile’s learner D. Definitely, the support is the best anyone can ask for as worksheets are handed out to be able to work on the topics covered in class and also helps in your knowledge on the topics to enhance to be sure of what you know. **Researcher:** Okay. **Learner E:** Mr. Andile’s learner E. Yes, I do feel I get enough support because, he's actually pushing me each and every day to be better than who and what I was last year. Because, he sees the potential in me even when I sometimes don’t see it myself. **Learner F:** Mr. Andile’s learner F. Yes, I do get enough support from my Life Sciences teacher. **Researcher:** Okay, thank you. **Learner A:** Yes, I do get enough support from my Life Sciences teacher in interpreting important and examinable questions, the atmosphere created in class is of freedom of speech without judgement so it enables me to communicate with my classmates. **Learner B:** Yes, it gives everyone a chance in communicating and making predictions. **Learner C:** Yes, he allows us to get corrected and understand examination questions and why certain questions are wrong under exam conditions. **Learner D:** Definitely, the support is the best anyone can ask for as worksheets are handed out to be able to work on the topics covered in class and also helps in your knowledge on the topics to enhance to be sure of what you know. **Learner E:** Yes, they all push me to do better than I have previously done last year. They see the potential in me even when I sometimes don’t see it myself. **Learner F:** Yes, I get enough support from my Life Sciences teacher. **Researcher:** The next question says, which is question five, ***do you think that you get enough support from your Life Sciences teacher, classmates now that is other learners and school in developing your scientific skills?*** **Learner A:** Mr. Bulunga’s learner A. Yes, they are doing everything in their power and giving me the support that I need and learning and having enough knowledge about the subject that that I’m doing. **Researcher:** Alright, thank you. **Learner B:** Mr. Bulunga’s learner B. Yes, because whenever I need clarity on something, I go to them and they help me. **Researcher:** Okay. **Learner C:** Mr. Bulunga’s learner C. Yes, I do get enough support for my lesson’s teacher, because Mr. Bulunga, when I don’t understand and sometimes fall behind. I tell him and he

revisits the topic again, and we discuss it as a class, and my classmates, they're always there to assist me wherever I don't understand.

Researcher: What about the school?

Learner C: The school, yeah, the school also play a big role in assisting me, in assisting me to understand my lessons better.

Researcher: Do you have a science lab?

Learner C: Sir?

Researcher: Do you have a science lab?

Learner C: Yeah, we do

Researcher: Are you using it?

Learner C: No

Researcher: You think you don't need science lab?

Learner C: We do, we do need it

Researcher: Not just having it, using it?

Learner C: Using it

Researcher: You know why I asked that question? This question came because we want the learner to tell us about, not only the challenges they have with the teacher, not only the challenges they have the support they couldn't get from their learners, their peers in the class, we want to see if they can, they also have area where the school authority needs to come in to assist them. You see, there's a need for it, because we are looking at a learner that will understand how, the use, how these apparatuses in the lab are used for. Because if you don't know what they are used for, when you get to the university, those who have that privilege will understand the apparatus better. You are going to be competing with them in the university, you are going to be writing, doing the same exam. The professor, the doctor who is taking that particular module in the university will assume that, if you say you want to come, you want to become a neurologist, or you are doing these set of subjects, then you should know these things, you're not supposed to tell me, you are hearing about these apparatuses for the first time. So that is why this research is important to me and to every one of us, so that we can go ahead and advise the school on how to speed it up so that these learners can start to see themselves as scientists each time they go to the science lab. Once you walk into the science lab, the environments should just tell you that, no, this is science. We're not doing commerce here. We're not doing Business Study here. This is biology, this is what? This is Physical Sciences, this is Chemistry that should fill your mind, the moment you walk into the science lab, not that you just go to, each time you go to class, you're having your chemistry, and you still seeing the same wall, nothing is tuning you to become like a scientist. Oh, this is science, this is science, this is science.

Learner C: Um.

Researcher: You see. So, when you have a problem that has to do with the school, we just need, we are not saying, I can't penalise your school. I don't have the power to do anything, what I can do is, in my findings, which I'm going to send to your teacher, by extension, your teacher is going to present it to the school, is to see areas where there is a need for improvement, and other weaknesses that we have observed in other schools too, because your school is the third one. You'll also see, okay, we can also adjust in this aspect, even if we did not mention the problem here in our school, someone explained that, talked about it in another school, then your school can say, Okay, let's do this to help our learners. You get the point?

Learner C: Yes.

Researcher: That is the whole essence of this interview. Can we take you now my friend?

Learner D: Mr. Bulunga's learner D. Yes, because my Life Sciences teacher provides us with morning classes, and my classmates are always helping each other because we think that knowledge is important.

Researcher: Good. What about the school? Oh, you are not talking about the school, all of you are quiet about the school, okay its fine.

Learner E: Mr. Bulunga's learner E. Yes, I do get support from my Life Sciences teacher, in a way that consultation, he enlightens me more about what I've missed in the class.

Researcher: Okay

Learner F: Mr. Bulunga’s learner F. Yes, I do get support from my Life Sciences teacher, he always tells me to come in the morning, since he's doing extra classes in the morning.
Researcher: Okay
Learner F: which means he needs me to be in class after school. It was single time.
Researcher: Okay, you normally have extra class.
Learners: Yes.
Researcher: Okay, the extra class is meant for people, who want to, who still need to understand something, well, that's a good idea.
Learners: Yes.
Researcher: It's very beautiful, to have extra classes, those who wants to partake can come and join, even if I know, if I'm one of them. Even if I understand the topic, I still want to join.
Learners: Um.
Researcher: Because I want to know more.
Learners: You will
Researcher: You see, are you doing that too?
Learners: Yeah, um.
Researcher: I don't want you to start to feel that, no, I already know everything, I don't have to go to extra classes, it’s good please, please attend
Learners: Yes
Researcher: Okay. Alright, let's move to the next question.

Researcher: Okay, question five says, ***do you think that you get enough support from your Life Sciences teacher, classmates and school in developing your scientific skills?***
Learner A: Mr. Chipo’s learner A. I do get enough support from my teacher and my classmates. My teacher pushes me to do well and he also motivates me, since he told me I can do a lot better, he has a lot of faith in me that also inspired me to do well. I love my classmates, since we can help each other with everything we are lacking at, but the school does not support Life Sciences learners enough, because I think the issue of having a science lab was suggested, but they haven’t done anything yet.
Researcher: If you have not mentioned that, I would have stopped you and ask the question, but it’s good you mentioned that, there is no need for me to ask that question again, please let’s go ahead. Learner B?
Learner B: Mr. Chipo’s learner B. No, because we in lack of labs, where we could find, and could understand our projects or assignments better. Some of us learners, as I’ve said, we learn better by being able to observe, hear, smell or touch as before us.
Researcher: Okay
Learner C: Mr. Chipo’s learner C. I feel as if I don’t get enough support because, as individual I like to read notes instead of visualizing or seeing or observing something, so, I feel like I’m not getting enough information, because I will need the teacher to explain himself and show me notes instead of going to the internet or YouTube trending information, because the information or the teaching methods on the YouTube video or Khan academy, could be so different from what the teacher teaches, shows us or the space to ask, which could be a problem, because I’ll grasp two different teaching methods and then I’ll try to combine them together, which will be a disadvantage.
Learner D: Mr. Chipo’s learner D. I’ll like to say, eh, for my teacher, I get enough support, which is very tremendous, and eh, when I have trouble, I had trouble with communication skills, like communicating in class, but when he asks me questions, eh, I communicate which is very great, because it improves my communication, I get used to communicating and saying out loud answers in class. And from my classmates, I’ll also say, eh, yes, they support me, because we are always engaging, I get closer to them, we help each other and we help each other to get better, you know sir. And from my school, I’ll like to say, well, no, because we have a lack of laboratory in our school, and they should also may be try to like do trips, for instance, they can like, organise trips, so that we can go like to hospitals, because there are learners who are like

motivated to be doctors when they grow up, so that, when they go to like eh, those hospitals, they get more knowledge and more skills on what they are planning to do for the future sir.

Researcher: Thank you so much.

Learner E: Mr. Chipo's learner E. From my Life Sciences teacher, I say yes, I do get support, because, for example, if I'm not performing well in Life Sciences, the Life Sciences teacher actually has a one on one conversation with me, may be when, before school or after school, and that shows that this teacher is actually in your thing, this teacher supports me, because this teacher wants to see you doing better and doing well, so therefore, the Life Sciences teacher actually supports me, because, if I'm struggling to keep up with my academy, he talks to me, he helps, he reminds me of several things himself, and like you mentioned, he's a parent, he doesn't want to see any of us eh, eh.

Researcher: Suffer

Learner E: Fail, yeah, so, as a teacher, he does support each and every one. And from my classmates, well, as my classmates, well, we started working all like machine, I'll like to say, we work together, you know, we understand each other better, and I'm feeling that um, I do get support from my classmates, you know, sir, and yeah, we are very eh, we support, for good people, we are just good people. And school, eh, well, eh

Learner B: Eh

Learner E: The school, not really, the school, for example, the school can actually bring in, ah, people who actually work with science, like scientists, as pro-physicists, doctors, neurosurgeons, you know, we, dermatologists, you know, we can get them and they can actually talk to us, you know, when we have our Life Sciences lessons, you know, they can give us tips on what to do, this and that, and like my friend mentioned, ecologist, the aspect of researches and stuff like that, yes.

Researcher: Okay, all you need is, this, neurosurgeons, you'll love that the school invite them as guest speakers?

Learner E: Yes

Researcher: to motivate you?

Learner E: Yes

Researcher: To prepare your mind for your future, for your career?

Learner E: Yes

Researcher: It's a good idea, that the school needs to also imbibe, we'll see if that is feasible, I'll discuss this also with your lecturer.

Learner E: Yeah

Researcher: Okay, F?

Learner F: Mr. Chipo's learner F. my Life Sciences teacher and my classmates do actually support me, like I mentioned before, we are a team and we work as a unit, but from my school, it's, I feel like we have been neglected as Life Sciences learners or actually as science learners, because, well, there are no learning trips, excursions and like learner E said, they should actually bring some people for motivation and some trips, that would really be nice for us as learners.

Researcher: So, eh, it's worrying, it's very worrying when the child wants to learn, but he's not empowered, he's not given the resources to learn, but it's not for you to fight the school, you know, like I said earlier, you can sit down as a group and approach your, the school through your lecturer, through your teacher, approach the management of the school in a very polite manner and request, even if this project is not completed before you write your exam, it will be on record that you started it, and now those who are coming after you have to enjoy it. If I also may ask, you don't even have any lab for all sciences? Not just Life Sciences?

Learner F: The only lab we have is for IT

Learner B: IT

Researcher: Okay, but in the time being, if you guys have access, because most of, before I went for my exam at North-West University, I am Unisa learner, before I went to, it was my last practicals, because it will involve me to make use of lab tools, a lot of them, what I did was to go online to check, to download videos on this, so that, at least I will have the opportunity to see the tools for the first time before I approach them physically during my exam, if you can do that just to

	enhance your memory to know what, okay, the name of um this apparatus is this, the name of this is this, you know, you need to know their names before you even get to the university. You don't get to the university and your friends will be saying this is a beaker, this is um this, then you will just be looking like this and you don't know what they actually mean or what they can be used for. It could be very painful, but I will tell, approach the school through your teacher in a very polite way, and request them to please, please, please help us, we need all of these, okay, alright. Sorry, learner G? **Learner G:** Mr. Chipo's learner G. From the teacher, yes, we, I do get enough support, his explanations are clear and understandable, his notes are easy to study, eh, and they are exam friendly, so when you are going through your own exam question papers, you are able to refer to the notes that sir gave you instead of always having to refer from other textbooks that we don't use in class. From the school, not so much as they have already mentioned, we don't have a lab, we don't eh, not given the opportunity to go to research centres and broaden our minds, so that's really disadvantaging us as science learners. **Researcher:** Thank you so much, right, I just hope that you have improvement in the near future, so that you'll enjoy the use of the science lab.
6.	**Researcher:** Alright, let's move to the next question. The next question is question number six, which says, ***are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?*** **Learner A:** Mr. Andile's learner A. Yes, I am inspired to enrol in Life Sciences courses in university. Firstly, because I know that my foundation of knowledge will be strong enough to equip me for the lessons, and I will also enjoy the courses because, not only does Mr. Andile teach the lessons, he relates it to real life situations and he makes it enjoyable, he also coaches you on which aspects are usually important in every topic, which will help me cope with the courses, because I know what to look for when the lecturer is speaking. **Researcher:** Thank you. **Learner B:** Mr. Andile's Learner B. Yes, I have enjoyed Life Sciences and I want to take it further. **Learner C:** Mr. Andile's learner C. Yes, I am inspired to enrol in science courses in the university, because my Life Sciences teacher has made it easy for me to understand how the lecturers in the university will be teaching the lessons. **Researcher:** Okay. **Learner D:** Mr. Andile's learner D. I am more inspired to study to become a biochemist as my strongest suit is Chemistry, so the learning experience I'm getting is pushing me to make it a reality. **Learner E:** Mr. Andile's learner E. Yes, I am inspired to enrol in Life Sciences courses because, the Life Sciences teachers that I've had, have actually made Life Sciences a very enjoyable subject for me and I am actually having fun with Life Sciences. **Learner F:** Mr. Andile's learner F. I am not yet inspired to enrol in any of Life Sciences courses because, I actually suffer between the subject, I have difficulties. **Researcher:** Okay, sorry, I'll come back, because I saw something that I really need to talk about. You are learner F? **Learner F:** Yes. **Researcher:** Do you think that you can get, you will still have that opportunity to want to enrol in a science subject, any of the science subjects in the university, if you speak with your teacher and request him to assist you to do that? **Learner F:** Yes, he supports it. **Researcher:** Okay, you know why? One of the main reasons for the research, like I said at the beginning of this interview was that I have a concern that not every learner who enrolled at the entrance level into university are graduating with science. Some of them tend to change. And just because they found, they are made to believe that science is a difficult subject that they cannot cope with in university, but it is very critical for you to want to pursue your dream of becoming a scientist in whichever field, like he spoke about Biochemistry, Biochemistry, right? **Learner D:** Yes **Researcher:** And which, there are so different fields. But I want to believe that if you see your

teacher, meet with him one on one, try to explain to him challenges on why you will not be able to go, I think he’s, I've seen him, I’ve spoken with him and I've known him for some time. From the time I met with him concerning this research project. After speaking with him, one on one, I have seen that he's got the potential to assist you. Because we don't want to leave any child or any learner behind. If you have the dream, the zeal to become a scientist, you should be able to pursue it and ensure that you have it, okay. Now that by the side. I think let's move to the last question, which is question seven.
Learner A: Yes, I am inspired to enrol in Life Sciences courses in university firstly because I know my foundation of knowledge will be strong enough to equip me for lessons, I will also enjoy the classes/courses because he also refers to real life situations and makes it enjoyable, he also coaches you on which aspects are usually important in every topic, which will help me cope with the courses.
Learner B: Yes, I am enjoying Life Sciences and I want to take it further.
Learner C: Yes, my Life Sciences teacher has made it possible for me to relate his teaching to university lectures.
Learner D: I am more inspired to study biochemistry as my strongest suit is Chemistry so the learning experience, I’m getting is pushing me to make it a reality.
Learner E: Yes, science has always been a field of interest for me. The Life Sciences teachers I have had have made me fall in love with the subject and also make it fun.
Learner F: No, I am not yet inspired as I first had difficulties with this subject.

Researcher: The next question says, ***are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?*** Are you inspired?
Learner A: I know that I am inspired, but I want to pick from contrary field, but not in any science courses.
Researcher: I love that. I like that when I hear someone said I'm not inspired but I'm not happy. I like to hear I'm not inspired because of um, if I get this, I will do, but if I don't get this I won’t do, you understand, then we’ll now look, how do you want us to help you so that you can become who you want to become? Because if you're saying that I don't want to be a scientist, we can't force you.
Learner A: Um
Researcher: It is, the interview is not about that everybody in school must be scientists. Everybody in school cannot be scientist, then who is going to take care of our groceries, who is going to make sure that we are taking care of in other sector of the economy. You understand?
Learner A: Yeah.
Researcher: Now it's acceptable. But since you said that, you already have a flair, a desire for something that is not science is fine. So, I don't want to ask the next question. Okay?
Learner A: Um
Researcher: Alright. Let's go ahead and take you.
Learner B: Hmmm, no, not, because I'm looking forward to doing something else in the near future.
Researcher: Um! The second person also says she is not inspired to become a scientist, she is looking forward to become something else. Well, I’m feeling as if I'm left alone now in the science world.
Learners: Huh, um.
Researcher: What about you C?
Learner C: Yes, I am feeling inspired to enrol in any science courses because I've already started applying. And I want to apply for a course that is MBChB in health sciences.
Researcher: Okay
Learner C: Which does include Life Sciences.
Researcher: Oh, Lovely. I love that. If you have passion for anything science, this is advice I like to give to people who has got passion to become scientists. Choose a mentor, one or two of them, go and search for people who have made it in that field of science, read about their

biography, read about their character, their behavior, what they do, you will see most of them who have made it in that field, who are very famous, who have made a lot of difference in the field of science, in whichever specialty they have chosen, you will observe that, there is a particular character, there's a particular behavior that they adopt, that keeps pushing them to learn more, you understand, to want to become great in that field. So, if you do that, even from now, you will observe that by the time you get to the university, science is so beautiful, because the passion is there, one, the desire is there to become a scientist, and you already have people who have made it in this field of science, that will also become motivation for you to push to become who you want to become in science. You understand? So that is the advice I'll give you since you have desire to enrol in science. Can I take yours?

Learner D: Mr. Bulunga’s learner D. I'm not inspired, because, uh, the course that I have applied for, doesn’t need Life Sciences.

Researcher: Okay. Alright, um, that is another question again, your response now tells me that, I was discussing with your teacher before we got here, we are looking at the possibility of we having a stream of subjects that you guys need to specialise on, even before you get to Grade 12. So that you have, you start to focus on what you want to do when you get to university. Not that I'll be spending so much time doing chemistry and yet I want to become a secretary. Why am I doing chemistry? You understand?

Learner D: Um.

Researcher: I would have just chosen some particular modules where I know I will become very good, very better, become the best I can be in that field. Instead of, we're talking about that, if the school is going to implement it, maybe this year or next year, and it will go far to help you. Because now if you are the Life Sciences, and yet, you don't, science is not even what you're going to do, considering your course. Okay, can I take yours?

Learner E: Mr. Bulunga’s learner E. Yes, I am inspired because several lessons have grabbed my attention, such as genetics. And I've been motivated by a scientist.

Researcher: I love that. Okay, I love what you have just told me now, those of you who say, I spend so much time here, because this one touches on my purpose. I want to see, we don't want you to drop out when you start science in the university. And that was why I gave you that advice that look for mentor those who have made it in that field, you will observe that also in Life Sciences, there are some topics you love so much.

Learners C, E: Yes.

Researcher: But I cannot separate all the topics because I enjoy when I start to pick the first topic and move to the next one. Because of the connections, they are so interested, especially Genetics. Genetics is one aspect that um, you have very few people. Specialised geneticists in the whole country, it’s one of the areas. And you can imagine when I went for one of my Zoology exams, Zoology practical exam, at North-West University, I am from Unisa, but we normally have our exam there, when I went for that exam, we have one of the professors who came to lecture us, and he talked about a field in science, where they have very few people. And there's this woman who is a doctor, a professor in that field, for the whole year she has been booked, all University have booked her, that is to say that from January to December, she doesn't have a space for any university. So, you have to book in advance. So, you just imagine, you are that woman.

Learner C: Uh.

Researcher: Are you not motivated? You are hotcake people want you, because I don’t want to queue, you see, what I've observed with science is, I don't want to queue on that, on that line where it is easy, where you have majority, I want to queue on that line where they say it’s tough, yeah, that one that is tough that is what I want. So that when I get out, then I’ll become what? Hotcake, I hope you get what I'm saying. Even in your different field too, wherever, go for that aspect where you know that not many, people are running away because it is difficult. I want to know, why it is difficult. I want to know.

Learners C, E: Um, yes.

Researcher: Then you push, then you get it. Okay, let's take you.

Learner F: Mr. Bulunga’s learner F. I am not inspired, because I already have some things on the side that I'm already doing, so I don't see myself in a university class, becoming a scientist.

Researcher: Becoming a scientist. You are a businessman?

Learner F: Yeah.

Researcher: I know that you're a businessman from the way you speak.

Learners: Uh, uh.

Researcher: But I don't want to jump. I don't want to speak like a prophet now like a pastor. I know that you are into, business I just know. I don't know how to say this is why know, I just know that you are doing something that, you know there's that that atmosphere around you that shows that this man is, is going into business buying and selling, doing business, making money, fine, but you see, education is good. Uh, in whichever field that you want to go in in the future, once you have passion for it, please go after it. Don't relent, it doesn't matter whether it's science or not science. Once you have passion for it, make sure you are the best in that field. Why is it that you have a woman selling magunya here, another woman selling magunya there, and everyone is always going to that woman who is selling magunya by that corner and they pass through others who are selling magunya and they go to that woman? You don't ask yourself why, service. She's giving them quality service. Maybe the, madam your magunya doesn't, is too salty. Oh, is too salty, she goes back and adjust, because it's all about the people who are buying, it's not about you. If I like it too salty, then will I be the one to eat all my magunya? I have to satisfy, I have to please those who are buying from me. So, what I'm saying in essence is this, whichever field you want to go in, be the best in that field. And you will thrive, that I can assure you, you will thrive. Okay.

Researcher: Let's move to the next question, it's six. ***Are you inspired to enrol in any of the science courses in the university due to your learning experience of Life Sciences?***

Learner A: Mr. Chipo's learner A. Yes, I am inspired to enrol in Biology, I have never been so interested in a subject before, and I think it was because the motivation he gives that makes me want to know about more about the subject.

Learner B: Mr. Chipo's learner B. Yes, I believe there's so much we can do. I'm a person that's really interested in human bodies, because I believe that we can do so much with our bodies, but we haven't reached that level of IQ, therefore, I find studying what's before me, or already existing, improving my mentality, my real thinking, yeah.

Researcher: Before I come to you (Learner C). yeah, you mentioned something that we as human don't even use the full capacity of our IQ, and that also will make me advise you, go and read about the Dolphin, the Dolphin is one animal that uses its mental capacity more than human, so read about it, and perhaps, it will inspire to want to stretch, the brain cannot break, it's not a bone you know, it's very soft, stretch it, use it, then you'll enjoy science okay, C?

Learner C: Mr. Chipo's learner C. for me I wouldn't like to take Life Sciences as a major because, I may be doing Life Sciences and it is very interesting, but it does not strike my interest, because I am interested in something far from sciences, yeah, it doesn't, I'm not really interested in it, I just learn it for now, and have knowledge about the human body and anything else you need to learn and then that's it.

Researcher: I love that, um she, I love your sincerity, and I'm able to connect it with the way you learn, most science learners like to visualise, but she likes notes only, wow, and she is in science class, I started to worry, but now, I can't be much worrier, because you just told me now that, that is interesting, because I'll tell you, science, they love to visualise, they want to see, you know, when you say, I'll give you an example, um, we all know, for you to have the male and female offspring, you need the chromosomes, the Y and X chromosomes, it is not like that with some animals, so you can go, you start to ask yourself question, how come, the X and Y chromosome does not determine gender in this animal, you see? You want to go and find out, you are so curious, if you are curious, you want to see, but if you are not that visualise person, then it will be difficult for you to go into science, ah I hope you understand?

Learner C: Yes

Researcher: So, I don't doubt the reason why you don't want to enrol ah

Learner C: Eh
Researcher: in one of the science courses in the university. D? Let’s have you.
Learner D: Mr. Chipo’s learner D. well, yes of course, eh, science is really exhilarating, and without Life Sciences, I wouldn’t have been motivated to study um the course I want to study in university, I really like Neurology, the study of the brain and nerves, so Life Sciences made it possible for me to like, ah, to know more about it, as we always going about it in class to, so, yes science is, yeah, I’ll like to study science in the university.
Researcher: That means you enjoy Nervous System so much?
Learner D: Yes sir
Researcher: All of it?
Learner D: Yes sir
Researcher: That’s good, right?
Learner E: Mr. Chipo’s learners eh, eh, Mr. Chipo’s learner D.
Researcher: E
Learner E: Eh
Researcher: E?
Learner E: Yes sir. Well, to be honest, Life Sciences doesn’t involve my university, you know, my, I want to do architecture you know, so I don’t believe that Life Sciences actually contributes, although, I chose Life Sciences because, so, science is actually really interesting as it is, you know, science is really interesting, you know, like you mentioned about the Dolphin, about how the Dolphin is the smartest animal, you know, we can venture into this new territory that we never, that we never discovered before, as time goes by you know, we have these people discovering new things, like, you know they broke the code for cancer, you know, the clone, eh, eh, eh, I think they’ve made some breakthroughs, eh, about HIV, you know, they’ve found a way to make shot people taller, you know. It’s just really over, it’s just really interesting, you know, so
Researcher: Will you, will you make, will you make um, science your second option, if not architecture?
Learner E: Yes
Researcher: Will you make it your second option?
Learner E: Hmmm
Researcher: Okay, go ahead
Learner E: Yes, so for me, it’s actually this door, you know, that unlock this unchartered territory as, this territory as we can learn about you know, and ah, yeah, you know, yeah.
Researcher: You love that?
Learner E: Yeah, I just love sciences.
Researcher: Science is interesting, especially Life Sciences, I don’t know, I love the subject too, so interesting, I can spend hours with science
Learner E: Yeah
Researcher: And I don’t get bored
Learner E: Yeah
Researcher: But if I move to something else
Learner E: Eish
Researcher: Ah, I feel like sleeping, you know. Science, science is interesting, um, there is something also you mentioned about breakthrough in science?
Learner E: Yeah
Researcher: I’ll love that you guys who want to pursue your career, read a lot about stem cell, stem, stem cell research
Learner E: Stem cell research, yeah.
Researcher: Please search, you’ll see how science are getting breakthrough, when using that research to solve problems that we couldn’t solve for years, now they are having serious breakthrough as a result of stem cell research
Learner E: Yeah, stem cell research
Researcher: Okay, check, read up on them, you’ll see, they will help you and prepare your mind for university.

	Learner E: Yeah
	Researcher: Are we together?
	Learner E: Yes sir.
	Researcher: Let's take F.
	Learner F: Mr. Chipo's learner F. well, I chose Life Sciences because I am actually interested in the, in the human body in general, well, I will go into science, because of my curiosity about the human body and all of that, but I'm not sure, what I'll actually be specializing on, did you get what I'm trying to say? But I do love the human body and I'm being fascinated.
	Researcher: That's very good, we've got a lot of area where you can specialise, if you check your curriculum, the CAPS curriculum, I can't tell you the page now, but if you read from the first, second, third up till the tenth page, I think up till the tenth or eleventh page, you will come across areas where you can specialise, but if you must pick one aspect, the advice I'll give you is this, look for something you enjoy doing, something that fascinates you, something that you want to be, you want your name to be mentioned about, that you had breakthrough for the country in that field, so if you look in that direction, it will guide you towards what, aspect you need to specialise on. Are we together? Let's take G.
	Learner G: Mr. Chipo's learner G. I've come to establish that Life Sciences is very broad subject and have different aspects, and wouldn't want to cover the whole entire subject in the university, but I would like to specialise in may be a few things, and another reason why I would like to consider an aspect of Life Sciences as a major is because, the topics we learn about in class, they are not as broad, and sometimes we are compelled to learn more, and the only other option for you to learn more and to gain more insight is through university.
	Researcher: Okay, that's good, but don't forget, what your lecturer is, your teacher is helping you with now is the foundation, he needs you to have the foundation and also to prepare you for university education, because by the time you get to the university, if don't have this knowledge he is giving you now, you will struggle with the information they are going to give you when you get to the university, but with the knowledge that your lecturer, your teacher is giving you now, you are able to build on them when you get to the university, you will, irrespective of the field where you want to specialise, do you understand?
	Learners: Yes
	Researcher: Let's go to the last question.
7.	**Researcher:** Question seven says, ***what advice would you suggest to your Life Sciences teacher and the school to improve teaching and learning of science subjects?***
	Learner A: Mr. Andile's learner A. I would advise my school to include active recall in their lessons, to give learners activities to answer in class as a group to analyse their understanding of the concept, encourage other learners to explain the concept in class to other learners to further better their understanding in that specific concept.
	Learner B: Mr. Andile's learner B. The approach or the teaching method that my teacher uses works for me, I wish we had it in all my classes.
	Researcher: In other classes too?
	Learner B: Yes, all of them.
	Researcher: As in other subjects, not just, okay, I got that.
	Learner C: Mr. Andile's learner C. The advice that I would suggest to my school is that, regarding science subjects, to use the same teaching methods, with all grades and all teachers, so that the learners are able to understand it more, yes, so that when they get to higher grades, they're not confused with a different teaching style.
	Researcher: Okay, (I will come to you, learner D). What you meant to say also, if I may rephrase, is to say that, this method should be introduced to learners at lower level even before they get to Grade 12.
	Learner C: Yes.
	Researcher: Okay.
	Learner D: Mr. Andile's learner D. I personally think that the teaching and learning of science subjects the school offers is perfectly fine, but it also goes by the determination of the learners if they want to achieve big, so it all counts by the learner and the determination that they have.

Researcher: Okay.

Learner E: Mr. Andile's learner E. What I will suggest is, in all science classes, we should have more group work, more group activities and more practicals. Because, for me personally, I feel like those are the most fun things about the science classes, the practical work and the group activities and any excursions which will also be able to educate learners.

Researcher: Okay.

Learner F: Mr. Andile's learner F. I will advise that the Life Sciences teacher to keep on going the extra mile and trying to motivate the learners in class to keep on studying harder all the time.

Researcher: Thank you so much. I want to, I'm looking at what you said, Learner A and learner E, there's a correlation in what you both said now, that is to say that, you love this method, so much that you want more of it, to engage you more in the aspects of group work, group task, doing also research work, in which you will have the opportunity to even express yourself in what you have learnt from your research work in the class, while the lecturer or your teacher is able to monitor you as a mentor to see how you describe those concepts in your group and in, is that what you said?

Learners A and E: Yes.

Researcher: Because I can see correlation from what you have said and from what he has said, Am I in order?

Learner A: Yes.

Researcher: Okay, you want to do something let me listen to you.

Learner A: Sir, they can also, like not change teachers from grade 10 to 12. So, usually, it's hard to adapt to new teachers, it takes a period of time to adapt to the new learning style and from grade 10 to 12 it is very crucial to understand the work from term one. So, when you also take time to adapt, it takes that understanding from getting it, it shortens the periods you have to learn the word to one question to adapting.

Researcher: Okay, that's an addition from yours.

Learner A: I would advise my school to include active recall in their lessons, to give learners activities to answer in class as a group to analyse their understanding of the concept, encourage other learners to explain the concept to other learners in class to further better their understanding in that specific concept.

Learner B: The approach/method that my teacher uses works for me. I wish we had it in all of my classes.

Learner C: I would suggest my school to use the same teaching style for lower grades as well not only Grade 12.

Learner D: I personally think the teaching and learning of science subjects the school offers is perfectly fine but it also goes by the determination of the learners if they want to achieve big, so it all counts by the learner and the determination that they have.

Learner E: Add more group activities and experiments. For me personally I enjoy group work as it makes the work somewhat easier and more enjoyable. In group work you are introduced to different ways of attacking the question. More excursions should also be added to help educate the learners.

Learner F: To keep on going the extra mile for their learners so that they can gain more experience.

Researcher: Now let's move to the next question, which is the last one, which is question seven. ***What advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?*** What advice?

Learner A: Mr. Bulunga's learner A. They must keep on doing, keep on using the teaching and learning approaches or methods, because it's working.

Researcher: Okay, it's okay. That is, what you're saying is this, the teaching methods he has been using, he most continues, he mustn't stop, because it's effective for you. Okay, that's very good. B?

Learner B: I would like to advise Mr. Bulunga to show us videos instead of slides.

Researcher: Okay, videos instead of slides. That is another aspect also that falls on the challenge too, you see these questions, they touch on each other, um, you guys can, I advised the learners in the last interview, I'll also give you the same advice. Okay. You see, because you are the learner, you are the most important stakeholders. Without learners, there's no school, no staff here will be employed. If there are no learners. We are all employed because it is a school, and because we have learners coming in. I give an example of magunya. If I don't, if there are no people eating my magunya, I won't be in business, you understand what I mean? So now you want some certain learning resources to be given to the school like lab, like pictures, like videos, like you can politely approach your lecturer or your teacher and explain those things to him. Politely not rudely or give us this I'm not saying you should go there and fight, is not what I'm saying. What I'm saying is you go to them politely and with humility, and say, Sir, we need you to tell the school to provide us with this or this or this, I've seen the effort your teacher is making to make sure that you guys have a lab working for you. You understand, I've seen it, is a very nice idea, lovely. But you can still approve them and say, a little push so that we can have the opportunity to see most of these apparatuses, the use, what they are meant for, how we can handle them ourselves in the lab, how we can make use of some of them, even before we get to the university and some of those things you have mentioned. You can talk to them, you understand and see how we can help, okay. Alright, let me take yours.

Learner C: Mr. Bulunga's learner C. I would like to advise my Life Sciences teacher to keep the strategy that he is using, but he must be slower.

Researcher: Not to be too fast?

Learner C: Yes

Researcher: Okay, I like that because now it's correlate to what your challenge was. I see. The strategy is good.

Learner C: Yes

Researcher: It is time consuming. That is why he is trying to cover the syllabus, he doesn't want to get to a point where, oh, I've not covered a lot and the exam is approaching. That is why he's moving at that pace. But that is why the extra classes also is important for you to make sure you always attend. And that is why you also must continue with your group work. That is why you also need to talk to your parents who have access to internet, not internet, where you start to go to Facebook and just laugh, you understand? Internet access, where you have opportunity to watch videos, you understand? On even laboratory, how the apparatuses are used. This my lecturer mentioned it in the class, I want to see, you Google it, you download it, oh, you watch the video on how they make use of those things. It will help you, it will enhance your learning of science. I'm telling you. Okay, right. Let's take yours.

Learner D: Mr. Bulunga's learner D. I would advise my school to buy us science equipment.

Learners: Yes

Learner D: So that we can use our science lab.

Researcher: I see that you guys all responded to when he said the school must buy us science equipment? Yes. So, it is already in your mind?

Learners: Yes

Researcher: You are waiting for the first person to say it. It's fine, that's the same thing I'm saying, you just approach them, and science equipment are good. The apparatus I'm talking about, the microscope, those test-tube, beaker, you can name them. You need to know the use, you understand? You need to know how to make use of them, they will, you see, some of these things will even make some people to want to become scientists.

Learner D: Yes

Researcher: Those who don't want, I'm not saying those who are already in business must stop their business, okay?

Learners: Uh, uh.

Researcher: But you just tend to say, oh, I love science, you see these things are so interesting when you start talking with them. I'm not trying to cajole you guys to come and join us. Okay?

Learners: Uh, uh.

Researcher: But I'm just telling you, you just get to a point, you'll see that science is beautiful. It's beautiful because it's real, it's not, science is not someone's philosophy, is not the philosophy of a man. It's not like a philosophy, where someone is giving you their idea that works. This is practical work, this is experiment. These are facts, that you are seeing

Learner C: You are seeing.

Researcher: It’s not like my own perception of this idea, you get the point. That is why, that is the beauty of science. That's the beauty of science. Can we take yours?

Learner E: Mr. Bulunga’s learner E. My advice to the school is that because we have a laboratory, they should improve it so that we witness experiments instead of just talking about them.

Researcher: Instead of talking about them?

Learners: Um.

Researcher: That’s true, uh, because all these experiments, when you are only hearing it, you didn’t participate yourself, is not as good as when you are doing it yourself.

Learner C: Seriously um.

Researcher: Interesting, but still go ahead politely approach school and see that, you just say sir, ma'am, after now, our journey is to the university, we want before we leave school, will you please help us so that we can play with these things? Work with them? Use them for practicals, before we leave for university to prepare us for study in the university education. Okay.

Learners: Yes.

Researcher: My friend?

Learner F: Mr. Bulunga’s learner F. My advice for Mr. Bulunga is to keep on using the projector, he should just increase his voice a little bit more and go slow, so that all learners can understand him in class. And for the school, yeah, they should improve with the lab, they should put more thing, they should buy more things, yeah.

Researcher: Yeah, it is good for your teacher to move a little bit slow. And also, to be very audible so that you can hear what he's saying. It's very good. But also, all your advice or suggestions. They will appear in my, that is why, we are not taking your names. Even the name of your teacher is not there. So, we only know sample of schools around Bojanala district. These are some of the challenges we have seen in the schools, when this teaching approach is used. Um, what is lacking is ABCD, may, can the school or the government or the authority. One of the suggestions that has come to my mind in my last is, I'm looking at the possibility of government making a regulation that will regulate a school, before you can have Grade 12 in your school, you must be able to show us that you have a science lab. If you don't show us that you have, I'm sorry, if you don't show us that you have a science lab, you cannot have Grade 12, all your Grade 12 learners will be move to another school. So, you see, it will push the school to quickly have what?

Learners: Lab, science lab.

Researcher: I'm already thinking of a suggestion like that, I want to suggest to governments.

Learners: Uh, uh, um.

Researcher: You see, because when, on the day the inspectors are coming to the dormitory, the dormitory is always very clean. But the day after the inspectors have left, then, the dormitory again looks very ugly. So, we are looking at the possibility of we making the schools to be pushed a little bit to assist the learners to get what they want. So, thank you for your time. I really appreciate your answers your response.

Researcher: Because we’ve consumed our time so much, and the last question is, ***what advice would you suggest to your Life Sciences teacher and school to improve teaching and learning of science subjects?***

Learner A: Mr. Chipo’s learner A. I do not have any advice for my Life Sciences teacher, but I would like to advise him not to spend a lot of time on one topic, and he should suggest to the school that we do need a lot of excursions, since some learners are motivated by actually seeing what it is to be a doctor or a scientist.

Learner B: Mr. Chipo’s learner B. I would like to advise the school to build us labs, for us

	observers who like to study with seeing and they should also bring like doctors, scientists to help us improve our mentality and to break our mentality into an infinity, like to infinity thinking to be able to think of many things as we can, yeah.
	Researcher: Thank you so much.
	Learner C: Mr. Chipo’s learner C. I feel like as, the teacher and the school could both come together and try build up a lab, labs for those kids who like to observe for them to get more understanding and experimental practical tasks. And also, I feel like we should get more activities from the teacher so that I could understand, we could understand the topic more. And for learner like me, eh, if they could eh, get us library, so that we can get more textbooks to get more information that we understand.
	Researcher: Okay, are you good in Literature?
	Learner C: We could say that, I understand a bit.
	Researcher: You are a literature student? You like poetry so much?
	Learner C: Yeah, poetry, novels, just reading in general, very interesting.
	Researcher: Because I also love poetry, um, but I’ll choose science above poetry
	Learner C: eh
	Researcher: I’m also in that I write my own poems, I, but I will not sacrifice
	Learner C: eh
	Researcher: Life Sciences for any of these, ahh.
	Learner D: Mr. Chipo’s learner D. Well, I’ll like to advise eh, my Life Sciences teacher to help slow learners, for instance, may be, organizing extra classes for them, because we can’t afford to like stay on one topic, like learner A said, we spent, waste a lot of time learning one concept. And for my school, I’ll like to advise the school, may be to build laboratories like she said, and um, bring more libraries, yeah.
	Learner E: Mr. Chipo’s learner E. Ahh, the suggestion I’ll like to give for my Life Sciences teacher, is that, he should give us more home-works, you know, ironically, because home-work actually, is, its practice, we as learners, we don’t know that we are actually practicing writing home-work and only few practices with the skills get stronger and intensify, so, more home-work it is you know. And to the school, well, excursion, excursion and one on one eh, one on one talk with those who have already made it, you know, those who have creates in the, in the Life Sciences field and Biology and stuff like that, yeah.
	Researcher: To motivate you?
	Learner E: Yeah
	Researcher: F?
	Learner F: Mr. Chipo’s learner F. Well, I have no advice for my teacher, but I’ll like to advise my school to support my teacher by building labs and all that stuff you know.
	Researcher: Yeah
	Learner F: Yeah
	Researcher: You are right, your teacher needs support from them, he cannot construct lab on his own
	Learners: Eh
	Researcher: He is not supposed to do that. Okay G?
	Learner G: Mr. Chipo’s learner G. Although, um, it might be quite expensive to set up a lab, I would like to advise my school as well to support the science subjects, not only Life Sciences, but other science subjects as well to develop um, the science learners and to also encourage them to continue with science outside of school. And then to my Life Sciences teacher, I don’t have much advice, but same as, I think it was learner E or F, to give us more work, more exam-based questions, so that, we are familiarised with what we are expected to know, come exam.
	Researcher: Thank you so much, we really have exhausted our time.
8	**Researcher:** Okay, I think I've done, we are done with question seven. But this one is an optional question. It comes in in terms of suggestion, and from your responses, I've seen that already have some of your suggestions, when I'm looking at how you respond to question seven. And this last part says that, if you have any suggestion, or a question or some questions you'd like to ask, so that I will be the one to respond now to your question.

I don't know if you have any question in mind that you would love to ask, as far as this interview for this research is concerned, we have anyone…
Researcher: A?
Learner A: No.
Researcher: B?
Learner B: No.
Researcher: C?
Learner C: No.
Researcher: D?
Learner D: No.
Researcher: E?
Learner E: No.
Researcher: F?
Learner F: No.
Researcher: None of you have any question for me, though, I've received most of your suggestion, and I must tell you that I had a very good time. From the very first time I met with your lecturer this morning, from your class activity, what I was looking forward to see have seen them. And when I came into your class, I had a short discussion with him on what I see on your walls, because the moment you get into this class, you should know that this is not literature class.
Learners: Yes.
Researcher: You'll know, I am in a science environment. And the world told us exactly that. And what I've seen also told me that I am in a science class, not in literature class. Thank you so much for your time, I really appreciate. But I'll give you this time to complete that which you have written, perfect them, then you can submit to me. Then, what I'm going to do, when I'm done with the capturing of these, converting my data into my system, I'll make a print-out and I'll send to your teacher, then you'll be able to see what exactly what I have written concerning the information you gave me. In nowhere your names will be mentioned. I don't even know your name, and I don't want to know your names.
Learners: Yes sir.
Researcher: Not that I don't care.
Learner A: We understand.
Researcher: I don't want to misinterpret that, I care, but. I don't want to know it for the purpose of the interview.
Learner A: Yes sir.
Researcher: Okay, then I can assure you also, the final writes up of my research will be sent to your school through your lecturer, your teacher, and because we want you to be able to see the advantage of this research that we have conducted. So, thank you very much, Okay.
Learners: Thank you sir. Good luck.
Researcher: Alright, you are done with that? Okay, you can leave once you're done thank you.

Researcher: Just last part, which I know most of you have been, if there's a question you would like to ask me concerning this interview that you have conducted, so that I can respond now? Or if I don't have the answer, I will send the answers to you, after today. Is there any question you'd like to ask me? No question? A? B? No question? C? D? E? You want to ask me a question? I like that.
Learner D: It's not a question sir, I would just like you to enlighten me about your journey to Unisa or the career route around it.
Researcher: Okay, I love that, I will respond to that, I'll come to it. Let me take any question for me.
Learner F: Yeah, sir, I will like to know more about this Unisa thing because you just called me now, I didn't know anything. So, I like to know.
Researcher: Okay, alright. Let me take the first one. My journey on studies at Unisa. I like that question. I'll respond to it. You. Your question is?

Learner F: I will like to know more about Unisa

Researcher: Okay, know more about Unisa. Unisa has been very good to me, I'll tell you. Very good to me, because I did my bachelor. This is it, when I came to South Africa. I'm not African. When I came to South Africa, my purpose of coming is, because I have to know before I even travelled, I was coming to study, and I was coming to work so that I'm able to sustain myself. So, when I came, I wanted to do what we call um postgraduate certificate in education. But my first-degree back home was in Business Administration and Management. But if I'm going to do PGCE, I may not achieve my aim on time, I'll have to go to social science, I can't use my background of social science to do pure science. But because I love Biology, which is Life Sciences. I love it so much that I said no I want to do something in Life Sciences. So, when I got to Unisa, and I applied, it went through, I registered when it was time to register, then I started picking my modules, but they told me they said you cannot do PGCE in that field of pure science because I don't have the foundation. And the person who attended to me said you have to do, pick it from the first year. So, I have to do my Bachelor of Education from the scratch, even if I've been to higher institution before I came to this country. So, I had to put that degree aside and start from the scratch. So, I started my first year, second year, third year. You see, that is why I'm already getting old you see.

Learners: Uh, uh, um.

Researcher: I love studying because it's interesting. So, I did my first, second, third, fourth year in Unisa, in, my major was Life Sciences and English. Then I went ahead to do my Honours (NS Education). When I finished my honours, I'm just starting my Master's, but because of COVID, I couldn't move as fast as I intend to move, but I will tell you, Unisa paid, is paying my fees, gave me bursary to study. You see the beauty of studying. But for you to have bursary in Unisa, you don't have to be a poor learner, you have to be a good learner. So that you will be able to have bursary. Bursary that will cover you for your Honours, your Master's, even if you want to go for PhD. They will give you a bursary, because they see that you, they see a potential in you and they're willing to assist you to get to where you're going. So, that is the beauty of studies. And you see bursaries are always applicable mostly in the field of science, they have very minimal on the other parts, but if it is in science, Unisa is going to help you. So, with Unisa, it becomes very easy for me because it allows me to do my business which is work and I'm also able to study. You see, I am studying and at the same time I am working, and Unisa is saying, we understand that you will need money to study, take bursary, so you see the advantage I have, so now, my advice to you is this, I know your question also touch on what I may want to become in future.

Learner D: Um.

Researcher: I want to become a professor, but in the field of Animal Science, Zoology, I love animals. If you ever see the way I watch National Geo Wild.

Learners: Uh, uh, um.

Researcher: Maybe one of these days, I like to touch other aspects of science too, you understand? But I love animals, I don't know, because they interact with me. You see, I have the opportunity to become a botanist. But I say no, I don't want to become, because in plants, we have very little interaction with plants. But with animals, but with animals, especially when you start to study the behavior of animals. Why is this animal behaving like this? You want to find out? Oh, this is why they behave like this. I'll give an example too like I said in my last interview. Now, doesn't that surprise you that chromosomes, the sex chromosome does not determine the offspring of some certain animals in this world? It doesn't determine the gender of those offspring. So that is a question for you to go and find out, I won't tell you the answer, I don't like to tell my learners the answer. I want them, when they leave, David said this, then go and search, oh, these set of animals. It is the weather that determine male and female offspring.

Learner C: Wow

Researcher: You see, that is the beauty of science, so beautiful. I can sit with animal planet, the whole day not going anywhere. If I'm not watching animal planet, I'm listening to music, because I love music.

Learners: Uh, uh, um.

Researcher: Animal planet? If, I can't be watching movie, I will waste three hours watching movie. No, I don't do that.

Learners: Uh, uh, um.

Researcher: You get my point. So, this is it. I may in the future may also divert or diversify. I may also go into what, because of what is happening right now in the world COVID-19. I may want to go into research in the area of epidemiology, I want to become an epidemiologist or want to become, because I love about the brain too, the nervous system that you teacher started with today, I want to learn so, I want to do research in that field. I also want to go into stem cell research.

Learners: Yeah, uh, um.

Researcher: If I have the power, if I have enough time, I want to go, because with stem cell research, we see that um, diseases that were not curable. Science is making breakthrough today from stem cell.

Learners: Yeah, uh, um.

Researcher: COVID, HIV, diabetes, name them, they are already getting breakthrough in some aspects of this not curable diseases. So, you see, when you look at this, you also want to leave your name on that marble.

Learners: Yeah, yes, uh, um.

Researcher: I am, this man was part of the people who discovered, you see, so if you have that at the back of your mind, you have the energy to also want to go deep into science, to become a scientist, that in the future, when they talk about, look at the this man, this man who discovered the last species, the remains at, Homo naledi, you need to go and read about, Lee Berger who discover with this team, the last, um, the missing link, Homo naledi in this um, you see, these are some of the breakthrough, the man had already left his name among the scientists who had his own discovery. The first cloned animal in Africa was here in South Africa, which your lecturer was telling you today. The set of doctors who did that they have already left their mark in the field of science. So why don't you want to leave your name? Also leave a mark, let's, you must be remembered as one of the people who did ABC in the field of science. Okay. Did I answer your question?

Learner D: Yes

Researcher: Did I answer yours too?

Learner F: Yeah

Researcher: Partially?

Learner F: Yeah, not really.

Learners: Uh, uh

Learner F: I want to know more about Unisa sir, is it like a university?

Researcher: Okay, Unisa is like you have said it’s a university, of course. It's one of the most reliable, because as far as I'm concerned, it's very flexible, flexible that accommodate you whether you are working or not working. If I don't go to Unisa I will not be able to survive, let me put it that way so that you will understand what I'm saying. Because other university may require that I come and sit down every day and I will not be able to what? Survive. And because I'm not a super-rich person I'm not rich, I’m in the middle class, I'm not very poor. If I say I want to go to University of Cape Town, then I’ll have to sell everyone in my house.

Learners: Uh, uh

Researcher: To be able to go to university. You see Unisa accommodate me. So, if you want to apply for Unisa, all I just need you to do is, make sure that you pass your Grade 12 very well. But before you finish, make sure that you try to apply in Unisa, you can start applying now.

Learners: Uh, uh

Researcher: Before you write your, but let your lecturer your teacher guides you when to apply, when to submit, all of that, then, so that you do all these things at the right time because you need to apply and then you need to register all of that, is going to guide you. But most importantly, make sure that you pass your Grade 12 perfectly. Put every energy you have behind your studies. You have to study as if you are writing the exam tomorrow. That's how I study, when you study today, just study with the mind-set that the exam will be written tomorrow, you know how you take the exam seriously

Learners: Uh, yes, uh
Researcher: When you're writing tomorrow, hey, you say to someone don't disturb me, then you face your book. If you can do that on daily basis, I am telling you, you guys, you'll pile up distinctions. And once you have that, it becomes very easy for you to do your course. Any other question? Did I answer your question?
Learner F: Yeah, you did.
Researcher: Talk to your lecturer, your teacher is going to guide you. But like I told you Unisa is not too expensive that you, it is meant for people like me, I don't know, you may come from a very rich family. But Unisa helped me, without Unisa, maybe I wouldn't have gone to university when I came to South Africa. Because when I looked around, this is what I can afford. If I make money, I can take little money from my salary and pay school fees and still pay rent and still have something to feed myself. But I can't do that with Cape Town, University of Cape Town, I can't do that with some universities. So Unisa accommodated me, gives me that accommodation and gives me everything I need. And is not a school where you don't get resources. Even now, we no longer have, we were the last set who went to North-West University for our Zoology 2 practical, because they told us, they said, your school now has got their own lab where you can have your, so it means that by the time you want to do science now, you don't have to be taken to North-West, you'll do everything within Unisa.
Learners: Uh, uh
Researcher: Yeah. Are we together?
Learners: Yes sir.
Researcher: So, but let your teacher always give you information on that. So, on this we close this interview. I want to thank you so much for your questions that you have asked me. And I also want to thank you so much for the response that you have given me. This will go a long way to help me finish up with my dissertation. Thank you, guys. I really appreciate Okay.
Learners: Yeah, uh.

Researcher: I don't know, the last part, I don't know, do you have any questions for me? Any suggestions for me? Questions for me? None?
Learner B: Not really
Researcher: I find it difficult, when I got to the first school, you don't have questions for me?
Learner B: No, no, no
Researcher: Why are you, learners not asking me questions
Learners: Ah
Researcher: I love it, when you ask me questions so that I respond, it will help my memory, it will also help me to improve in my dissertation. But I can assure you guys, I really appreciate your time, I want to thank you specially for this time that you have given me, it is going to really help me improve my research work and I can promise you, this I can promise you, the final work will be sent to your teacher, he will communicate that same work to you, and you will see the benefits that we are going to highlight in my dissertation
Learner B: I have a question. Would you advise the school to break, to like, how would I say this? To divide the Life Sciences topics like, to focus more on Biology, like those who want to focus on Biology to like, like that, would you advise their school to like divide their Life Sciences topics?
Researcher: Okay, I'm talking to learner B?
Learner B: Yeah.
Researcher: Okay. Your question is if I will agree to it that the school should divide learners according to their preference?
Learner B: Yeah
Researcher: Life Sciences and Biology?
Learner B: Um
Researcher: Okay, why would you, how are you able to differentiate between Life Sciences and Biology?
Learner A: Can I add unto her

Researcher: Yeah, please.
Learner A: Thinking that, may be, for example, there is a topic on Nervous System, she says, she enjoys Nervous System, and I enjoy Genetics, so may be like, I think she said, may be they divide and they have Genetics and the Nervous System as two different links, so that um, you gain in one information that you will be taught in university.
Researcher: Okay
Learner A: Is that what you were?
Learner B: Yeah, something like that.
Researcher: Okay, if I also would add to your question, I'm trying to see if I can fine-tune it very well so that I can respond
Learner B: Um
Researcher: Your question also could mean that um. Is it okay, that the school should at this stage, find out what you want to specialise on, so that they can start to prepare you in that regard?
Learner B: Yeah um
Learner A: Yes, um
Learner D: Yeah
Researcher: Perfectly asked right?
Learners: Yes, um, yeah
Researcher: Yeah, I will support that, 100 percent, 101 percent.
Learner B: Um
Researcher: You understand? You know why I said I'll support that, because, the earlier the better you start to see yourself as a neurologist, like you have mentioned, a geneticist, then you'll, your mind is fine-tuned, and you are more encouraged to pursue your career in that field.
Learner B: Um
Researcher: I hope that's the last question?
Learner B: Um
Researcher: But, from what I have received from you, they are very rich information.
Learner D: Yes sir.
Researcher: Very rich, I'm telling you, I'm impressed, thank you so much guys.
Learner D: Thank you sir.
Learner B: Thank you sir.
Researcher: Yeah, the final dissertation, the final report will be sent to your teacher. But I'll like you to submit these ones you have written, because I'll need them, I'll need them to validate what I have here, I hope you understand?
Learners: Yes sir.
Researcher: Yeah, in case you need them, just let me, I'll communicate through your lecturer, your teacher, then you can have them, you can also have them, okay?
Learners: Yes sir.
Researcher: Thank you so much
Learners: Thank you sir.
Researcher: And enjoy the rest of the day
Learners: And you too sir.
Researcher: Yeah, really appreciate.

Appendix Z: Classroom Lesson Observation Schedule

Date of Lesson Observation	:
Observation's Venue	:
Observer (Researcher)	:
Teacher Observed	:
Level of Learners Observed	:
Level and Name of Subject	:
Topic of the Lesson	:
Lesson Plan and Objectives	:
Lesson Duration	:
Teaching & Learning Resources	:
Teaching & Learning Approach	:
Learners' Interaction & Participation	:
Classroom Management	:
General Observable Activities	
Reflection	:

Appendix AA: Mr. Andile: Classroom Lesson Observation Worksheets

Reproduction

Terminology

	Description	Term
1	Process by which the ovum is released from the ovary in humans	
2	Type of cell division by which sperms are produced	
3	Sex organ responsible for production of sperms	
4	Coiled tubular structure outside the testis that temporarily stores sperms	
5	Tubes in the female reproductive system through which the egg moves towards the uterus	
6	A term that describes the formation of gametes by meiosis	
7	Hormone produced by the Graafian follicle that prepares the uterus for pregnancy	
8	Structure in the ovary that is, responsible for the formation of progesterone	
9	Process by which the embryo attaches to the wall of the uterus	
10	Structure that maintains contact between the embryo and the mother for nutrition, gas exchange and excretion	
11	Fluid that protects the embryo against injury and temperature changes	
12	The offspring produced from a fertilized egg or zygote which subsequently divides into two separate balls of cells	
13	The process whereby a small amount of amniotic fluid containing foetal cells is withdrawn and analysed for genetic defects	
14	The process during which strong contractions of the uterus result in the birth of a baby	
15	The lining of the uterus which is richly supplied with blood vessels	
16	The stage when sexual maturity is reached in males and females	
17	Removal of the endometrial lining of the uterus wall, accompanied by bleeding	
18	Process by which an ovum is released from the ovary in humans	
19	The delivery of a baby by means of a surgical operation through the abdomen of a female	
20	Images formed of an unborn baby obtained by bouncing off sound waves through the mother's body	
21	The tube leading from the testes to the urethra in males	
22	The fluid produced by testes and associated glands that contain spermatozoa	
23	The part of the sperm which produce enzymes to dissolve the surface of the ovum	

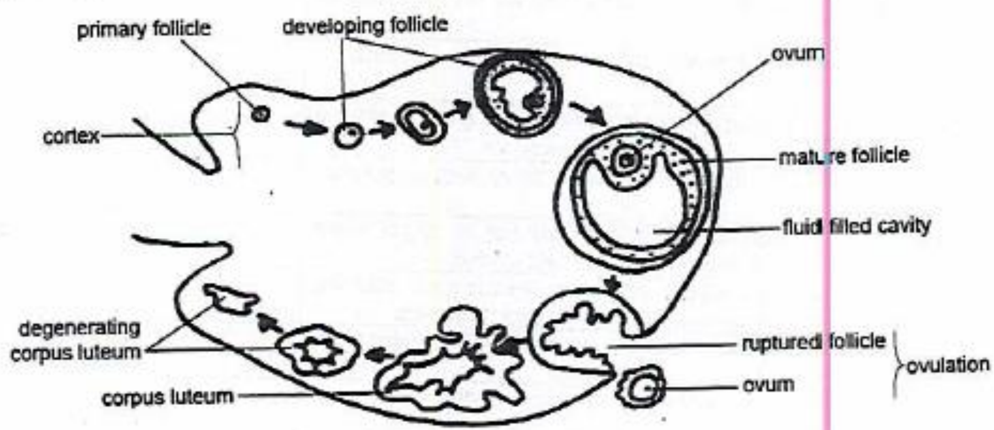
(23)

A spermatozoan

1. Make a fully labelled drawing of a spermatozoan in the space below. (5)

The ovarian cycle

Study the diagram below showing various structures in the ovary and then answer the questions set.



1. Name the layer of the ovary from which the primary follicles develop. ______ (1)
2. Which type of cell division is responsible for the formation of the primary follicles? ______ (1)
3. Name the mature follicle containing a fluid filled cavity and an ovum. ______ (1)
4. Which hormone is responsible for the formation of the structure named in Question 3? ______ (1)
5. What hormone is produced by the structure named in Question 3? ______ (1)
6. What is the function of the hormone named in Question 4. (2)

______

7. Name the structure from which the corpus luteum develops. ______ (1)
8. Which hormone is responsible for the formation of the corpus luteum. ______ (1)
9. Which hormone is produced by the corpus luteum? ______ (1)
10. What is the function of the hormone named in Question 9? (2)

______

11. When does the corpus luteum degenerate? (2)

12. What is ovulation? (2)

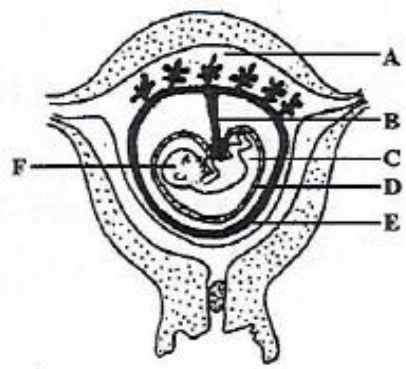
13. What is the period of time between one ovulation and the next? ______ (1)

14. What happens to the ovum if it is not fertilized? (2)

(19)

Pregnancy

1. Study the diagram below showing a developing foetus in the uterus and answer the questions set.



a. Name the parts numbered:

A______ B ______ C ______

D______ E ______ F ______ (6)

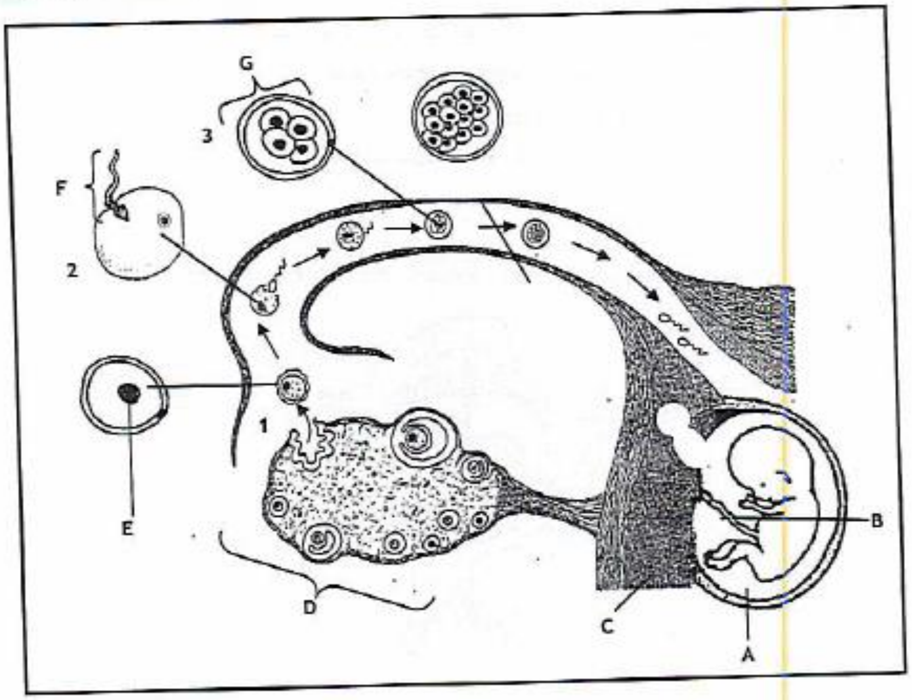
b. List THREE functions of the part A. (3)

c. List TWO functions of the fluid C. (2)

d. List TWO probable differences between the composition of blood in an artery leading from the foetus to structure labelled A, and the blood in a vein leading from structure A towards the foetus. (4)

(15)

2. The diagram below shows part of the female reproductive system. Structures B to G and processes 1, 2 and 3, occurring in the Fallopian tube and uterus, are magnified.



a. Label C and D. C__________________ D________________________ (2)

b. State which processes are taking place at 1, 2 and 3 respectively. (3)

1__________________ 2__________________ 3__________________

c. State how many chromosomes are present in the following structures:

i. E __________ (1)

ii. Each cell of structure G __________ (1)

d. State TWO functions of fluid A. (2)

____

____

e. Structure B transports substances to and from the foetus.

i. Name ONE useful substance transported to the foetus. __________________ (1)

ii. Name ONE waste product transported from the foetus. __________________ (1)

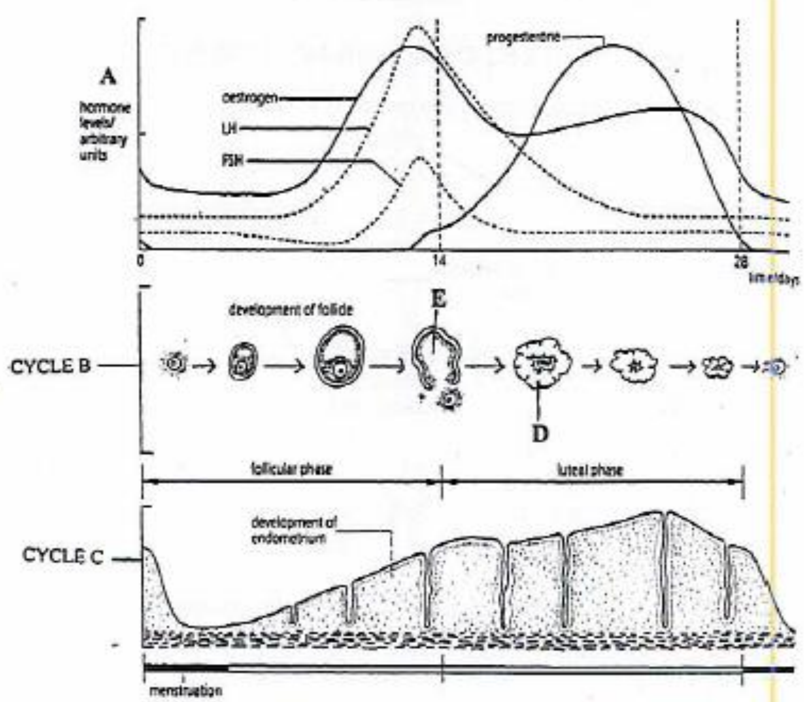
(11)

Hormonal control of reproduction

1. Write down the name of the hormone and the gland that produces it, for each of the functions listed in the last column. (12)

HORMONE	GLAND/STRUCTURE	FUNCTION
		• In females, stimulates development of a follicle inside which an ovum develops.
		• In females, causes ovulation. • Stimulates empty Graafian follicle to develop into corpus luteum.
		• Development of secondary characteristics in females. • Stimulates the endometrium to thicken in preparation for implantation of a fertilized ovum. • Inhibits secretion of FSH so that no further follicles are produced.
		• Maintains endometrium. • Prevents pituitary gland from producing FSH and LH.
		• Development of secondary characteristics in males.
		• Causes uterus to contract during childbirth.

2. The following represents the cycles that occur in the reproductive system of a human female. Answer the questions based on it.



2.1. Name the part of the female reproductive system in which cycle B occurs. ____________ (1)

2.2. Name the process that occurs at E. ____________ (1)

2.3. Label part D and state its function. (2)

D____________ Function____________

2.4. How do we know that fertilization did not take place in the 28-day cycle represented? (2)

____

____

2.5. Explain the relationship between the level of oestrogen and the thickness of the endometrium. (4)

____

____

____

2.6. Why does the level of progesterone rise when the level of oestrogen drops? (2)

____

____

2.7. Why does the level of FSH reach a very low level around day 17? (2)

____

____

2.8. Why does the level of LH reach a very low level around day 21? (2)

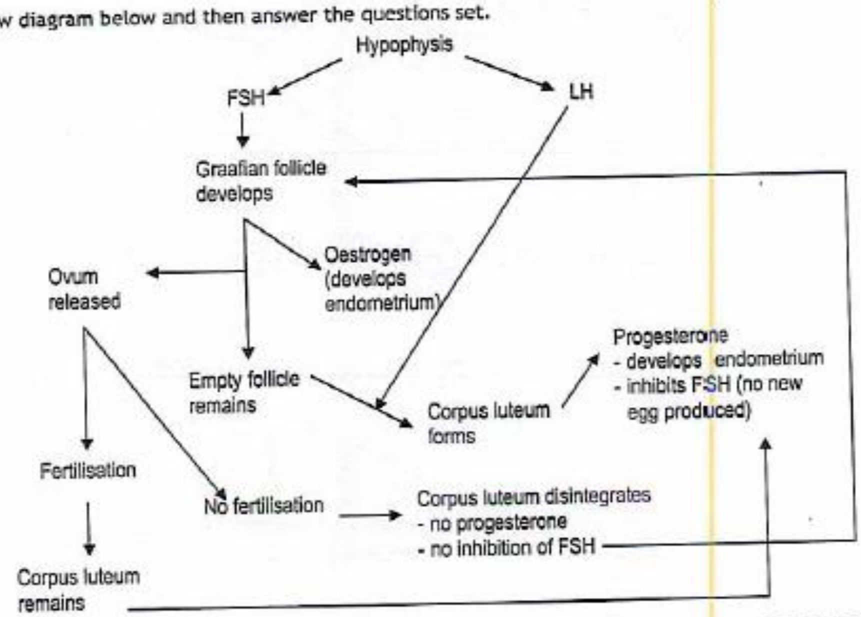
____

____

(16)

Negative Feedback : FSH, LH, Oestrogen and Progesterone

Study the flow diagram below and then answer the questions set.



1. Use the information provided in the flow diagram to complete the paragraphs below outlining the feedback mechanism involving oestrogen, progesterone, FSH and LH.

The hypophysis produces ______ which stimulates the development of a Graafian follicle. The Graafian follicle produces the hormone ________________ which starts the preparation of the endometrium. When the ovum is released, the empty follicle is converted into a corpus luteum under the influence of the hormone ______________ produced by the ________________.

The corpus luteum produces __________________ which continues the development of the endometrium. This hormone also inhibits the hormone ________ since now new egg is required now.

If fertilization takes place, the ______________ remains and continues producing ________________ to prepare the endometrium finally for pregnancy. ________ inhibition continues since no egg is required during the period of pregnancy.

If fertilization does not take place, the corpus luteum disintegrates and hence the production of ________________ stops, causing menstruation to occur. There is also no further inhibition of the hormone ___________ and so a new egg develops once more, starting another cycle.

Contraceptives

1. Select from the list below the method of contraception that best fits each description in the table: (11)

Contraceptive injections
Spermicides
Condom
Femidom
Female Sterilisation - tubal ligation
Rhythm
Diaphragm
Withdrawal
Loop/IUD
Contraceptive pill
Male sterilisation - vasectomy

	Description	Method of contraception
	Acts as a barrier/stops sperm getting into the vagina	
	It prevents fertilised eggs/embryos from becoming attached to the uterine wall and is highly effective	
	Acts as a barrier /stops sperm getting into the uterus/Fallopian tubes	
	It covers the cervical opening and prevents sperm from entering the uterus and is fairly effective.	
	Contains artificially produced hormones which prevents the production of eggs/ovulation/signalling the body that it is already pregnant. It changes the lining of the cervix/ womb. It is a very reliable method	
	It contains a chemical substance that kills sperm and acts as a barrier/prevents sperm from entering the Fallopian tubes. They are not very reliable on their own.	
	It contains progesterone/combination of oestrogen and progesterone which stops ovulation/ changes the lining of the womb and the cervix. It works for 2 to 3 months and are very effective.	
	The sperm ducts are cut and tied. Semen without sperm is produced and is a very effective method of contraception.	
	The fallopian tubes are cut and tied during a small surgical operation preventing the fusion of sperm and egg.	
	The penis is removed out of the vagina before ejaculation but is not a safe method because many sperms are released during sexual intercourse	
	Sexual intercourse is avoided during ovulation but is not a safe method of contraception because it is impossible to be 100% sure when ovulation will occur	

Appendix AB: Mr. Bulunga: Classroom Lesson Observation Worksheets

2.3 Read the extract below.

The first cloned animal in Africa, a calf named Futhi, was born in North West in South Africa on 19 April 2003. No fertilisation was involved in the production of Futhi. She was produced from a single cell taken from the ear of a donor cow named LMJC 865. The donor cow had a high average milk yield of 78 litres a day. Cloning allows for the production of organisms with desired characteristics.
Some people argue that cloning reduces genetic variation in the offspring, with no further genetic improvement. Cloning is an expensive procedure and may not be economical for commercial agriculture.

2.3.1 According to the extract, state ONE:

(a) Advantage of cloning (1)

(b) Disadvantage of cloning (1)

2.3.2 State why the donor cell was taken from LMJC 865 and not from any other cow. (1)

2.3.3 State why an ear cell was used and not an ovum. (2)

2.3.4 Briefly describe the process of *cloning*. (4)

(9)

2.3 Read the following extract.

Duchenne's muscular dystrophy is a genetic disorder in which the skeletal muscles progressively weaken. It is a sex-linked disorder. The recessive mutated gene codes for a weak form of protein which cause the muscle fibres to weaken and break down. Duchenne's muscular dystrophy mostly affects boys and causes their muscles to weaken from the age of about 3. By the time they are teenagers they will be using a wheelchair and eventually their heart and respiratory muscles will also be affected.

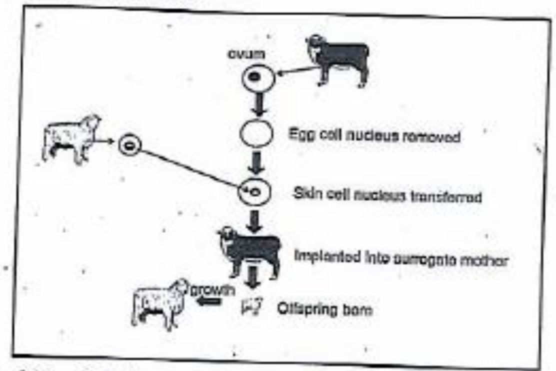
2.3.1 Define a *sex-linked disorder*. (1)

2.3.2 According to the extract, when will parents first notice the changes in the muscles of their child? (1)

2.3.3 Explain why is it more common for boys to suffer from Duchenne's muscular dystrophy than girls. (4)

(6)

2.4 Study the diagram below.



2.4.1 Name the process shown in the diagram above. (1)

2.4.2 Give TWO possible benefits of this process. (2)

2.4.3 Explain why the nucleus of a skin cell was used in this process and not the nucleus of a gamete. (2)

(5)

Appendix AC: Mr. Chipo: Classroom Lesson Observation Worksheets

2022/04/09

2.3 In humans brown tooth enamel is inherited as a sex-linked recessive trait. A man who carries the recessive allele will have brown tooth enamel.

A man with brown tooth enamel marries a woman with white teeth, but whose father had brown tooth enamel.

Use X^B for white teeth enamel and X^b for brown tooth enamel.

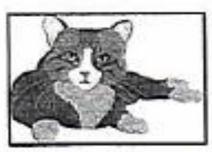
2.3.1 Explain why the woman is heterozygous for tooth enamel colour. (4)

2.3.2 Use a genetic cross to show the possible ratio of the phenotypes of their children. (6)

(10)

1

3.4 The inheritance of fur colour in cats is sex-linked. The tortoise-shell colour of cats is a combination of black and orange fur. The allele for black fur is represented by X^B and the allele for orange fur is represented by X^O.



HINT: The sex chromosomes/gonosomes in cats are inherited in the same way as in humans.

3.4.1 A female cat with a tortoise-shell colour is crossed with an orange male cat.

Show the genetic cross between the two cats and determine the phenotype ratio of the F_1 - generation.
(Use X^B, X^O and Y.) (7)

3.4.2. Explain why male kittens can never have the tortoise-shell colour. (3)

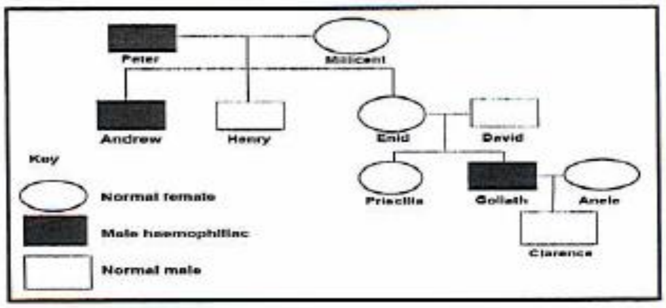
(10)

[40]

2

1

1.6 Study the pedigree diagram of a family where some individuals have haemophilia. Haemophilia is a sex-linked disorder. Use H for normal blood clotting and h for the haemophiliac trait



1.6.1 From the pedigree diagram above, state the relationship between gender and haemophilia. (2)

1.6.2 Write down all the possible genotypes of individuals:

(a) Peter

(b) Enid

(c) Clarence (6)
(8)

3

1.4 In tomato plants the allele for red fruit (R) is dominant over the allele for yellow fruit (r). The allele for tallness (T) is dominant over the allele for shortness (t).

Plant A, which is heterozygous for red fruit and homozygous tall, was crossed with Plant B, which has yellow fruit and is short.

1.4.1 Write down the genotype of:

(a) Plant A (1)

(b) Plant B (1)

1.4.2 Write down ALL the possible genotypes of the gametes of plant A. (2)

1.4.3 Name the phenotype of an offspring having the genotype:

(a) Rrtt (1)

(b) RrTt (1)

1.4.4 Plant B was then crossed with another plant (Plant C) and all the offspring had red fruit and were tall.

Use this information to write down the genotype of Plant C. (2)
(8)

4

2

2.5 In rats the allele for a black coat colour (**B**) is dominant over the allele for a white coat colour (**b**). The allele for a long hair (**L**) is dominant over the allele for a short hair (**l**).

2.5.1 Two rats were crossed. The genotypes of their offspring are represented in the Punnett diagram below, except at **(i)** and **(ii)**.

	BL	Bl	bL	bl
Bl	BBLl	BBll	BbLl	(i)
bl	BbLl	Bbll	(ii)	bbll

Give the:

(a) Genotype of the offspring at (i) (1)

(b) Phenotype of the offspring at (ii) (2)

2.5.2 If rats produce offspring all with the genotype **BbLl** and the female genotype is **bbll**, state the only possible genotype of the male. (2)
(5)

5

3.2 Indian maize has four grain types that involve combinations of colour and appearance. Four alleles are involved, which are located on two pairs of homologous chromosomes (each gene on a separate chromosome). The alleles are:

B = black b = yellow R = round r = wrinkled

The table below shows the results of a cross between two hybrid Indian maize plants.

Grain phenotype	Observed number of offspring
Black and round	144
Black and wrinkled	48
Yellow and round	48
Yellow and wrinkled	16
TOTAL	256

3.2.1 State the type of genetic cross represented in the above table. (1)

3.2.2 State the phenotype of the parents. (2)

3.2.3 Determine the genotypes of the yellow and round offspring. (2)

3.2.4 Predict the possible gametes produced by the parents. (2)

3.2.5 Using the data, calculate the phenotype ratio in this cross. (2)
(9)

6

3

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3.2.3 Determine the genotypes of the yellow and round offspring. (2)

3.2.4 Predict the possible gametes produced by the parents. (2)

3.2.5 Using the data, calculate the phenotype ratio in this cross (2)
(9)

7

The table below shows the alleles that control these two characteristics.

CHARACTERISTIC	ALLELE	PHENOTYPE
Fur colour	B	Black
	b	White
Fur texture	R	Rough
	r	Smooth

The Punnett square below shows the inheritance of these alleles in a genetic cross.

All possible gametes from female

All possible gametes from male

	BR	Br	bR	br
bR	BBRR	BbRr	X	bbRr

1.5.1 Name the:

(a) Dominant phenotype for fur colour (1)

(b) Recessive phenotype for fur texture (1)

1.5.2 Give the:

(a) Genotype of offspring X (1)

(b) Phenotype of the female parent (2)

(c) Genotype of the male parent (1)

1.5.3 State the phenotype that ALL the offspring of this genetic cross have in common. (1)
(7)

8

Appendix AD: Editor’s Certificate

Mirna Lawrence
Language editor & proofreader

DATE: 12th June 2023

I, Mirna Lawrence, hereby declare that I edited the Master’s in Education dissertation of Olufemi David Naiye titled *Teachers’ Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study*

The document has been edited within ethical and professional limits for syntax, grammar, spelling, punctuation, word usage, sentence structure and flow, consistency of argument, stylistic consistency, tense, consistency of voice (passive voice to active voice), sequencing of figures and tables, and referencing.

The editor’s revisions, comments and suggestions and overall quality of the final product do not detract from the content being the author’s sole responsibility and work in its entirety.

The language editor does not accept responsibility for any changes made to this document after the issuing of this declaration.

MLawrence

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Molteno Institute for Language and Literacy
Senior Material and Development Manager for Writing and Editing

Master’s Degree in Arts and Humanities
University of the Witwatersrand

Appendix AE: Turnitin Report

Teachers' Perceptions of Inquiry Based Learning in Teaching Grade 12 Life Sciences: a case study

ORIGINALITY REPORT

12%	11%	7%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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