



A Lesson Study Approach for Grade 10–11 Biology teachers: A framework to foster teaching praxis in education for sustainable development

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DECLARATION

I, Alina Hambelela Angula declare that “A Lesson Study Approach for Grade 10–11 Biology teachers: A framework to foster teaching praxis in education for sustainable development” is my own original work. References to work by other people have been acknowledged. I further declare that the work in this thesis has not been submitted at any other university for degree purposes.

14/11/22

Signature

Date

DEDICATION

This thesis is dedicated to my biological parents; my father, the late Lazarus Nakambale Angula and my mother, the late Alina Niilonga yaSakeus Akwaake. The two shaped me to be who I am today. They encouraged me to work very hard when they were alive. My dear parents, you were my inspiration. May their beautiful souls continue resting peacefully!

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ABSTRACT

The Lesson Study Approach (LSA) is a professional learning approach that has the potential to revolutionise how teachers plan and deliver lessons in Africa. Despite teachers being trained in collaborative planning and peer teaching, Namibian teachers have experienced challenges in its implementation. The implementation of the LSA is not common practice among Namibian teachers, and its effective implementation has not been well emphasised. Equally, the call to integrate Education for Sustainable Development (ESD) across all Namibian school curricula has been given little attention by teachers. The purpose of this research study was to establish how the LSA has been integrated by Grade 10–11 Biology teachers to foster teaching praxis in ESD.

The professional development of teachers as planners and implementers of subject knowledge is often neglected due to time and resource restraints. To aid with professional development in Biology teaching in Namibia, I attempted a Participatory Action Learning and Action Research (PALAR) study with a group of teachers as a professional learning group (PLG), by implementing the LSA cyclical process of plan, do, see and improve in Grade 10 and 11 Biology teaching and learning.

Convenience sampling was used to select one secondary school in the Onathing Circuit in the Oshikoto Region, Namibia. Purposive recruitment was used to select the four participants. The data were generated from the lesson planning discussions, discussions of the lesson observations and narratives of the presented lesson discussions, the discussions of the PLG reflective diaries and my analysis of the reflective diaries. Thematic analysis was used to analyse the data collaboratively.

This research study familiarised the involved PLG teachers with the LSA through collaborating on the critique of the planning and presenting for the betterment of both planning and presenting the lesson, and therefore teaching in a learner-centred approach. The recurrent reflection discussions of the planned and observed lessons in which the PLG was involved led to lesson improvement. This study established that a lack of time, time allocation and management, teacher's workload and the lack of appropriate teaching and learning resources were identified as challenges in the implementation of the LSA. In this research study, the PLG

teachers shared the challenges of Biology teaching, namely time and resources, and opened up possible ways to address the challenges.

The overall aim of this research study was achieved by addressing the research objectives of this study which was to develop an LSA framework for Grade 10–11 Biology teachers. The LSA framework can direct Biology teachers to develop professionally and bring changes in their classroom teaching through its implementation. The Grade 10–11 LSA framework was developed for the benefit of the Biology teachers in the form of professional development. The developed framework presents Namibian teachers with an alternative to planning the lesson individually – teaching in a teacher-centred manner and moving towards collaborative planning, observing and reflecting on learner-centred lessons.

Though it was the intention of this research study to more fully discuss ESD, the PLG did not make ESD a priority. The developed framework directs Namibian teachers to address the National Environmental Education (EE)/ESD policy in their teaching and learning. The involvement of the PLG teachers in providing guidelines for this framework and the recurrent collaborative planning, observing and reflection discussions helped increase their confidence and remove the fear of being observed.

Keywords: Education for Sustainable Development; Lesson Study Approach; Participatory Action Learning and Action Research; Professional Development, Biology Teachers, Collaborative Learning, Cyclical Process, Teaching Praxis

OPSOMMING

Lesstudiebenadering (LSA) is 'n professionele leerbenadering wat die potensiaal het om 'n revolusie te weeg te bring hoe onderwysers lesse in Afrika beplan en lewer. Ten spyte van onderwysers wat opgelei is in samewerkende beplanning en portuuronderrig, het die Namibiese onderwysers uitdagings ondervind met die implementering van die LSA. Die implementering van die LSA was nie algemene praktyk onder die Namibiese onderwysers nie, en die effektiewe implementering daarvan is nie genoeg beklemtoon nie. Die oproep om Opvoeding vir Volhoubare Ontwikkeling (OVO) in alle Namibiese skoolkurrikulums te integreer, is nie noodwendig deur onderwysers geïmplementeer nie. Die doel van hierdie navorsingstudie was om vas te stel hoe die LSA deur graad 10–11 biologie onderwysers geïntegreer is in hul onderrigpraktyke om OVO te bevorder.

Die professionele ontwikkeling van onderwysers as beplanners en implementeerders van vakkennis word dikwels afgeskeep weens tyd- en hulpbronnbeperkings. Om te help met professionele ontwikkeling in biologie-onderrig in Namibië, het ek 'n Deelnemende Aksie Leer en Aksie Navorsing (PALAR) studie met 'n groep onderwysers, as 'n professionele leergroep (PLG) nagevors deur die implementering van die LSA sikliese proses van plan, doen, sien en verbeter in graad 10 en 11 biologie-onderrig en -leer.

Geriefssteekproefneming is gebruik om een sekondêre skool in Onathing Sirkel in die Oshikoto-streek, Namibië, te kies om deel te neem aan die navorsing. Doelgerigte werwing is gebruik om die vier deelnemers te kies. Die data is gegenereer uit die lesbeplanningsbesprekings, besprekings van die leswaarnemings en narratiewe van die aangebied lesbesprekings, die besprekings oor die PLG-reflektiewe dagboeke en my ontleding van die reflektiewe dagboeke. Tematiese analise is gebruik om die data saam te ontleed.

Hierdie navorsingstudie het die betrokke PLG met die LSA vertrou gemaak deur samewerking rondom kritiek op beplanning en aanbieding vir die verbetering van beide beplanning en aanbieding van die les, en dus onderrig in 'n leerdergesentreerde benadering. Die herhalende refleksiebesprekings van die beplande en waargenome lesse waarby die PLG betrokke was, het tot lesverbetering gelei. Hierdie studie het vasgestel dat tyd- en tydbestuur, onderwyser se werklading en die gebrek aan toepaslike onderrig- en leerhulpbronne as uitdagings in die implementering van die LSA geïdentifiseer is. In hierdie navorsingstudie het

die PLG die uitdagings van biologie-onderwys, naamlik tyd en hulpbronne, gedeel en moontlike maniere oopgestel om die uitdagings aan te spreek.

Die oorhoofse doel van hierdie navorsingstudie is bereik deur die navorsingsdoelwitte van hierdie studie aan te spreek en om 'n LSA-raamwerk vir graad 10-11 biologie-onderwysers te ontwikkel. Die raamwerk kan biologie-onderwysers aanstuur om professioneel te ontwikkel en veranderinge in hul klaskameronderrig te bring deur die implementering van die LSA. Die graad 10-11-raamwerk is ontwikkel tot voordeel van die biologie-onderwysers in die vorm van professionele ontwikkeling. Die ontwikkelde raamwerk bied Namibiese onderwysers 'n alternatief van die beplanning van die les individueel, tot onderrig op 'n onderwysergesentreerde wyse en beweeg na samewerkende beplanning, waarneming en refleksie van leerdergesentreerde lesse.

Alhoewel dit die bedoeling van hierdie navorsingstudie was om meer rondom OVO te bespreek, het die PLG nie OVO 'n prioriteit gemaak nie. Die ontwikkelde raamwerk beveel Namibiese onderwysers om die Nasionale Omgewingsopvoeding/OVO-beleid in hul onderrig en leer aan te spreek. Die betrokkenheid van die PLG om riglyne vir hierdie raamwerk te verskaf en die herhalende samewerkende beplanning, waarneming en refleksiebespreking het gehelp om hul selfvertroue te verhoog en die vrees om gedurende lesaanbieding geobserveer te word te verwyder.

Sleutelwoorde: Opvoeding vir Volhoubare Ontwikkeling, Lesstudiebenadering, PALAR, Professionele Ontwikkeling, Biologie-onderwysers, samewerkende leer, sikliese proses, onderrigpraktyke

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LIST OF ACRONYMS

ALEI-PDSI –	Activity, Learner centred, Experiment and Improvisation – Plan, Do, See and Improve
CEMASTEА –	Centre for Mathematics, Science and Technology Education in Africa
CPD –	Continuous Professional Development
EE –	Environmental Education
EE/ESD –	Environmental Education / Education for Sustainable Development
ESD –	Education for Sustainable Development
HIV/AIDS –	Huma Immuno Virus / Acquired Immuno Deficiency Syndrome
JICA –	Japan International Cooperation Agency
LCE –	Learner Centred Education
LSA –	Lesson Study Approach
MoE –	Ministry of Education
NEEN –	Namibia Environmental Education Network
NEEC –	Namibia Environmental Education Certificate
NIED –	National Institute for Educational Development
NNSC –	Namibia Senior Secondary Certificate
NWU –	North-West University
PALAR –	Participatory Action Learning and Action Research
PDT –	Professional Development Team
PLG –	Professional Learning Group
SDGs –	Sustainable Development Goals
SEEN –	Supporting Environmental Education in Namibia
SMASE –	Strengthening Mathematics and Science Education
TRC –	Teachers Resource Centre
UNESCO –	United Nations Educational Scientific and Cultural Organization

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

The professional development of teachers as planners and implementers of subject knowledge is often neglected due to time and resource restraints. To aid professional development in Biology in Namibia, I attempted a Participatory Action Learning and Action Research (PALAR) study with a group of teachers as a professional learning group (PLG), by implementing the Lesson Study Approach (LSA) in Grade 10 and 11 Biology.

This chapter presents the background and the rationale of the research study. The research questions, the aim and objectives of this research study precede the clarification of concepts. In this chapter, the research methodology, context of the research site and recruitment of the participants as a PLG as well as the data generation procedures are presented. The chapter discusses the data analysis, the ethical considerations, the quality criteria and the contribution of the study. The chapter concludes with the thesis chapter outline and a conclusion.

The next section discusses the background and the rationale for the research study.

1.2 BACKGROUND AND RATIONALE FOR THE STUDY

According to Article 95 (1) of the Namibian Constitution the Republic of Namibia, Environmental Education (EE) and ESD are at the top of its national priorities. The Constitution states that:

...the state shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at the ... maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilisation of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future (Ministry of Information and Broadcasting, 1998:45–46).

In line with the Constitution, the Namibian Draft Policy for EE, states that:

Environmental education should aim to empower Namibians from all sectors to critically assess available environmental information and options, to make sound and informed decisions and to take actions that will contribute to the goal of environmental and economic sustainability through developed skills, knowledge, attitudes and commitment in order to improve quality of life for all Namibians citizens (Ministry of Environment, Forestry & Tourism (MFET), 2017: iii, 1).

To adhere to the Constitution and the draft policy the revised ESD policy recognises the most recent global, regional and national policy and planning frameworks such as Vision 2030, the Harambee Prosperity Plan and the Namibian fifth National Development Plan, which has a strong emphasis on sustainability and development (Mangundu, 2017:1). The fundamental principle incorporated within the policy frameworks is to guide the mainstreaming and integration of long-term sustainability concepts across all sectors in Namibia (Mangundu, 2017:2; MEFT, 2017:1,). Environmental Education (EE) and ESD involve all sectors of society including formal education, non-formal education, teacher education, technical and vocational education institutions and the general public (MEFT, 2017:1–2). The formulated ESD policy aimed to ensure that all sectors of society acquire relevant knowledge, attitudes, values and skills required for managing natural resources in a way that causes no significant damage to the environment and considers the needs of present and future generations (MEFT, 2017:1–2).

In the context of this study, the need arose for the Grade 10–11 Biology teachers to integrate ESD into their lesson plans. The Junior Secondary Phase, Life Science syllabus for Grades 8 and 9 calls for teachers to select the learning content and methods based on the learners' needs within their immediate environment and community (Ministry of Education, Arts and Culture (MEAC), 2015:1). The Grades 8 and 9 Life Science syllabus further states that the application of knowledge and attitudes to health and environment is of special relevance for the individual, the family and the society (MEAC, 2015:1). Integrating ESD and the LSA in teaching and learning presents a significant opportunity for the formal education sector. The inclusion of ESD into lessons plans could not only enhance the environmental performance of schools as institutions but could raise the quality of education and build a more sustainable future by imparting the values and tools that today's children and youth will need to build and maintain more sustainable societies (Tshiningayamwe, 2017:111). Hargreaves (2008:69) indicates that

the whole school approach seeks to incorporate teaching and learning for ESD, which is not only limited to aspects of formal curriculum but considers general sustainable school operations such as community involvement, long-term planning and sustainability monitoring and evaluation. These school operations are recognised through active participatory learning processes of the entire school community of learners, teachers and school management (Hargreaves, 2008:69). In comparison, the LSA allows teachers to observe new pedagogical methods, assess the instruction of their colleagues and provides valuable feedback to foster reflective practice and improvement in communities of practice (Avalos, 2011:11).

In addition to the Namibian ESD policy, the Government of the Republic of Namibia introduced a policy framework “Toward Education for All” in 1993. The policy framework aimed to ensure that all Namibians, children and adults, receive education (Ministry of Education and Culture (MEC), 1993:4). The Toward Education for All policy framework works hand in hand with the ESD policy in realising the importance of incorporating learners’ existing knowledge into teaching and learning. This then led to the introduction of the conceptual framework “Learner-Centred-Education (LCE) in the Namibian Context” (National Institute for Educational Development (NIED), 2003:1). The purpose of the LCE approach was to improve the quality of learning in the classroom through a more considered and consistent approach. The LCE aims at putting all learners at the centre of learning, and it realises the inclusion of individual learners’ learning abilities into the lesson (NIED, 2003:1).

Despite teachers’ training on how to use the LCE approach, most teachers continue to employ a top-down approach in their teaching. During lesson presentations, teachers dominate discussions without considering learners’ views, interests and abilities, and learners become passive recipients of knowledge (Annan, 2001:101). Regardless of teacher training on LCE, there still exists a gap in the effective implementation of LCE in the classroom (Gutierrez, 2015:118).

The then MEAC in Namibia, through the Program Quality Assurance division, went the extra mile in finding a solution to the problems encountered with the LCE approach. With the support of the Japanese International Cooperation Agency (JICA), the Strengthening Mathematics and Science Education – Western, Eastern, Central and Southern Africa Association (SMASE-WECSA), allowed Namibian education officials from the MEAC to engage with colleagues of other African countries, such as Angola, Burundi, Kenya, Malawi, Mozambique, Nigeria,

Rwanda, South Africa, Swaziland and Zambia in a training workshop in 2010 that aimed to improve the LCE lessons (SMASE-WECSA, 2010:4).

This training workshop aimed to sensitise teachers and education officials about the problems in teaching Mathematics and Sciences and to discuss intervention strategies that aimed at addressing the problems. Workshop participants were taught how to use the LSA intervention to fill the gap in the implementation of the LCE approach. The training of the education officials on how to use the LSA was held at the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEА) in Nairobi, Kenya. The fundamental principle for this training was that participants should “adapt the skills and knowledge acquired to suit their unique circumstances” (SMASE-WECSA, 2010:7). The project’s possible solution to the problems was the philosophy of Activity, Learner-centred, Experiment and Improvisation (ALEI) through Plan, Do, See and Improve (PDSI) principles of effective teaching and learning (Ono & Ferreira, 2010:64; SMASE-WECSA, 2010:8; Chikamori *et al.*, 2013:15; Gutierrez, 2015:119).

Participating countries such as Kenya, South Africa and Zambia have already introduced the LSA project to school teachers. The Ministry of Education in Zambia in collaboration with JICA came up with an implementation guideline document for schools titled “School-Based Continuing Professional Development (SBCPD) through LSA” (MoE & JICA, 2010:3), which is used by many teachers across Zambia. Furthermore, in South Africa, Ono and Ferreira (2010:65) carried out a case study on LSA titled “The Mpumalanga Secondary Science Initiative (MSSI)” from 1999–2006. Kenya held many workshops and seminars on the use of LSA at the CEMASTEА (SMASE-WECSA, 2010:7). However, Namibia did not include LSA in their priority list of projects, and therefore, the Government of the Republic of Namibia, through the MEAC, did not roll out training of LSA as a component in the LCE framework to all teachers.

The implementation of the LSA by countries such as Kenya, South Africa, Zambia and Japan triggered this research. Unlike in Japan, LSA has sometimes been superficially understood by countries outside Japan as an activity aimed at perfecting individual lessons, rather than an activity that helps teachers to work together to research their own practices (Herbert *et al.*, 2013:99). I, therefore, feel it is important to introduce the LSA to Grade 10–11 Biology teachers in Namibian schools because it holds the potential to make a major contribution to the

community of practice for the professional development (Herbert *et al.*, 2013:90) of Namibian Biology teachers when including the LSA to enhance teaching praxis. In the next section, the research questions, aims and objectives of this study are formulated.

1.3 RESEARCH QUESTIONS

1.3.1 Primary question

How can the LSA be integrated by Grade 10–11 Biology teachers to enhance teaching praxis that will foster education for sustainable development?

1.3.2 Secondary questions

The study will specifically address the following secondary research questions:

1. How do Grade 10–11 Biology teachers integrate the LSA in their teaching praxis?
2. What factors hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA?
3. What should a Namibian LSA framework look like for the Grade 10–11 Biology teachers to enhance their teaching praxis to educate for sustainable development?

1.4 RESEARCH AIM AND OBJECTIVES

This research study aimed to:

Establish how the LSA is integrated by the Grade 10–11 Namibian Biology teachers to enhance teaching praxis to foster ESD.

The objectives of the study were to:

- establish how Grade 10–11 Biology teachers integrate the LSA in their teaching praxis;
- determine factors that hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA;
- design a Namibian LSA framework for the Grade 10–11 Biology teachers to enhance teaching praxis to educate for sustainable development.

In the next section, concepts related to the study are clarified.

1.5 CLARIFICATION OF CONCEPTS

1.5.1 Biology

Biology is one of the Science subjects offered in the Namibian curriculum at the secondary level in Grades 10–12. The syllabus for Biology is designed to meet the requirements of the Namibian National Curriculum for Basic Education (NCBE) and has been approved by the Namibian National Examination, Assessment and Certification Board (MEAC, 2018:1). This subject deals with the study of living organisms, including their structure, function, growth, origin and evolution (Clarke & Thoka, 1991:93).

The subject of Biology places a strong emphasis on the learners' understanding of the physical and environmental world around them at the local, regional and international levels (MEAC, 2018:2). The study of Biology aims to provide a worthwhile educational experience for all learners to enable them to acquire sufficient understanding and knowledge to become confident citizens and it also stimulates care for the environment (MEAC, 2018:2). As part of ESD, the Biology syllabus aims at increasing the learners' knowledge that can help them understand the physical and biological world (Murray, 2005a:38). The curriculum document urges Grade 10–12 Biology teachers to plan their lessons in such a way that appropriate tasks are organised for the learners to work in groups or pairs and solve problems through planning, designing and evaluating (MEAC, 2018:2).

1.5.2 Education for Sustainable Development

Education for Sustainable Development (ESD) is a term used to describe the practice of collectively teaching for sustainable development (SD). The international community agreed to integrate ESD more actively into education beyond the declaration of the United Nations Decade of Education for Sustainable Development (UN-DESD) in 2005–2014 (Kanyimba, 2016:i). According to the United Nations Decade for Sustainable Development (UNESCO, 2005:2), ESD teaches all the spheres of sustainability – environment, society and economy – with an underlying dimension of culture. It further indicates that ESD calls for participatory learning and the use of pedagogies that promote higher-order thinking skills and support decision-making.

To address the global challenges that are related to poverty, inequality, environmental degradation, the protection of the planet and to ensure the prosperity of all, the Sustainable Development Goals (SDGs) were adopted in September 2015 by Namibia (MEFT, 2017:1). In Namibia, ESD is infused across the curriculum (Tshiningayamwe, 2017:110) and all the other SD goals are interlinked (Lotz-Sisitka *et al.*, 2017:5) to ensure the provision of quality education to all learners.

1.5.3 Lesson Study Approach (LSA)

The concept of LSA is translated from the Japanese term “*jugyou kenkyuu*” (Cajkler *et al.*, 2015:192). A group of teachers who are involved in “research-like activities” for their own professional knowledge is referred to as an “LSA” in Japan and “Teaching Research Group” in China (Pang *et al.*, 2015:13). Several authors (Chikamori *et al.*, 2013:14; Chong & Kong, 2012:265; Coenders & Verhoef, 2018:2; Gutierrez, 2015:119; Saito, 2012:778-779) define LSA as professional development for teachers. According to Chikamori *et al.* (2013:14), LSA is a “collaborative, cyclical and continuing professional development process, aiming at improving a lesson through critical reflection”. It is a “professional development model widely used by Japanese teachers, conducting a systematic inquiry into their pedagogical practices through a close examination of their lessons” (Gutierrez, 2015:119).

According to Chikamori *et al.* (2013:14-15), the LSA’s unique feature lies in the continuing, steady improvement of practices using a cyclical process of researching instructional methods and materials, planning and implementing a lesson and collaborative reflection on the lesson. The LSA guided this study, as different cycles offered participants the opportunity to continuously reflect on their teaching (Chikamori *et al.*, 2013:14). However, as it was alluded to earlier in the background, in Namibia, studies of LSA and its effective implementation have not been emphasised. Therefore, this research study designed a Namibian LSA framework for the Grade 10–11 Biology teachers to enhance their teaching praxis to enable Namibian teachers to develop professionally.

The next section discusses the research design of the study.

1.6 RESEARCH METHODOLOGY

This research study followed the cyclical process of PALAR (Wood, 2020:105) whereby the teachers met and worked collaboratively in planning their lessons and refining their teaching practices (Esterhuyse, 2015:8). Supporting the view of Esterhuyse, the research followed the four iterative steps, namely plan, do, see and improve (*cf. Figure 3.4*).

The PALAR approach aided me in justifying decisions and actions concerning the following significant lenses, namely ontology, epistemology and methodology. Discussion of the elements, namely theoretical framework, philosophical orientation, methodology, theory of learning and facilitation process will be done in chapters two and three (*cf. 2.5 and 3.2*).

Qualitative research can be described as the gathering of rich descriptive data in respect of a particular context to develop an understanding of what is being observed (Nieuwenhuis, 2013:50). Qualitative research, according to Nieuwenhuis (2013:51), typically studies people by interacting with and observing the participants in their natural environment. This research design is a form of educational research that provided the PLG with an opportunity of studying one another's lessons and improve their educational practices (Edelson, 2002:105).

The site for this research study was a particular secondary school in the Oshikoto Region where I work as an Education Officer. The choice of a particular school in the Oshikoto Region was for convenience (Gay *et al.*, 2009:134), and the subject Biology, my field of subject expertise. McMillan and Schumacher (1997:169) see convenience sampling as a “group of subjects selected on the basis of being accessible and suitable”.

Recruitment refers to the process used to select a portion of the population (total number of people) for the study (Nieuwenhuis, 2013:79). According to Bertram and Christiansen (2016:59), recruitment involves making decisions about which people, settings or behaviours to include in the study.

The PLG members in this study were recruited by purposive sampling. Purposive sampling aided me in making specific choices about which people or groups to include in the research study (Bertram & Christiansen, 2016:60). The choice of Grade 10–11 Biology teachers was based on the following criteria at the time of the study:

- They were teaching Grade 10 and/or 11 Biology as one of the subjects that recognise ESD in its curriculum – the subject is often perceived to make a significant contribution to ESD (Creswell, 2009:178; Leedy & Ormrod, 2005:206).
- Biology PLG members who had voluntarily attended a workshop on LSA training (Gay *et al.*, 2009:135).

In this research study, multiple data-generating methods such as lesson planning discussions, discussions on the observation and narratives on the presented lessons (that used the ALEI-PDSI lesson observation checklist to guide the discussion), the discussions of the PLG reflective diaries and my analysis of the reflective diaries (Gay *et al.*, 2009:366–372) were used to generate data. The tools used to gather data were, namely personal lesson plans, collaborative lesson plans using the LSA lesson plan template, the ALEI-PDSI lesson observation checklist, reflective diaries and the verbatim transcripts of discussions (*cf.* 3.4).

1.7 DATA ANALYSIS

To analyse means to do a “close systematic study or the separation of a whole into parts, for the purpose of study” (Bertram & Christiansen, 2016:115). With permission from the participants, all data were recorded to capture the individual and collective participants’ contributions and their understanding of the LSA process. Data were thematically analysed using Braun and Clarke’s (2006:35) phases of thematic analysis which was combined with the steps by Tesch (cited in Creswell, 2014:248) for coding. The data were summarised to categorise relationships and patterns (Esterhuysen, 2015:57). After identifying the patterns, data were grouped into themes according to the process of data gathering (Nieuwenhuis, 2013:78) (*cf.* 3.4)

1.8 THE ROLE OF THE RESEARCHER

I was enabled by my role to enter into a joint partnership with the PLG in order to gather and analyse data (Maree, 2013:41). In this research study, I availed the lesson observation checklist and other necessary documents to the PLG, which they would use when planning and observing lessons. It was my role as the researcher in this research study to observe the lesson presentations and capture the data. During lesson planning and presentations, my role was to observe how the PLG shared ideas and also see how the lessons were presented. My other role

in this research study was to gather data and then transcribe and analyse the data with the PLG. It was also my role to organise meetings and book the meetings' venue (*cf.* 3.7).

1.9 ETHICAL CONSIDERATIONS

This research study was conducted with ethical considerations. The research proposal was submitted to the Community-based Educational Research (COMBER) Scientific Committee after which ethical clearance was obtained from the Research Ethics Committee of the Faculty of Education (EduREC) of the North-West University. Informed consent and voluntary participation were obtained where the right to privacy and confidentiality was followed.

1.10 QUALITY CRITERIA

The validity of this research study was obtained through the generation of new knowledge (dialogic validity), the achievement of action-oriented goal (outcome validity), the education of both the researcher and the PLG (catalytic validity), the results that were relevant to the local setting (democratic validity) and a sound and appropriate research methodology (process validity) (*cf.* 3.8.1–3.8.5).

1.11 CONTRIBUTION OF THE STUDY

The contribution of this research study is the development of a Namibian LSA framework for the Grade 10–11 Biology teachers to enhance teaching praxis to educate for sustainable development. The framework will assist Namibian Grade 10–11 Biology teachers to integrate ESD in their teaching praxis through the LSA. The framework acknowledges the professional development of teachers through planning, teaching, observing and critiquing as well as revising the lessons in collaboration. The framework presents how the LSA can be implemented in Biology lessons in Namibia.

This research study composes contextually synchronised chapters. The chapters of the research are outlined next.

1.7 THESIS CHAPTER OUTLINE

Chapter One: Orientation of the Study

This chapter provided an overview of the study that included a background introduction and rationale of the study. It also contained the research questions, research objectives and clarification of concepts. I also offered a summary of the research design, the context of the research site and recruitment of the PLG and data generation and analysis procedures. The chapter also briefly discussed the ethical considerations, quality criteria and contributions of the study. The chapter concluded with the outline of the thesis.

Chapter Two: Literature Review

The literature that relates to the integration of LSA and EE/ESD is discussed in-depth in this chapter.

Chapter Three: A Theoretical Discussion of the Research Methodology

Chapter Three describes the research study process in detail, including the research design and methodology. Data-gathering methods and tools and data analysis are described in this chapter. The context of the research site, the recruitment of the PLG and the data generation procedure and analysis are discussed in this chapter. This chapter also discusses my role as a researcher, ethical considerations and the validity of the study.

Chapter Four: Discussion of the Research Results and Contextualisation of Findings

Chapter Four provides a detailed explanation of the research study results and the analysis of the generated qualitative data of this research study. This chapter identifies and discusses the key areas and the challenges that emerged from this research study.

Chapter Five: The Namibian LSA Framework for Grade 10-11 Biology Teachers

This chapter presents new knowledge that emanated from the research study. It provides a detailed description of the Namibian LSA framework that I developed. The developed framework emanated from the findings of this research study.

Chapter Six: Summary, Conclusion and Recommendations

This chapter summarises the findings of the research study, discusses the limitations of the study, suggests recommendations for future research and concludes with my reflections on the research study.

1.8 CONCLUSION

In this chapter, the purpose for undertaking this research study was explained as well as the research aim and objectives. This research study followed the cyclical process of PALAR and the methods used for the research, ethical aspects and chapter divisions were also presented. In the next chapter (Chapter Two), the focus will be on reviewing the literature that informed this study.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter introduces the reader to a literature review that I did to explore the LSA. The LSA is a teacher professional development training tool (Groves *et al.*, 2013:10) to improve teachers' teaching and learners' learning (Herbert *et al.*, 2013:1; Ono & Ferreira, 2010:63). This chapter indicates the intrinsic properties of the LSA and how it can be linked to the professional development of teachers for ESD.

The discussion in this literature review chapter is according to the following conceptual framework in Figure 2.1.

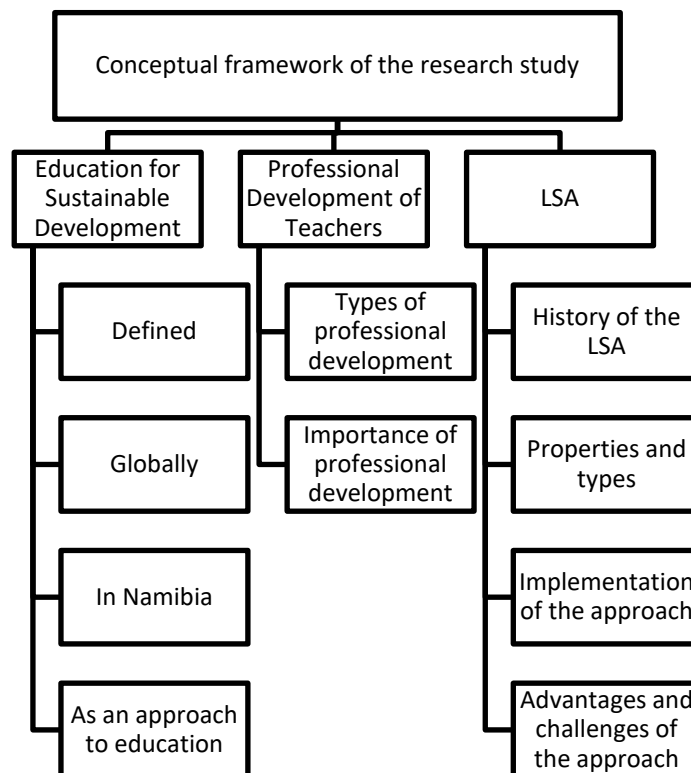


Figure 2.1: Conceptual framework of the research study

I conclude this chapter with a discussion of social constructivism and situated learning theories as the theoretical framework that underpinned this study. Against this background, in the next section, the concept of ESD will be discussed.

2.2 EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) DEFINED

Education for Sustainable Development (ESD) is defined by the National EE and ESD Policy for Namibia as a learning process based on the ideals and principles underlying sustainability and is concerned with all levels and types of learning to provide quality education and foster sustainable development (MEFT, 2019:4). The body that is globally responsible for ESD is the United Nations Educational Scientific and Cultural Organization (UNESCO) that defines ESD as an approach to teaching and learning which empowers everyone and allows every human being to acquire knowledge, skills, attitudes and values necessary to shape a sustainable future (Jucker & Mathar, 2015:3).

United Nations Educational Scientific and Cultural Organization (UNESCO) has identified the professional development of teachers in ESD as the ‘priority of priorities’(UNESCO-UNEP, 1990:1). It was maintained by the “Education for Sustainable Development, SDG 4- Education 2030, Part II” document that a programme would be set up to support global ESD initiatives. Furthermore, UNESCO aims to enhance communication and advocacy on achieving the SDGs through ESD and to monitor the implementation of the programme as a whole (UNESCO, 2019:3).

In 2015, the global community launched 17 SDGs and SDG Target 4.7 addresses, among others, issues related to poverty, hunger, health, human rights and peace among cultures through ESD (Malone & Somerville, 2015:37–41; UNESCO, 2014:9; UNESCO, 2019:3; UNESCO, 2020:14Watanabe, 2015:17).

While ESD advocates for the sustainability principle to be reflected in educational policy, curricula, training and practice (Laurie *et al.*, 2016:236; UNESCO, 2019:3; UNESCO, 2020:56), ESD for 2030 ensures that teachers are trained to be able to teach ESD and apply whole school approaches to ESD in educational institutions (UNESCO, 2020:49). Thus, this study aimed to establish how the LSA is used by Grade 10–11 Biology teachers to foster teaching praxis in ESD. In the next section, how ESD has been implemented worldwide will be discussed.

2.2.1 Education for Sustainable Development globally

Following the recommendation from UNESCO, most schools in Japan applied to become members of the UNESCO Associate School, which was established with the aim to promote ESD in the country. In addition, member schools were encouraged to use the educational activities that contribute to the promotion of ESD and shared their experiences with other schools in Japan (Watanabe, 2015:18). The idea of schools becoming part of the UNESCO Associate School is a positive decision because schools do not only engage in implementing ESD, but also seek to ensure the continuous development of learners to become future leaders in a sustainable society.

One of the best examples of integrating ESD into curricula is in Finland – one of the European frontrunners in education quality and success. It was reported that Finland has reformed the national core curricula for preschool and basic education aimed at supporting and promoting sustainable development and well-being following the value basis of education, where the necessity of a sustainable way of living and eco-social understanding is emphasised (UNESCO, 2017:50).

Apart from Finland, since 2015, the government in Kosovo has officially brandished the 2030 Agenda for Sustainable Development to mark the direction of the country's development (Islami, 2017:2). The education system in Kosovo had, for some years, undergone reform. The principles of ESD have been incorporated into ministerial policy and the Kosovan curriculum. Over the past years, numerous research papers and reports have assessed the practice of ESD in Kosovo (Islami, 2017:6). Despite the incorporation of ESD in the curriculum and ministerial policy, Islami (2017) maintains that ESD is far from being implemented in practice at Kosovan high schools.

Many studies on the implementation of ESD have been reported worldwide (Laurie *et al.*, 2016:234-240). Therefore, it is worth noting that the speedily growing research on the contribution of ESD to quality education provides much evidence. For example, a synthesis of studies on actual ESD in 18 countries (Laurie *et al.*, 2016:234-240) observed that similar significant positive themes occurred across the countries as indicated below:

- a) increase of ability to solve problems in Korea;
- b) social appreciation for communities in Sweden;
- c) increase of learner engagement and commitment in Canada, China, Germany, Netherlands, Peru, Scotland, Sweden and the United States;
- d) self-confidence by the German learners;
- e) self-esteem and self-awareness in the Finnish and the Estonian learners respectively (Islami, 2017:7–8).

Furthermore, numerous problems regarding the implementation of ESD were mentioned, such as:

lack of infrastructure and resources; inadequate teacher backgrounds and methods coupled with lack of pre-and-in-service training; an outdated system and outdated content; lack of extracurricular activities; lack of integrating effectively the potential of information technology and the internet (Islami, 2017:7).

The research study that I undertook can contribute to determining the factors that hamper or facilitate the teaching and learning of ESD using an LSA framework in Grade 10–11 Biology teachers that took part in the study. The LSA is discussed in detail in section 2.4.

The next section discusses the application of ESD in Namibia.

2.2.2 Education for Sustainable Development in Namibia

During Namibia's post-independence, progress regarding the integration of environmental sustainability into development pathways towards sustainable development was made, but challenges regarding environmental sustainability still exist. The most challenging issues include (a) land degradation and soil erosion; (b) poverty and inequality; (c) deforestation; (d) water management; (e) waste management; (f) pollution; (g) HIV/AIDS; and (h) the impacts of climate change (*cf. Figure 2.2; Murray, 2005a:4*). These challenges as noted in Figure 2.2 below slow down the progress towards sustainable development as outlined in the Harambee Prosperity Plan for 2016, the Fifth National Development Plan for 2016 and Vision 2030 for 2004.



Figure 2.2: Key environmental challenges in Namibia (adapted from Murray, 2005)

The concept of sustainable development in Namibia is embedded in the outcomes of international negotiations on sustainable development, such as Agenda 21 from the Earth Summits of 1992, the Johannesburg Plan of Implementation from 2002, Future We Want from the Rio+20 Conference in 2012, the SDGs in 2015 and the National Environmental Education and Education for Sustainable Development Policy (EE/ESD) (MEFT, 2019:ii, iv).

The agenda, conferences and summits emphasised that education is critical for promoting sustainable development and achieving environmental awareness, values and attitudes, skills and behaviour consistent with sustainable development, and for effective public participation in decision making. They also highlight education as one of the means to change social, cultural, economic and political factors to secure ecologically sustainable development (MEFT, 2019:iv).

The two Danish projects, Life Science and Supporting Environmental Education in Namibia (SEEN) were introduced between 1991–2000 and 2001 respectively to support the teaching of ESD across the curriculum in Namibia (Tshiningayamwe, 2017:110). The purpose of the Life Science project was to support LCE in teaching ESD. The LCE is a teaching and learning

strategy that was introduced in 1991 as a foundation strategy for the new educational system in Namibia. The purpose of LCE was to improve the quality of learning in the classroom (NIED, 2003:1). The SEEN project broadly addressed the issues related to the environment, for example, global warming, climate change, greenhouse effect and the impact of floods on living organisms across the curriculum. The SEEN project regarded ESD as crucial and included the ESD approach (the rationale, aims and goals) which is summarised in Table 2.1 following key subject areas across the four phases (Murray, 2005a:23–43).

Equally, the NCBE in Namibia (MoE, 2009:7), the National Subject Policy Guide for Natural Sciences (MEAC, 2019:1) in its aims and objectives and the Namibia Senior Secondary Certificate (NSSC): Grade 10 & 11 Biology syllabus (MEAC, 2018:2) encourages the inclusion of ESD in teaching.

Table 2.1: Subjects indicating the environmental statements within their rationale, goals and aims

Phase/Grades	Subjects	Rationale	Goals and Aims
Lower Primary (1 – 4)	Environmental Studies	Environmental Studies integrates learning about the natural and social environment related to the learner’s immediate environment and community.	<ul style="list-style-type: none"> To develop a lively, questioning and creative intellect, enabling learners to discuss ESD issues.
Upper Primary (5 – 7)	Elementary Agriculture	Agriculture is of great importance today and will be in the decades to come. ... The execution of agricultural activities must be based on the principle of a sustainable agricultural environment.	Learners should be able to: <ul style="list-style-type: none"> Develop a sense of responsibility towards the environment relating agriculture practice to sustainable use of natural resources. Acquire agricultural knowledge and practical skills that are relevant and useful to their lives.
	Natural Science & Health Education	Namibia, like most African countries, is rich in natural resources, which requires scientific knowledge and relevant	... help learners develop self-confidence, self-knowledge and understanding of the world in which they live.

		skills for the exploration of these resources.	
	Social Studies	This subject helps learners understand the relationships between people and their environments.	Develop knowledge and understanding of relationships between people and their physical and cultural environments locally and globally and how they organise, adapt to and change their environment.
Junior Primary (8-10)	Geography	This subject explores the inter-relationships between people, their values and attitudes and the environment and the manner in which considerations of sustainable development influence decisions concerning the planning and management of environments and resources.	Learners to have an understanding of the relationships and interactions of people and their environment in response to physical and human processes in Namibia and internationally.
	Natural Sciences (Life Science, Agriculture and Physical Science)	Namibia, like most African countries is rich in natural resources, which requires scientific knowledge and relevant skills for the exploration of these resources.	Environmental learning helps learners develop self-confidence, self-knowledge and understanding of the world in which they live, through meaningful scientific activities.
Senior Secondary (11 – 12)	Biology	This syllabus aims at increasing the learner’s knowledge and understanding of the physical and biological world of which they are part. This includes understanding how people use the natural environment to satisfy human needs and how the environment may be changed in ecologically sustainable ways.	The study of this subject will enable learners to acquire and develop competencies in environmental learning through: <ul style="list-style-type: none"> • Stimulating an interest in, and care for, living organisms and their environment. • An understanding of scientific and technological applications with their social, economic and environmental implications.

The main aim of the SEEN project establishment was to explore how the ESD challenges (*cf. Figure 2.2*) could be effectively integrated into the Namibian education system (Murray, 2005a:4). The SEEN project was also tasked with exploring educational sustainability to activate the draft EE Policy for Namibia which was in place since 1999 before it became a National EE/ESD policy in 2019. The draft EE policy was the document developed in conjunction with two ministries in Namibia – the Ministry of Education (MoE) and the Ministry of Environment and Tourism (MET) – with the support of the NEEN (Murray, 2005a:1). The draft EE policy document was developed aimed to learn about ESD in Namibia. Therefore, since 1999, a series of workshops were conducted by the SEEN project, especially for schools in the north of Namibia, to promote a greater understanding of ESD issues among teachers (Murray, 2005b:4).

The MoE in Namibia through the SEEN project developed, among others, the National Curriculum Guidelines for Environmental Learning in Namibia and the teaching, learning and assessment materials (*cf. Figure 2.2*). Murray (2005b:11) addresses the key environmental challenges (*cf. Figure 2.2*) (Murray, 2005a:4). The document summaries are displayed in Figure 2.3 below.

1. The eight Rs to ESD



2. Bush Telegraph ESD resource books



3. Animals and ESD



Figure 2.3: Examples of ESD teaching and learning materials in the National Curriculum Guidelines for Educators: Environmental Learning in Namibia (Murray, 2005)

In 2002, the SEEN project, together with teachers, subject advisor and teachers developed two professional development courses: the Namibian Environmental Education Certificate (NEEC) and the Pilot Environmental Learning Course which was adapted to the needs of Namibians (Murray, 2005b:9, 10). The two professional development courses aimed to develop leader-teachers that were capable of promoting institutional and professional changes in schools and communities that made them *better places in which to live, learn and work* (Murray, 2005b:10,17).

After the review of the draft Namibian EE Policy in 2017, the funds were sourced under the Hanns Seidel Foundation Environmental Awareness Project, to officially finalise the EE policy process. The EE Policy for Namibia was renamed the National Environmental Education and Education for Sustainable Development Policy (National EE/ESD Policy) for Namibia in 2019 and was launched on 6 August 2020 by the MEFT (2019:2). As a 10-year document, the National EE/ESD Policy will be reviewed every 10 years to remove unnecessary information and incorporate new developments regarding ESD.

The current National EE/ESD Policy is aligned with the United Nation's SDGs, especially SDG #4, Target 4.7 Quality Education, which seeks to ensure that all learners acquire the knowledge and skills needed to promote sustainable development by 2030 (MEFT, 2019:iii; UNESCO, 2019:1). The National EE/ESD Policy provides comprehensive guidance and

strategies on how to promote environmental sustainability on different levels of society and also seeks to empower all educational stakeholders, including learners, teachers, parents and communities to take informed decisions and responsible actions to protect the environment (MEFT, 2019:2).

The National EE/ESD Policy further emphasises the incorporation of EE and ESD issues into Namibian development planning frameworks. The goals, principles and actions necessary for mainstreaming EE and ESD issues in regional, national and international development planning that should guide and support the implementation of sustainable development activities and programmes through education were clearly spelt out in the National EE/ESD policy.

The National EE/ESD Policy is a necessity and an opportunity for Namibia to meet its targets for the SDGs (MEFT, 2019:18). Incorporating ESD across the Namibian curriculum provides learners with the knowledge and skills to explore their environment so that they can make informed choices about their future and that of the environment. Furthermore, it encourages learners to respect and live within the limits of nature and helps them to achieve sustainability (Tshiningayamwe, 2017:111)

Even though the Namibian EE Policy has been implemented in Namibia, some challenges were experienced in the implementation of ESD. In her study, Tshiningayamwe (2017:109) indicated that most teachers were taught using the teacher-centred method, for example, lecturing, which is not in line of what ESD calls for. ESD calls for LCE. Indeed, the implementation of ESD requires a teacher to have a deeper understanding of what is required and how to implement it in particular contexts, and not only to focus on curriculum policy changes, strategies and plans. Tshiningayamwe (2017) further stated the need for teachers to be trained on strategies to implement ESD, and thus one of the objectives of this study was to determine how the Grade 10–11 Biology teachers applied ESD in teaching and learning.

The other challenge in the implementation of ESD in Namibia stated by Tshiningayamwe (2017) is that teachers were not able to convince the learners about the importance of ESD as little attention is given to ESD in the school curriculum, despite the call by the NCBE for the inclusion of ESD in the curriculum.

This research study, together with the National EE/ESD Policy, addresses some of the above-stated challenges. The next section discusses ESD as an approach to education.

2.2.3 Education for Sustainable Development as an approach to education

The teaching and learning of ESD is well structured in the NCBE (MoE, 2010:3) and is integrated in cross-curricular themes, among others, HIV/AIDS, ICT, environmental learning and road safety and their main environmental risks and challenges across the curriculum (MEAC, 2017:16). The national curriculum is designed in such a way that, while the lower primary phase focuses its teaching on understanding the relationship between people and their environments, the upper primary phase focuses on learners improving their local environments, and the junior and senior secondary phases focus on identifying and investigating real-life issues at local, national and global levels (Endjala & Keding, 2013:4). Thus, the aim of the NCBE (MEAC, 2017:7) and that of the then Grade 10 and 12 Biology subject (MEAC, 2018:3) is that teaching about ESD will ensure that the environment is respected and sustained, but only if people have scientific knowledge about the environment and the skills and attitudes necessary for its sustainability.

In September 2015, the 193 Member States of the UN General Assembly adopted the SDGs to promote ESD among people (Didham, 2018:92). It is only through education that the implementation and achievement of the sustainable development agenda through Goal 4 of the 17 SDGs can be successful. It is through quality education and the implementation of ESD in particular, which will enable learners to have a better understanding of the milieu in which they live and the social impacts of their daily lives.

Figure 2.4 shows some examples of the daily life environmental awareness messages that can be found in the teaching and learning resource books. The resource books aid in the teaching and learning of ESD through the Biology syllabus. The ESD activities shown below can be found in the community where learners live.



Figure 2.4: An Example of EE in our Daily Life in a Teaching and Learning Resource Book (Endjala & Keding, 2013:5)

Quality teaching and learning experiences allow learners to gain critical life skills and the capacity to be active in the pursuit of sustainable development as well as realise a sustainable future for all (Didham, 2018:97). Pedagogies that are based on ESD focus the attention on learners as opposed to teacher-centred lessons. Learning based on memorisation can be replaced with the LSA and participatory learning where learners are put at the centre of learning (UNESCO, 2012:15). As opposed to traditional teaching methods and curricula, those based on ESD often deal with concrete and relevant issues that are connected to the affected places; they draw upon the arts, using drama, music, design and drawing to stimulate creativity and imagine alternative futures. In that respect, ESD helps learners to develop a sense of social justice and self-efficacy as community members (UNESCO, 2012:15).

It is the role of the teacher to nurture learners' understanding of the ESD risks and challenges and how they can be addressed so they can make informed and mindful decisions for a sustainable future (Council of Ministers of Education Canada, 2012:1; MEFT, 2017:16; Tshiningayamwe, 2017:111). Capacity building of teachers has therefore been identified as a priority action area by the Global Action Programme (GAP) on ESD. The GAP on ESD is the ESD programme that was launched at the UNESCO World Conference on ESD in Aichi-Nagoya, Japan, in November 2014. The GAP aims to build on the achievements of the United Nations Decade of ESD and create new momentum for action (UNESCO, 2017:1). The GAP

on ESD programme provides the international framework for teachers to accelerate and scale up ESD actions in countries around the world (UNESCO, 2018:7).

Thereafter, an ESD global framework was introduced in 2019 entitled “Education for Sustainable Development: Towards achieving the SDGs” (ESD for 2030) for the implementation of ESD from 2020–2030 by teachers to support the post-GAP position (UNESCO, 2020:12; UNESCO, 2019:6). The proposed ESD framework aims to build a more just and sustainable world through strengthening ESD and contributing to the achievement of SDG 4 and all other SDGs (UNESCO, 2019:7; UNESCO, 2020: iii).

To encourage learners to become change agents who have the knowledge, means, willingness and courage to take transformative action for sustainable development, learning institutions themselves need to be transformed. All learning institutions need to be aligned with sustainable development principles so that learning content and its pedagogies are reinforced by how facilities are managed and how decisions are made within the institution. Therefore, it is worth indicating that when teachers incorporate ESD into teaching, it does not only equip learners with new knowledge but promotes new ways of thinking. Therefore, by integrating ESD into teacher education, learning methods and content can be reoriented towards sustainability. In the next section, I discuss teacher professional development.

2.3 TEACHER PROFESSIONAL DEVELOPMENT

Professional development can be defined as an activity that develops an individual’s skills, knowledge, expertise and other characteristics as a teacher (Organisation for Economic Cooperation and Development (OECD), 2009:49).

With this definition, professional development can be provided in many ways which are both formal and informal. For example, development can be made available by an expert in the form of workshops and training and/or formal qualification programmes, through collaboration between schools or teachers across schools; for example, observational visits to other schools or in the schools in which teachers work. The latter professional development can be provided through coaching/mentoring, collaborative planning and teaching, and the sharing of good practices (OECD, 2009:49).

The Organisation for Economic Cooperation and Development (OECD, 2009:49) further explains teacher professional development as any type of continuing education effort for teachers. It is one way that teachers can improve their skills and, in turn, boost learners' outcomes. The United State Department of Education (DoED, 2018:5) believes that pre-service training for teachers cannot be expected to prepare teachers for all the challenges they will face throughout their careers. Equally, novice teachers take years to gain the experience and skills to be effective in the classroom. Therefore, it is a necessity for a country's education system to provide teachers with opportunities for in-service professional development to maintain a high standard of teaching and to keep high-quality teacher personnel (OECD, 2009:49). Equally, when countries experience the poor performance of learners in any subject's curriculum, a need for change in teaching arises if it wants its learners to be on par with those that perform well (Ebaegu, 2018:1). Thus, professional development for any person is necessary because education and experience alone will not be enough to serve a teacher throughout their career. Therefore, for teachers to rejuvenate their teaching career, there is a need for continued professional development (DoED, 2000:9). Thus, a continuous training programme for teachers on professional development is needed. The next section discusses the types of professional development for teachers.

2.3.1 Types of professional development for teachers

Earp (2016) specifies the two types of professional development programmes, namely criticism and model lessons, which were done way back in the 1890s. Earp (2016) explains that in a criticism lesson, many people observe a teacher teaching the lesson, and afterwards have a lengthy discussion, whereas the model lesson is just to demonstrate some model-type lesson for the teachers who are observing. In this type of lesson, the teachers who observe go back to their home school and do the same thing as the model.

Apart from the criticism and model lessons, nowadays, professional development focuses more on the context, focus and scope of the lessons within whole school districts (Earp, 2016) at a circuit and cluster level, where teachers of the same subject interest visit a school to observe a lesson and discuss it.

For the teacher to develop professionally, depending on the developmental needs and the environment where the teachers find themselves, the following are some of the types of professional development educational activities that teachers should participate in: (a) related

topics problems on subject matter and subject methods courses; (b) conferences and workshops; (c) qualification programmes; (d) school visits for lesson observation where peer observation and coaching is the main objective; and (e) collaborative research on a topic of professional interest (OECD, 2009:50).

For the purpose of this research study, I acknowledge the criticism around the different types of professional development that speaks to the focus of this research study. This research study aimed to bring together a group of Grade 10–11 Biology teachers to plan their research lesson following the cyclical process of an LSA as illustrated in Chikamori *et al.* (2013:15). The LSA is one of the professional development activities of teachers that is the focus of this research study and is characterised as collaborative planning leading to action, cyclical, context-based, improvement-oriented and teacher-owned (*cf.* 2.4) (Chikamori *et al.*, 2013:14–15; Saito, 2012:778; Ono & Ferreira, 2010:63).

Similar to the criticism lesson, in an LSA, the planned lesson is presented to the learners by one of the teachers while others observe. When a teacher presents the lesson, the observers observe how the teacher integrates the LSA in their teaching praxis. In this research study, the observers gave feedback to the teacher after the lesson presentation for further improvement. More about the LSA is discussed in section 2.4. The next section highlights the importance of professional development for teachers.

2.3.2 Importance of professional development for teachers

Failure is an opportunity for improvement, and it is through professional development a person learns how to overcome the challenges experienced. Professional development helps teachers to update their skills, polish their expertise and improve learners' success (DoED, 2000:6–7).

Teacher professional development is a key component in creating an effective learning environment for both teachers and learners. Further than that, in the education system, particularly in schools, new skills are needed by both teachers and learners that can only be attained if the school has a professional development plan in place (Bruski, 2016:1). The DoED (2000:5) stated the importance for all teachers, both veteran and novice teachers, of participating in professional development activities through the LSA, which in the long run, will help teachers to integrate LSA in their teaching praxis. The DoED (2000:9) further stated that by participating in professional development activities, teachers will be helped to gain the

confidence to overcome any obstacles faced in the classroom. The next section discusses the origin and definition of the LSA and how it is related to the professional development of teachers.

2.4 THE LESSON STUDY APPROACH

The LSA is a teacher professional development activity that originated in Japan during the establishment of the Tokyo Normal school in the 1870s (Ono & Ferreira, 2010:63). The LSA became the centrepiece of Japanese teacher's professional development at elementary schools in the 1990s (Puchner & Taylor, 2006:923). The term 'Lesson Study' is the direct translation of the Japanese term "*jugyou kenkyuu*". The word "*jugyou*" means lesson and "*kenkyuu*" means study or research (Gutierrez, 2015:119; Rock & Wilson, 2005:78). The LSA process involved the cyclical process of the four steps, namely plan, do, see and improve (Stigler & Hiebert, 1999; Gero, 2015:40) (*cf. Figure 2.5*). The next section discusses the history of the LSA as it was implemented in Asia and then in the rest of the world.

2.4.1 History of the LSA

Originating and deeply rooted in school education in Asia – Japan (Stephens, 2018:1), the LSA then gained a foothold in Europe, America and Africa (Groves *et al.*, 2013:90; Ilmu, 2016:171) and has now spread to other countries (Grimsæth & Hallås, 2016:110).

With growing interest from the educational sphere and the success of Japanese teachers in developing LSA, it became a global pedagogical model and has captured the attention of many international teachers who make use of it to improve their lessons (Ebaegu, 2018:213; ; Grimsæth & Hallås, 2016:112; Ilmu, 2016:169, 171; Nishimura, Kobayashi & Ohta, 2018:1; Özdemir, 2019:38; Watanabe, 2018:1). The history of the LSA in different countries is discussed in the next section.

2.4.1.1 LSA in Japan

Japan has a long history of improving teaching and learning through school-based professional learning communities named Teacher Research Groups (Doig & Groves, 2011:77). The “*jugyou kenkyuu*” in Japanese or the LSA is a professional learning activity for teachers (Groves *et al.*, 2013:10) that was first applied in Mathematics and introduced by Makoto Yoshida in the 1990s (Ilmu, 2016:171).

There are three major forms of the Japanese LSA which are described by Watanabe (2018:6) as follows:

- a) **School-based LSA:** All teachers from a school participate to address a school lesson with several subgroups, each engaging in a Lesson Study cycle. The purpose of a school-based LSA is to achieve systematic and consistent instructional and learning improvement for teachers in the school as a whole and to develop a common vision of education at the school through teacher collaboration.
- b) **Cross-school LSA:** Subject-oriented groups (e.g. Biology teachers) from each school in the district come together once or twice a month to develop communication between the schools in the district, exchange ideas and improve instruction and learning in the district.
- c) **Cross-district LSA:** This can be either regional or nationwide. Usually, it is a voluntarily organised group or group of enthusiastic practitioners who want to improve teaching and learning or curriculum in a certain subject. They meet once or twice after school on off-school days with the purpose to develop new ideas for teaching chosen topics, investigate curriculum sequences and content and develop the curriculum (Watanabe, 2018:7).

The research study that was conducted in Japan by Catherine Lewis in 1993 is aligned with one of the three major forms of Japanese LSA described by Watanabe above: the school-based LSA. This research study followed the idea of the school-based LSA, where four teacher participants who teach Biology Grade 10–11 at a school were observed to see if and how they integrated ESD into their teaching and learning. In this research study, the teacher participants had to be aware that they should include ESD in their teaching and learning. Lesson presentations and reflections on the lesson presentations as components of the LSA helped the teacher participants to improve on the lessons (Chikamori *et al.*, 2013:15–16), and thus include ESD in their lessons. To this end, LSA is therefore an activity that helped these teachers

develop professionally in their teaching praxis. The next section discusses the implementation of LSA in the United States of America (USA).

2.4.1.2 LSA in the United States of America

After the introduction of LSA in Japan, USA teachers' attention was attracted by this teaching and learning approach (Watanabe, 2018:1). In the USA, LSA was introduced by Catherine Lewis, who had been conducting research on LSA since 1993 in Japan (Ilmu, 2016:171), followed by Lewis and Tsuchida (1998), Stigler and Hiebert (1999) and then Yoshida (1999).

Because LSA was seen as an effective model for teacher professional development, this made many researchers in the United States (US) showed interest in the LSA (Ono & Ferreira, 2010:63). When US teachers began implementing LSA, it was usually with groups of volunteer teachers. Sometimes all of the teachers were from the same school, but often teachers from different schools formed teams; in many cases, only teachers in the Lesson Study groups observed the research lessons (Watanabe, 2018:2).

United States (US) Lesson Study groups were organised somewhat like the cross-school or cross-district Lesson Study groups in Japan. Their goals were also a mixture of goals from the different types of Lesson Study in Japan (Stigler & Hiebert, 1999:130). The lesson observation by the US teachers from the same school fits well with this study because in this case, this research study involved teachers from the same school that were teaching Biology Grade 10–11 who observed each other teaching.

The next section discusses the implementation of LSA in Europe.

2.4.1.3 LSA in Europe

The LSA was introduced in the United Kingdom (UK) in the late 1990s, and most UK teachers pay more attention to course research. Ten years later after the introduction of the LSA, more than 400 schools in the UK began to implement the LSA (Özdemir, 2019:38). On the other hand, in their studies, Buchard and Martin (2017:2) stated that they were fascinated by its bottom-up approach to teacher professional development when they first came across LSA a few years after its introduction. They further indicate that in every book they read on the subject

and each article published, the emphasis was on the positive effects of LSA on learners, teachers, schools and even educational systems.

Further to that, to prove the authenticity of the LSA, a Turkish researcher, Özdemir (2019:36), from Mersin University in Turkey, carried out a case study to find out how the teachers implemented the LSA at primary schools in Turkey. He conducted the research study involving two participants, who were primary school teachers. Data were obtained from observations and field notes taken during the teaching of the course alongside data coming from teachers' reflective diaries and interviews held with the teachers.

The findings of Özdemir's case study showed that the Lesson Study activity contributed considerably to the professional development of the teachers in various ways. For example, participant teachers were able to meet their colleagues to cooperate with them, especially with the help of the LSA; they collaborated and exchanged ideas and had the opportunity to observe different practices and activities other than their own (Cajkler *et al.*, 2015:194; Dudley, 2014:2; Kihwele & Guoyuan, 2020:50; Özdemir, 2019:48).

The above case study fits well with my research study, and therefore, the four teachers in the PLG in my study gave me ample data that was collected from the lesson observations, reflective diaries and interviews with the participants.

The discussion on the implementation of LSA in Africa follows.

2.4.1.4 LSA in Africa

The LSA was not only used by European countries but has also been recognised by some African countries, among them Kenya, South Africa, Zambia and Namibia. With the help and support of the JICA, the above-listed African countries were introduced to the LSA (SMASE-WECSA, 2010:9). A programme meant for Mathematics and Science teachers called Strengthening Mathematics and Science Education (SMASE) was put in place, and the training of teachers from the African countries was held in the CEMASTE in Nairobi, Kenya. The purpose of the SMASE was two-fold:

1. To strengthen the Mathematics and Sciences teacher education through in-service and pre-service training, workshops and seminars (SMASE-WECSA, 2010:3-4).
2. To provide Mathematics and Science teachers with an opportunity to continuously improve their knowledge and skills in teaching (SMASE-WECSA, 2010:7).

The next section discusses the implementation of LSA in some African countries, starting with Kenya.

- **LSA in Kenya**

After the introduction of LSA in Kenya by the JICA, Mathematics, Biology and Physics teachers from all corners of Kenya gathered at the CEMASTEIA during holidays attending the SMASE programme to be sensitised on the problems experienced in teaching their subjects and the intervention strategies. The possible solution which was put in place for effective teaching and learning by the SMASE programme is the philosophy of ALEI through the approach of PDSI. The ALEI-PDSI philosophy aims to assist teachers to shift their teaching and learning strategies and techniques from content-based to activity-focused; move from teacher-centred to learner-centred; change from lecture method or theoretical approach to experiments and research-based approach; and modify the recipe-type experiments to the use of improvisation (SMASE-WECSA, 2010:8).

The philosophy of ALEI-PDSI under the umbrella of LSA was well understood by the Kenyan Mathematics, Science and Social Studies teachers in an attempt to place more responsibility on learners and had a positive impact on the teaching and learning of Mathematics and Science. Therefore, it is worth noting that it was not only in Kenya that the impact and the effectiveness of the LSA were witnessed but it has been shared and embraced in other African country's education systems (SMASE-WECSA, 2010:9). For example, I used the ALEI-PDSI checklist in my research study to direct observations in the classroom.

The next section discusses the implementation of LSA in South Africa.

- **LSA in South Africa**

The introduction of LSA in South Africa started in Mpumalanga province through the joint partnership of the Mpumalanga Department of Education, the JICA and the University of Pretoria (Ono & Ferreira, 2010:65). The project called MSSSI was launched in 2000, specifically

to promote more collaborative approaches to teacher professional development in the province of Mpumalanga, to improve Mathematics and Science teaching through teacher retraining and to also establish in-service training provincially. The purpose of the partnership was to explore the use and efficacy of a school-based in-service education modelled along the lines of the Japanese ‘*jugyou kenkyuu*’ in the South African context and to also develop and enhance the opportunities for secondary school Mathematics and Science teachers to foster the kinds of learning and support required to change classroom practices in these two subject areas. Prior to the initiation of the MSSSI intervention, there was consensus among the MSSSI stakeholders on the need for, and importance of, pursuing some form of school-based professional development through teacher collaboration and dialogue (Jita *et al.*, 2008:466).

Japan International Cooperation Agency (JICA) facilitated the training of a small group of teacher trainers and teachers from South Africa in short-term training in Japan. This training under the MSSSI took place in two phases from 1999–2003 and 2003–2006 respectively. Phase 1 targeted the Grade 8 and 9 secondary schools’ Mathematics and Science teachers. With the use of the cascade model, the Mathematics and Science curriculum implementers (CIs) were empowered to become teacher trainers through the six-week group training in Japan at Hiroshima University and Naruto University of Education. After their return, training workshops for heads of Mathematics and Science departments (HoDs) of the secondary schools were conducted at their respective districts whereby the HoDs then conducted similar training sessions for their colleagues at their schools.

Phase 2 targeted the Mathematics and Science teachers of the Further Education and Training Band whereby CIs and cluster leaders (CLs) were empowered in a six-week group study in Japan at Hiroshima University and Naruto University of Education. Like the CIs for the Grade 8 and 9 secondary schools, regional workshops for other CLs who represented the clusters of schools that are geographically close together were organised and conducted. The first LSA, which included a study lesson and post-lesson reflection, was conducted in September 2000. With the help of the Naruto University of Education, 60–70 Mpumalanga participants – teachers, CIs, principals and local education administrators – participated in the training and were introduced to the LSA. Since then, the LSA began to take root as a joint activity between neighbouring schools and within networks or clusters of teachers in the South African Mpumalanga province (Jita *et al.*, 2008:466).

The next discussion is on the implementation of LSA in another African country, Zambia.

- **LSA in Zambia**

After the introduction of the LSA in 1990, the Zambian Ministry of General Education in partnership with the JICA introduced and implemented the LSA from 2005–2015. The two-year pilot programmes for teachers under the project called Strengthening Mathematics, Science & Technology Education (SMASTE) and the Strengthening Teachers' Performance and Skills (STEPS) were introduced in 2011 and 2015 respectively (Jung *et al.*, 2016:5–6). These two Zambian educational programmes were earmarked to help capacity development and improve the skills of teachers who teach Mathematics and Science subjects.

In Zambia, the LSA was introduced to shift chalk-and-talk lessons, which mainly aim to transmit knowledge, to participatory lessons, which aim to develop learner's thinking and activities (Baba & Nakai, 2011:58). It was reported that the Zambian teachers gathered together every month by grade or subject level to identify challenges experienced in their topics. Like other countries which applied LSA, when Zambian teachers gathered, they followed the cyclical steps of plan, do, see and improve by identifying challenging topics, and developing and addressing the lesson plans. When the planned lesson was delivered by one teacher, the other teachers observed and gave feedback after the lesson presentation (Jung *et al.*, 2016:5–7). The Zambian teachers' approach fits well with this research study because the cyclical process of identifying challenging topics, planning, presenting and observing a lesson was followed by the teacher participants.

The next section discusses the implementation of LSA in Namibia.

- **LSA in Namibia**

Like the above African countries where the LSA was introduced, the JICA introduced the LSA to Namibians in early 2000. The training of the first Namibian participants was held at the CEMASTE in Nairobi, Kenya. Despite the training, the LSA was not one of the priority projects in the Namibian education system. Therefore, studies of LSA and its effective implementation have not been emphasised. It was not until 2016 when Peters, one of the scholars at the University of Stellenbosch conducted a research study in a primary school in Namibia. The purpose of such a research study was to establish the extent of the professional

development of teachers based on the principle of Realistic Mathematics Education (RME) and the process of LSA.

The research study by Peters in 2016 aimed to bring LSA to life by detailing a case study of a primary school in Namibia. Peters (2016:97) indicated that teachers at this primary school were involved in the three steps of LSA namely '*planning, doing and seeing*'. The researcher envisaged that LSA can be a potential professional learning activity which would be carried out by several teachers of a certain subject to improve the quality and content of their teaching. Peters (2016: 256, 376) further indicated that the process of LSA provided the majority of participants with an opportunity to critically reflect on their own teaching practices.

The unfortunate part observed by Peters (2016: 299, 376) was that participants could not fully observe each other's research lesson. The participants' reflections, however, created an awareness of how they could improve their own teaching because they had the opportunity to perceive themselves through their learners' eyes. Peters (2016: 376) indicated that participants gained an enriching experience in the sense that they did not only share subject knowledge but also gained pedagogical knowledge while planning research lessons. The idea of collaboration, cooperation and collegiality among the participants was promoted by Peters's studies (2016:376). The effect of the above research study indicated that, through collaboration and cooperation, primary Mathematics teachers got the experience of correctly interpreting the subject syllabus, and of carefully planning research lessons and reflecting on the research lesson presented (Ono & Ferreira, 2010:71; Peters, 2016:396–7). As a result, as supported by the findings of Peters' study, the need has arisen for all teachers in all subject's curricula to be trained on the implementation of the process of LSA in Namibia, and not only primary Mathematics teachers. Thus, this research study endeavoured to expose the Grade 10–11 Biology teachers to the LSA, and thus give room for the Biology teachers to observe and evaluate each other's lessons. This research study ascertained the factors that hinder the ESD teaching praxis of Grade 10–11 Biology teachers using the LSA through the evaluation of the observed lesson.

Namibians need to shift from thinking about how to improve teachers to thinking about how to improve teaching (Jalongo *et al.*, 2007:42) through the LSA. This research study aimed to design a Namibian LSA framework for the Grade 10–11 Biology teachers to enhance their

ESD teaching praxis. The framework was designed by me to facilitate the Grade 10–11 Biology teachers to integrate ESD in their teaching praxis through LSA.

The next section discusses the LSA as a form of professional development for teachers.

2.4.2 The LSA to promote the professional development of teachers

The LSA is more school-based and grounded in daily activities that help teachers develop professionally (Groves *et al.*, 2013:10; Puchner & Taylor, 2006:923; Saito, 2012:778; Stephens, 2018:1). The LSA, in fact, is a special form of class action research that focuses on the development of teacher practice knowledge (Özdemir, 2019:38).

The LSA as a form of professional development includes a process in which a group of teachers plan a series of lessons based on their common goal which is to improve classroom practices (Lewis, 2009:124). When planning a lesson, one teacher, from the group of teachers, leads the jointly designed lesson and invites colleagues to observe their lesson implementation (Özdemir, 2019:38). The planning of lessons together helps teachers to match the lesson to their learners' needs by agreeing on everybody's role in the lesson and that make their tasks lighter (Saito, 2012:779).

Unlike the traditional way of teaching whereby teachers work as individuals and in isolation, in an LSA, a group of teachers in a school or from different schools in the same community meet regularly. Implementing a collaborative approach, these teachers agree upon and jointly undertake to design research teaching plans, develop research teaching materials and practice teaching together with the aim to improve teaching and learning (Bocala, 2015:351; Herbert, Tillyer & Spencer, 2013:1; Rock & Wilson, 2005:79; Stephens, 2018:1-2; Arani *et al.*, 2010:171; Stiegler & Hiebert, 1999:121). Thus, the LSA as a teacher professional development activity involves a cyclical process (*cf. Figure 2.5*) that focuses on the key actions of collaborating, planning, teaching, observing, reflecting and revising lessons (Buchard & Martin, 2017:4–5, 14; Chong & Kong, 2012:265; Copriady, 2013:179). In this sense, the evaluation of lessons by the teacher participants increases teacher professional collaboration and decreases teacher isolation, because these teachers have the opportunity to learn from their colleagues (Lewis, 2004:123).

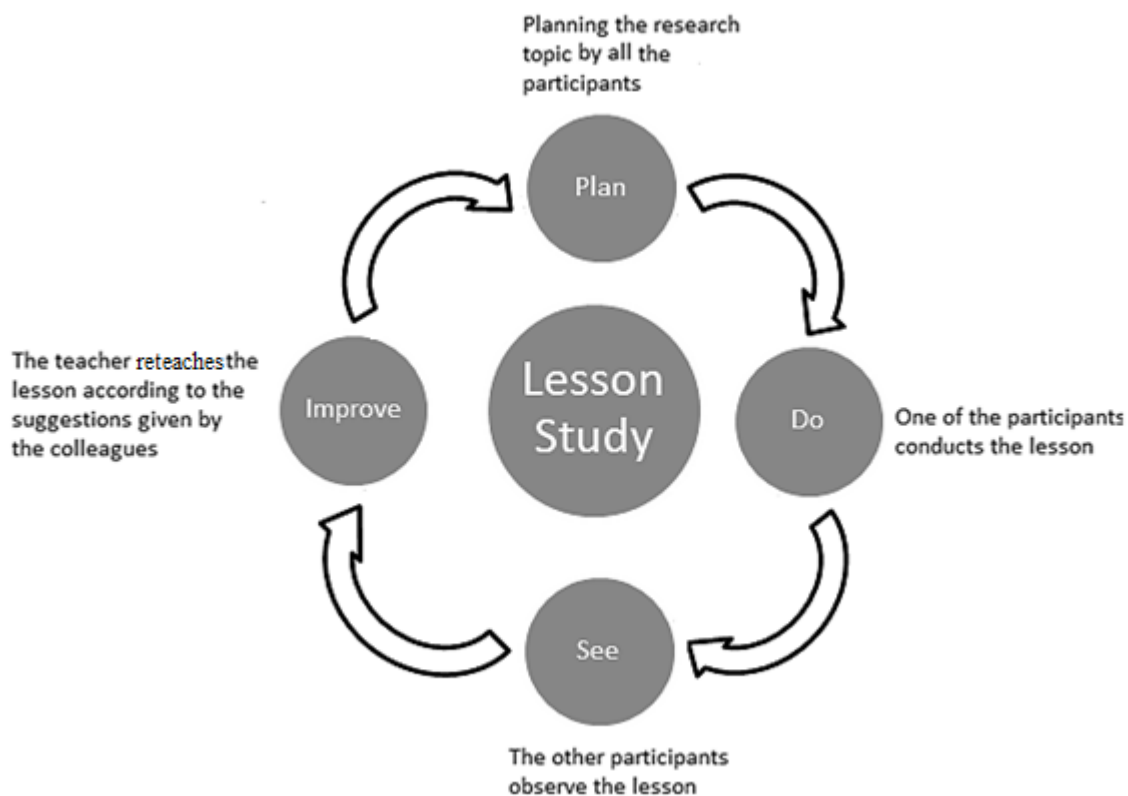


Figure 2.5: The cyclical process of the LSA (adapted from JICA, 2010)

Relating to Figure 2.5, various researchers have explained how LSA as a teacher professional development works. For example, Hanford (2015) clarified that when a group of teachers come together and identify a teaching problem they want to solve, they have taken part in the LSA. Hanford (2015) further stated that, if learners are struggling with a topic, the teachers can do some research on why learners are struggling with that topic, and then after researching the topic in question, the teachers can design a lesson plan together. In an LSA, the lesson is planned according to how it is going to be taught, keeping in mind the learners' different levels of understanding.

The cyclical process of the LSA in Figure 2.5 is a good professional development activity that was adopted in my study. The reason being that it allowed all the PLG members to plan a research lesson together, observe and share information (Bocala, 2015:351; Ilmu, 2016:173) about how well the lesson worked and how well learners accomplished the learning goals. Thus, the LSA as a professional development strategy for teachers can narrow the gap between theory and practice (Kanellopoulou & Darra, 2019:18). This study, therefore, aimed to

establish how the Grade 10–11 Biology teachers integrated ESD into their teaching through the LSA for teacher professional development.

As explained by Chikamori *et al.* (2013:14–15) and as in this research study, the PLG was helped to review instructional materials, develop teaching practices, explore ideas to enhance thinking, find solutions to their problems, understand the topic and broaden understanding, skills and abilities.

As a form of professional development, LSA can be implemented through two methods – the bottom-up or grassroots and top-down. In the top-down method, the teacher guides the instruction, the activity, the discussion and the specific output. In this approach, the learners receive knowledge from the top person, which is a teacher, and they test that knowledge through application by building greater understanding and clarifying confusion along the way (Watanabe *et al.*, 2008:135). In other words, in the top-down method, the teaching strategy involves starting with the big, abstract concept and working down to the specific details. The fact is that the top-down teaching by institutions in many countries results in the creation of passiveness and dependency (Baba & Nakai, 2011:57), hence there is a need for the teaching and learning fraternity to move away from passive learners to active and independent learners, which is the purpose of the LSA.

In contrast to the top-down method, in the bottom-up or grassroots method, though the decisions are made by the top management, team members are asked for their input (Clarizen, 2020). In a bottom-up or grassroots method, when presenting a lesson, a teacher starts with the basic skills and learners are invited to add their views. As learners master the basic skills, the teacher broadens the scope of the lesson that needs application. The broader argument of the bottom-up or grassroots method is that people should be aware of their problems and share the responsibility for their own benefit and that of the community (Lewis, 2004:129–130). In other words, in the bottom-up or grassroots method, the instruction comes from within and not from an outsider.

This research study was motivated by the bottom-up or grassroots method since it looked at how the Grade 10–11 Biology teachers integrated the cyclical process of PDSI (*cf. Figure 2.5; JICA, 2010*) into their own professional development learning activity.

The next section discusses the challenges in implementing the LSA.

2.4.3 Challenges in implementing the LSA

As much as I find LSA a good approach, there are some challenges or factors that were observed which hindered its implementation in research that has been done.

The major challenges experienced in LSA are of a lack of time, time allocation and time management which most of the researchers reinforced (Alamri, 2020:4; Cohan & Honigsfeld, 2006:28; Chin Mon *et al.*, 2016:80; Hiebert & Stigler, 2000:15; Özdemir, 2019:49; Watanabe, 2018:5). Huang and Shimizu (2016:9) indicated that lack of time led to the unsuccessful implementation of the LSA. Rahim *et al.* (2015:4) indicated that a lot of time is needed for the effective implementation of LSA; namely, time to plan, time for meetings to reflect on the lesson plan, and time for observation. They further indicated that spending too much time on such a lesson caused them to miss their own lessons. The researchers indicated that suitable and allocated time to the process was not sufficient, because it was observed that more time was needed throughout the whole LSA process (Saito, 2012:780; Ogegbo *et al.*, 2019:1; Peters, 2016:200). Kanellopoulou (2019:19) indicated that the time needed to complete all the stages of the LSA is the most difficult part of the implementation of the LSA. It was also reported that though LSA activities require time for learners to express their multiple opinions and innovative thinking (Cajkler *et al.*, 2015:197), due to the limited time, learners could not reveal their thinking potential (Nesusin *et al.*, 2013:1414).

Another factor that has hindered the implementation of LSA was the lack of appropriate teaching resources in schools (Gutierrez, 2015:125; Stephens, 2018:3; Watanabe, 2018:6) which Ogegbo *et al.* (2019:7) recommended needed involvement and support from the school management and other educational stakeholders.

The study conducted by Rahim *et al.* (2015:4) indicated that the involvement of the teachers in the LSA process was an extra workload for teachers. Alamri (2020:4) established that due to the workload, participating in an LSA process resulted in the teachers postponing some of their activities. Chin Mon *et al.* (2016:81) indicated that the workload of teachers limited the full attendance of the participants in all the stages of the LSA.

It was also observed that not all teachers received the information on the implementation of the LSA because those who were responsible, were reluctant to do it. For example, the leadership and strict division of responsibilities in each post level at schools and district level in

Mpumalanga resulted in the difficult dissemination of LSA information (Ono & Ferreira, 2010:70). In the same vein, teachers who took part in the implementation of the LSA were reluctant to share ideas and experiences (Peters, 2016:251).

The study by Saito (2012:782) indicated that the observation guideline document which was used by the observers during the LSA lesson observation does not clearly indicate where to stand while observing a lesson (Copriady, 2013:18; Leong *et al.*, 2021:31), thus making it difficult for the teachers. Therefore, the LSA process in this study and the designed Namibian framework for the Grade 10–11 Biology teachers helped to address the challenges indicated by the literature.

In the next section, the advantages and benefits of the LSA are discussed.

2.4.4 Advantages and benefits of LSA

While teachers consider that LSA contributes to the professional development of teachers, they recognise the importance of the planning process involved in the approach. In LSA, teachers work collaboratively with their peers to design a research topic (Bower & Richards, 2006:5; Chong & Kong, 2012:265). Another benefit of the LSA was that when teachers were involved in an LSA, they had the opportunity to meet together regularly and develop shared responsibilities for their learners' success (Chong & Kong, 2012:264). In addition, planning together in an LSA motivated the participants more, and thus learners' learning became more effective (Bruski, 2016:1; Taylor *et al.*, 2005:20). Further to that, an Indonesian teacher who conducted the LSA indicated that the approach helped him to construct a good lesson plan where the need to consider the learners' anticipated responses is required by the teacher (Ebaequin, 2018:10).

Participating in LSA, peer coaching and mediation, helped teachers feel more comfortable when receiving and providing constructive feedback from their peers (Rock & Wilson, 2005:87). As a matter of fact, LSA helped teachers to develop greater awareness about the needs of their learners (Dudley, 2014:3; Rock & Wilson, 2005:79).

Studies by Arslan (2018:10), Watanabe *et al.* (2008:135) and Bruski (2016:1) indicated that during reflections, teachers gained the opportunity to deepen their knowledge and reflected on their own teaching with confidence (Wood *et al.*, 2017:4), and as such, improved their knowledge on how to teach as well as how much to teach. Another study by Özdemir (2019:46)

indicated that teachers found it useful when meeting with other teachers in a group, as they could exchange views and find different teaching methods and assessment strategies that could help them solve their learners' problems.

Teachers in many countries have been fascinated by the practice of LSA in Japanese schools, particularly in primary and junior high, and have recognised its impact on the professional life of teachers and its potential for improving the teaching and learning of mathematics (Stephens, 2018:1). It is, therefore, worth noting that when Zambia introduced the LSA in the Central Province, a great impact was observed. The pass rate of learners since the introduction of LSA in Zambia until 2010, increased from 12.4% in Physics and Chemistry and 19.2% higher Biology, compared to learners in non-target provinces. Similarly, after conducting the LSA, it was observed that the Zambian teachers who were involved became agents of change rather than targets of training (Jung *et al.*, 2016:9, 18). Furthermore, as a professional development activity for teachers, LSA can help teachers to become actively involved in all the steps involved in the LSA cycle process (*cf.* 2.4.2: *Figure 2.5*) (Buchard & Martin, 2017:4–5, 14; Coenders & Verhoef, 2018:2; Gutierrez, 2015:118; Özdemir, 2019:42–43), value the reflection discussions and gain confidence through the involvement in this continuous professional development activity (Chikamori *et al.*, 2013:22).

A study by Rahim *et al.* (2015:3) indicated that the LSA as professional development has been acknowledged as a method that systematically improves teachers' quality of teaching through peer collaboration. Copriady (2013:179) further states that LSA has become a form of common practice in schools when solving the problems of teaching and learning and improving the teachers' skills (Ebaequin, 2018:13). Equally, Herbert *et al.* (2013:1), Ono and Ferreira (2010:63) and Stephens (2018:1) point out that LSA as a teaching and learning approach helps teachers to improve and to incorporate new ideas and methods into their teaching (Edelson, 2002:105; Gero, 2015:10; Ilmu, 2016:171; Zuber-Skerritt, 2015:14).

The LSA seemed to be fitted to transfer the goals of ESD in a unique way to school classrooms. Although LSA is seen as a time-consuming activity, it can also be highly rewarding to both teachers and learners. Shimizu and Huang (2016:9) indicate that a teacher's commitment to the implementation of the LSA is a necessity and develops professionally through collaborative learning. This research study provides a possible action plan on how to direct teachers to implement the LSA (Cohan & Honigfeld, 2006:28; Hiebert & Stigler, 2000:15). The findings

in the research study are an indication to policymakers who need evidence to promote the use of LSA as a school-based professional development initiative (Ogegbo *et al.*, 2019:1).

To support the professional development of teachers, a sound theoretical framework is needed. In the next section, I discuss the theoretical framework.

2.5 THEORETICAL FRAMEWORK

A theoretical framework introduces and describes the theory that explains the research problem under study (Swanson, 2013:122). Its purpose is to demonstrate an understanding of theories and concepts that are relevant to the topic and that relate to the broader areas of knowledge being considered (Leedy & Ormrod, 2005:4). According to Bertram and Christiansen (2016:13), the theoretical framework affects how the first-hand data are analysed. In order to help make sense of the findings, this study drew on the social constructivist theory and situated learning theory under the theoretical perspective of constructivism. Though there was a lack of consistency on the meaning of constructivism, it was discussed in Schunk (2012:230) that constructivism is not a theory but rather an epistemological or philosophical way of learning. On the other hand, the constructivist theoretical perspective views knowledge not as given, but as actively and continuously constructed and reconstructed by individuals, groups and societies (Donald *et al.*, 2010:79). This simply means that in constructivism, knowledge is not imposed from outside people, but rather formed inside them (Schunk, 2012:274).

As was discussed earlier in section 2.4, LSA has been widely used and advocated by Japanese teachers. For this study, and to implement LSA in Namibian schools, there needed to be a sound theoretical foundation that supports its use. The theories of situated learning and constructivism through social constructivism provided a framework that supports the use of the LSA process. Situated learning is an approach developed by Jean Lave and Etienne Wenger in the early 1990s. Situated learning theory follows the work of Dewey, Vygotsky and others (Clancey, 1995:3) who claimed that learners are motivated to learn by actively participating in the learning experience. Situated learning theory advocates that learning takes place through the relationships between people and by connecting prior knowledge with authentic, informal and often unintended contextual learning (Oregon Technology in Education Council, 2007:4). This is strongly supported by Schunk (2012:231) that people produce their own knowledge based on their beliefs and that experiences in situations differ from person to person. Situated learning gives learners the chance to engage with real-life, problem-solving contexts and involves

learners in cooperative activities where they are challenged to use their critical thinking abilities. Thus, in the case of this study, when the PLG were planning their lessons, they were aware that learning is situated in contexts and thus kept in mind the learners' environment or situation.

Social constructivism is a social learning theory developed by a Russian psychologist, Lev Semenovich Vygotsky. Similar to situated learning, the success of teaching and learning in social constructivist contexts is heavily dependent on interpersonal interaction and discussion, with the primary focus on the learners' understanding of the discussion (Prawat, 1992).

In social constructivism, knowledge is socially embedded, and learning occurs from socially mediated collaborative processes (Vygotsky, 1978:90). This simply means that knowledge is constructed through social interaction and is a shared experience. Social constructivism stresses that knowledge is constructed to respond to social interaction through social negotiation, reflection and clarification, and this speaks well with the notion of LSA. This principle of social constructivism supports the idea of teacher engagement in activities that require verbal communication and interactions (MEFT, 2017:2). Social constructivism theory suited my study well as it helped the PLG to work together through the whole cycle of LSA and solve their own problems within their own teaching and learning environment.

Situated learning and social constructivism emphasise that learning is an active social process in which individuals make meanings through their interactions with each other and with the environment where they live (MEAC, 2015:4). Thus, when confronted with a problem, teachers should seek answers within socially collaborative environments. In the social constructivist theory, teachers should be motivated to reflect on their experiences, create understanding, evaluate them and be able to explain their understanding to the social group.

The situated learning and social constructivism theories underpin LSA, which is my research area. As the PLG worked through the LSA process, they analysed, reflected, evaluated and shared their understanding. In constructing knowledge and meaning from their experience, chances are high that this increased their professional knowledge and skills (Bertram & Christiansen, 2016:45). With the support of situated learning and social constructivism theories, this study looked at how the PLG integrated the cycles of LSA into their teaching praxis.

2.6 CONCLUSION

In this chapter, I presented the review of literature related to the LSA as a professional development activity for teachers which is the focus of this research. I discussed the concept of ESD as defined and implemented globally and within the Namibian region. I further discussed how the infusion of the LSA into teacher professional development supports the global aims of ESD. The types and the importance of professional development for teachers were discussed in this chapter. I then moved on to present the history and the types of LSA. The implementation of LSA globally and within the Namibian region, the benefits of the involvement of teachers in the LSA, as well as the factors constraining the implementation of the LSA, were presented. I concluded the chapter with a discussion of situated learning and social constructivism as the theoretical framework for this research study.

Next, in Chapter Three, the research methodology followed to direct the research will be discussed.

CHAPTER THREE: RESEARCH APPROACH AND METHODOLOGY

3.1 INTRODUCTION

In this chapter, I describe the research approach and methodology I used to generate, interpret and analyse data, to enable me to answer my research questions. I was mindful of the research problem as it determined the methods of data gathering and analysis that were used. This chapter provides a description of the following aspects or elements relating to the methodology: the research and paradigmatic approach; method of research; context of the research site; recruitment of the PLG; and data gathering and analysis. I followed a Participatory Action Learning and Action Research (PALAR) approach focusing on the active involvement of the PLG to identify and investigate the problem they experienced around the integration of the LSA in biology lessons, and then how they directly collaborated to find a solution to the identified problem and then implemented the solution (Bertram & Christiansen, 2016:47; Kearney *et al.*, 2013:121; Zuber-Skerritt, 2018:3). A discussion on the role of the researcher precedes the ethical aspects of the research and validity of the findings. The next section discusses the research design.

3.2 RESEARCH DESIGN

A research design is a master plan for the research study and is used by a researcher to gather and analyse the data that is needed to answer the research question (Bertram & Christiansen, 2016:40). The research design, therefore, states how I, the researcher, gathered data and analysed it (Bertram & Christiansen, 2016:40). A research design consists of five key elements, namely methodology, philosophy, recruitment of the PLG, data generation procedure and data analysis.

. The framework that suited this PALAR research approach is illustrated in Figure 3.1. The PALAR framework influenced the choice of actions taken in this project which brought about the type of changes the PLG members were seeking (Wood, 2019:38).

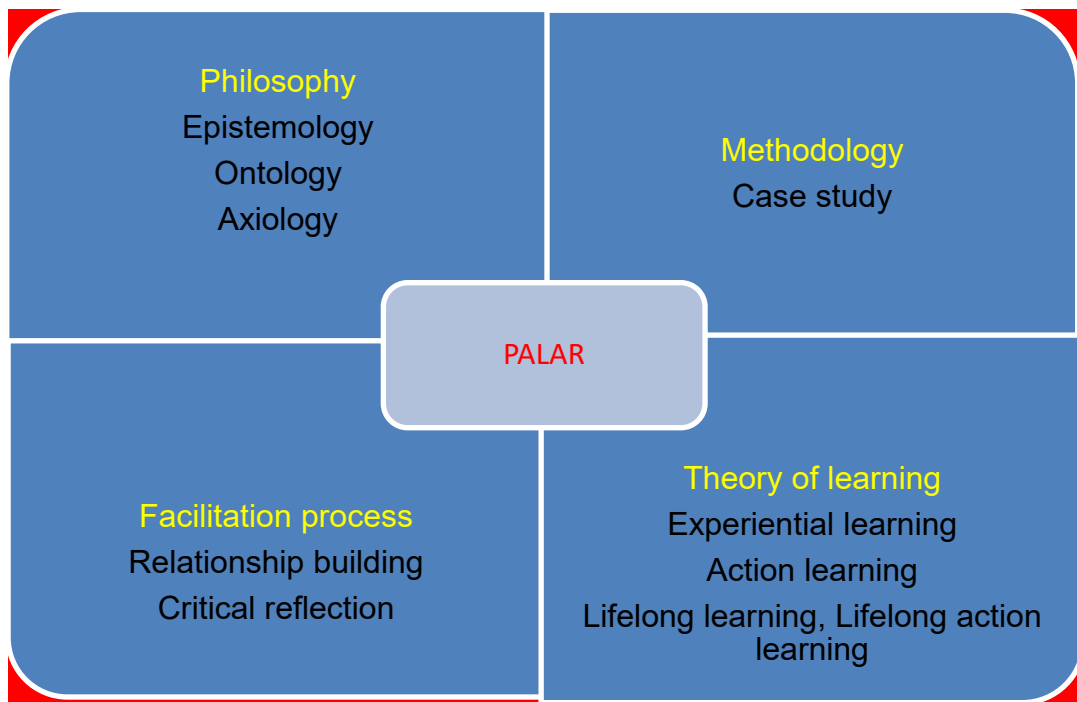


Figure 3.1: The framework for this PALAR study (adapted from Zuber-Skerritt, 2015:13)

3.2.1 Philosophical orientation

Philosophical orientation refers to the philosophical and epistemological underpinnings of knowing about the world and the problematics for conducting research (Swanson, 2013:122).

Bertram and Christiansen (2016:22) indicated that a participatory research paradigm signifies a particular worldview that defines, for the researchers who hold this, what is acceptable to research and how this should be done. Guba and Lincoln (1994:105) termed ‘paradigm’ as a basic system or worldview that guides the researcher to explain the research reality. A participatory paradigm can be used when a PLG works collaboratively with or without a facilitator (Zuber-Skerritt, 2015:7). In this PALAR research approach, the PLG were involved in collaborative engagement, with a focus on self-awareness, action and effecting change (Bertram & Christiansen, 2016:47- 48, Wood & Zuber-Skerritt, 2022:14). This critical self-reflection on learning, which is strengthened by participatory, democratic, and mutually supportive learning relationships, was applied in this research (Wood *et al.*, 2017:4).

The philosophy of PALAR supported the justification of decisions and actions concerning not just the *methodology* but also the following important aspects: *ontology* (assumptions and understanding about the nature of being and reality), *epistemology* (assumptions and

understanding about the nature of knowledge and knowing) (Maree & van der Westhuizen, 2013:31; Nieuwenhuis, 2013:47; Zuber-Skerritt, 2015:14) and *axiology* (the assumptions and understanding about ethics and values) (Wood *et al.*, 2017:5; Zuber-Skerritt, 2015:14; Zuber-Skerritt, 2018:518).

Regarding *epistemology*, this research study was grounded on PALAR as a theory of learning which is based on real-world phenomena and associated with shared knowledge (Shah & Al-Bargi, 2013:260). Denzin and Lincoln (2011:8) indicated that researchers seek answers to the question of how social experiences are created. Thus, the PLG was placed in their social context which colleagues was teaching Biology to aid with the understanding of diverse perceptions in their teaching and learning (Nieuwenhuis, 2013:59). In the context of this study, the PLG were able to generate their own knowledge through designing and interpreting planned lessons and pursue consensus through participatory and critical dialogue when they reflected on the lessons designed and presented in class (Bertram & Christiansen, 2016:35; Wood & Zuber-Skerritt, 2022:13). As a researcher I wanted to understand the PLG's knowledge and their experience of the implementation of the LSA from this perspective (Zuber-Skerritt, 2018:517).

Ontology can be referred to as the starting point of a theoretical framework. Based on Kolb's (1984:20) process of experiential learning, this research study was based on the creation of knowledge through critical reflections on the experiences of the PLG. Kolb's experiential learning theory is seen as the cornerstone of participatory forms of research since it encompasses interactive cycles of reflection and action (Zuber-Skerritt *et al.*, 2015:8) Thus, this study adapted the model of the experiential learning process of Lewin (see Figure 3.4) which describes the four stages cycle of experiential learning as discussed under section 3.2.3. According to Nieuwenhuis (2013:47), ontology addresses fundamental assumptions such as beliefs about the nature of reality and the understanding of the nature of being and the order and structure of reality (Zuber-Skerritt, 2018:518). The interaction between language and aspects of an independent world helps to shape reality (Frowe, 2001:185). In this research study, the PLG were required to trust one another (Wood & Zuber-Skerritt, 2022:14). Through discussions and sharing of the focal point for learning, the PLG had the chance to test the implications and the validity of ideas that were created during the learning process (Kolb, 1984:21).

Axiology is a Greek word which means ‘value’ or ‘worth’ (Britannica, 2015). As an assumption and understanding about the nature of being and reality, axiology studies the judgement about the value of the researcher in all stages of the research (Britannica, 2015). I, therefore, had to keep in mind that my actions in this research were fundamentally shaped by my understanding of ethics, values and beliefs (Zuber-Skerritt, 2018:518) and thus acknowledged the diversity of the PLG’s origins of knowledge and respected their interpretations of ideas.

In the next section, the research methodology will be explained.

3.2.2 Research methodology

The methodology offers a theoretical underpinning for understanding which set of methods can be applied to a specific case (Howell, 2013:10) as well as an understanding of which holistic approach can be followed to find answers to the research questions (Jackson, 2013:55). This qualitative research study followed the PALAR approach that encompasses the idea that cycles, relationships and research is continuous (Wood, 2020:105). Figure 3.2 presents the visual representation of a double-loop PALAR process complemented by the LSA.

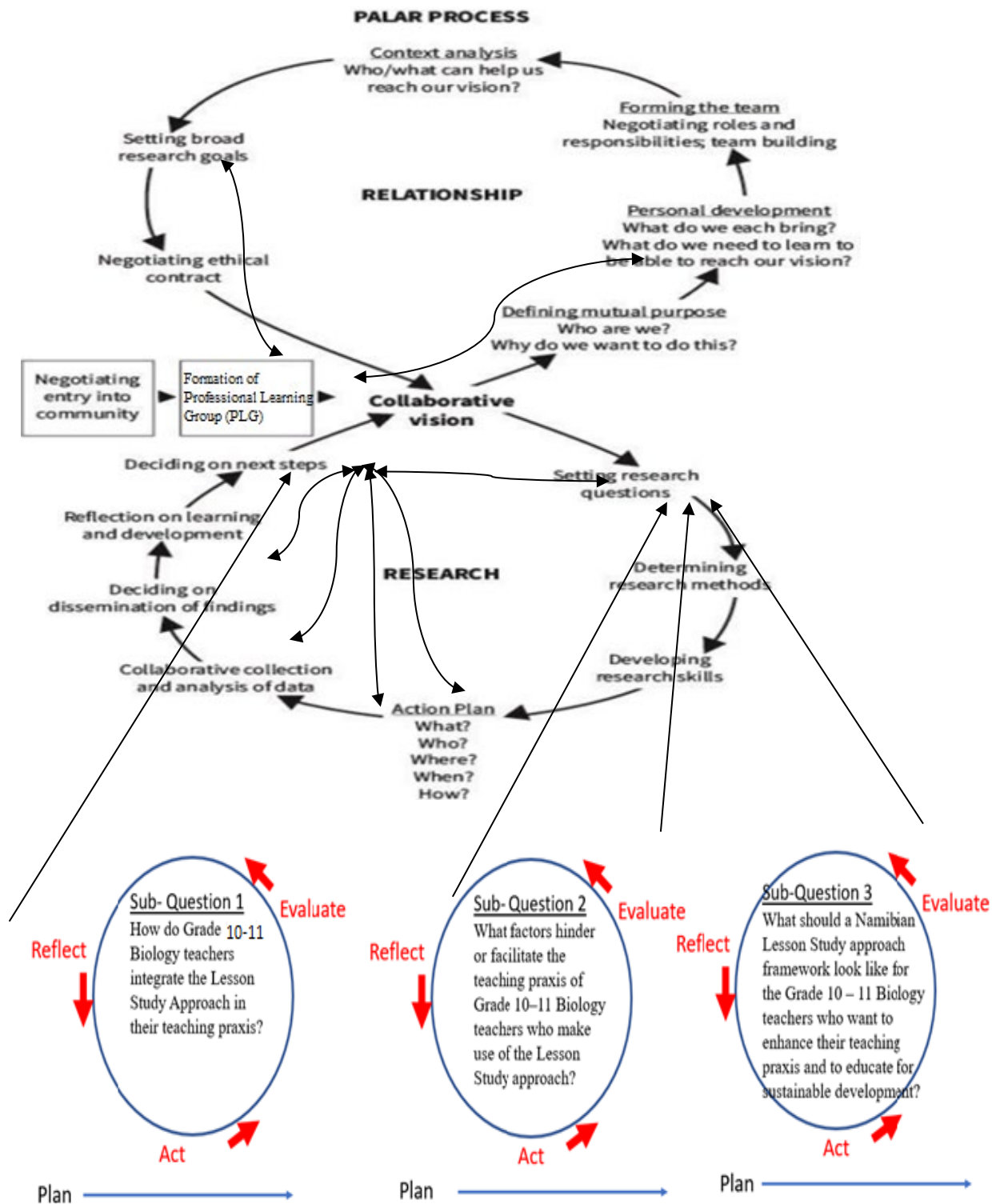


Figure 3.2: How LSA Complements the Steps of PALAR (adapted from Wood, 2020:106)

In the Relationship loop of PALAR:

We, the research team, formed a PLG with the aim to:

- integrate the LSA in the planning of Biology lessons that have the potential to educate for sustainable development;
- improve the teaching of Biology lessons;
- acquire and develop the planning, collaboration, observation, reflection and critical thinking skills of Grade 10 and 11 Biology teachers;
- achieve the objectives of this research study; and
- become the experts in the implementation of the LSA.

For personal development as a Senior Education Officer, I had the:

- experience on how to integrate the LSA in the planning and teaching of Biology topics related to ESD; and
- teaching and observation skills.

The four PLG members who were teaching Biology had:

- planning and teaching skills;
- were exposed to the LSA during the circuit-based workshop;
- little background in the implementation of LSA; and
- some background of ESD.

As the PLG we wanted to:

- become experts in the implementation of the LSA when teaching Biology topics; and
- develop planning, teaching, collaboration, observation, critical reflection and critical thinking skills.

Our team was composed of five PLG members who were co-researchers who generated and analysed the data. Apart from the PLG expertise, the Grade 10 and 11 syllabus and the textbooks were used to plan the lessons.

Our goal was to implement the LSA in Biology teaching and learning to improve our professional teaching praxis skills using LSA in our classrooms to educate for sustainable development.

In this research study, we were guided by the ethical requirements of the North-West University (NWU). We signed the consent forms and agreed on the timeframe of the research study process; five months with no budgetary constraints involved. During the five months, we used 40 minutes each for four lesson observations and approximately 1h 30 minutes for 10 discussion meetings each; (introduction, planning and feedback) which suited everybody. The discussion meetings were always done during break time or in the afternoon after classes. An agreement was reached on how to gather and analyse the data . We agreed and understood the purpose of gathering the data. The identity of the school and PLG were protected, thus pseudonyms and codes were used.

We agreed to collaboratively implement the LSA to educate for sustainable development in Grade 10–11 Biology lessons.

In the research loop:

Our research study was guided by the following research questions which were mastered, following the action research cycle as seen in Figure 3.3.

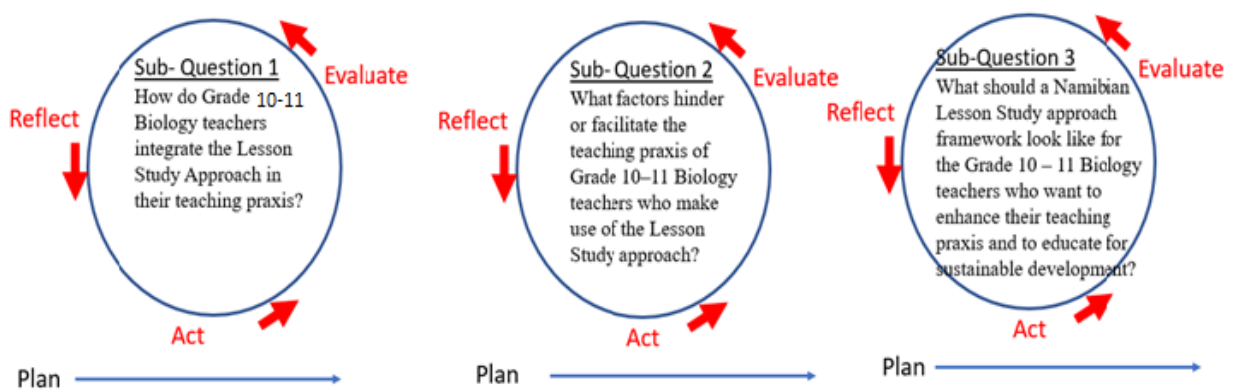


Figure 3.3: Research loop excerpt from Figure 3.2

The following data generation methods were used to gather the data:

- lesson planning discussion;
- reflective discussions and narratives on the observation of the presented lessons (that used the ALEI-PDSI lesson observation checklist to guide the discussion); and
- reflective discussions about the PLG reflective diaries and my analysis of the reflective diaries.

The following data generation tools were implemented:

- personal lesson plans;
- collaborative lesson plans using the LSA lesson plan template;
- Activity Learner-centred Experiment Improvisation-Plan Do See Improve (ALEI-PDSI) lesson observation checklist (the tool used to evaluate and critique the LSA lessons);
- reflective diaries; and
- verbatim transcripts of the discussions.

We geared towards the development and achievement of the following skills:

- planning skills;
- collaboration skills;
- observation skills;
- critical reflection skills; and
- critical thinking skills.

We collaboratively devised the research plan for action and worked according to the LSA with its cycles. Data generation was undertaken collaboratively. Thematic analysis of the data obtained from the mentioned methods and tools was followed.

As a group, we used the reflective discussions and diaries to note how we developed our skills when implementing the LSA to educate for sustainable development in Biology Grade 10–11.

The broad goals of our group included:

- the intention to inform other teachers regarding ESD infusion in other subjects. Research and implementation of LSA were estimated to complement our own professional development;
- an agreement that after the completion of the research study, the final product (thesis) will be published and the copies will be made available to institutions like the GwaaNampano Gweegonga SS (pseudonym of where the research study took place), Oshikoto Education Directorate and all its Circuit Offices, NIED, Teachers Resource Centres (TRCs) and Oshikoto Regional Council Office;
- the suggestion that the MEAC in Namibia recognises the LSA and PALAR approaches as priority areas in delivering quality professional development; and
- the agreement to introduce the LSA to the teachers of different subjects in the schools in the Oshikoto Education Directorate, and that findings would be shared with the PLG school and other schools through the Inspectors of Education.

This research study was collaboratively planned and conducted with, for and by, “not to or on” the PLG themselves who were affected by the problem from the beginning till the end of the study (Zuber-Skerritt, 2015:14). This research study aimed to bring a change in the classroom, and improve practice, skills building and capacity building of the PLG (Zuber-Skerritt, 2015:16).

The PALAR is not a new approach to teaching and development, but rather a synthesis of different genres of action learning and research (Wood *et al.*, 2017:4). PALAR follows a cycle similar to any other participatory action research whereby a small number of people form a PLG and in collaboration identify the problems or needs, decide the best course of action and its implementation, evaluate the action and decide on further action to take based on the PLG’s critical reflection (Berg & Lune, 2012:259; Bergold & Thomas, 2012:9-10; Kearney *et al.*, 2013:115; Wood & Zuber-Skerritt, 2013:3).

In this research, PALAR together with an LSA, allowed the PLG to work together and support each other to find solutions to the self-identified problem (Bless & Achola, 1990:51; Wood, 2020:101), that might be present beyond a single classroom (Mills, 2003:4).

The PALAR is one of the genres of participatory action research study used to answer the what, who, when, how and why research questions (Wood, 2020:106). In this PALAR approach, the PLG tried to collect rich descriptive data in respect of a particular context to develop an understanding of what was being observed (Nieuwenhuis, 2013:50).

The PALAR follows the cyclical process of action research of Plan, Do/Act, See, and Improve (Wood & Zuber-Skerritt, 2013:5), whereby the PLG meet and works collaboratively in planning their lessons and refining their teaching practices (Esterhuysen, 2015:8) The information in red in Figure 3.4 indicates the method used to carry out this research process.

The PALAR is a type of qualitative research where the participatory engagement of the PLG in an institution, for example, a school in this research, requires the PLG to become co-researchers. As co-researchers, the PLG involved in action learning generated their own data and reflect on it (Bertram & Christiansen, 2016:47). The PALAR, as a useful method, directed the action learning of the PLG through the cycle of trial and error. The PLG developed lessons applying the LSA and then critically reflected on the challenges to reach a suitable outcome (Wood & Zuber-Skerritt, 2022:15).

The PALAR cycle involves the following steps: 1) Identifying and investigating a problem; 2) finding a solution to a problem; and 3) implementing a solution through observation and critical reflection to improve the way of teaching. The PALAR often uses the qualitative participatory action research (PAR) methodology to collect and analyse data (Zuber-Skerritt, 2018:518). This made PALAR my preferred genre of action research when investigating the case of how the Grade 10–11 Biology PLG integrated the LSA in their teaching praxis. When implementing PALAR, the PLG tried to understand why they acted and said what they did (Bertram & Christiansen, 2016:31, Kearney *et al.*, 2013:115,117).

The LSA complemented the PALAR approach by following the following cycle: collaborative planning, do or act, observe or see and improve or reflect, with detailed information of my study, as indicated in Figure 3.4.

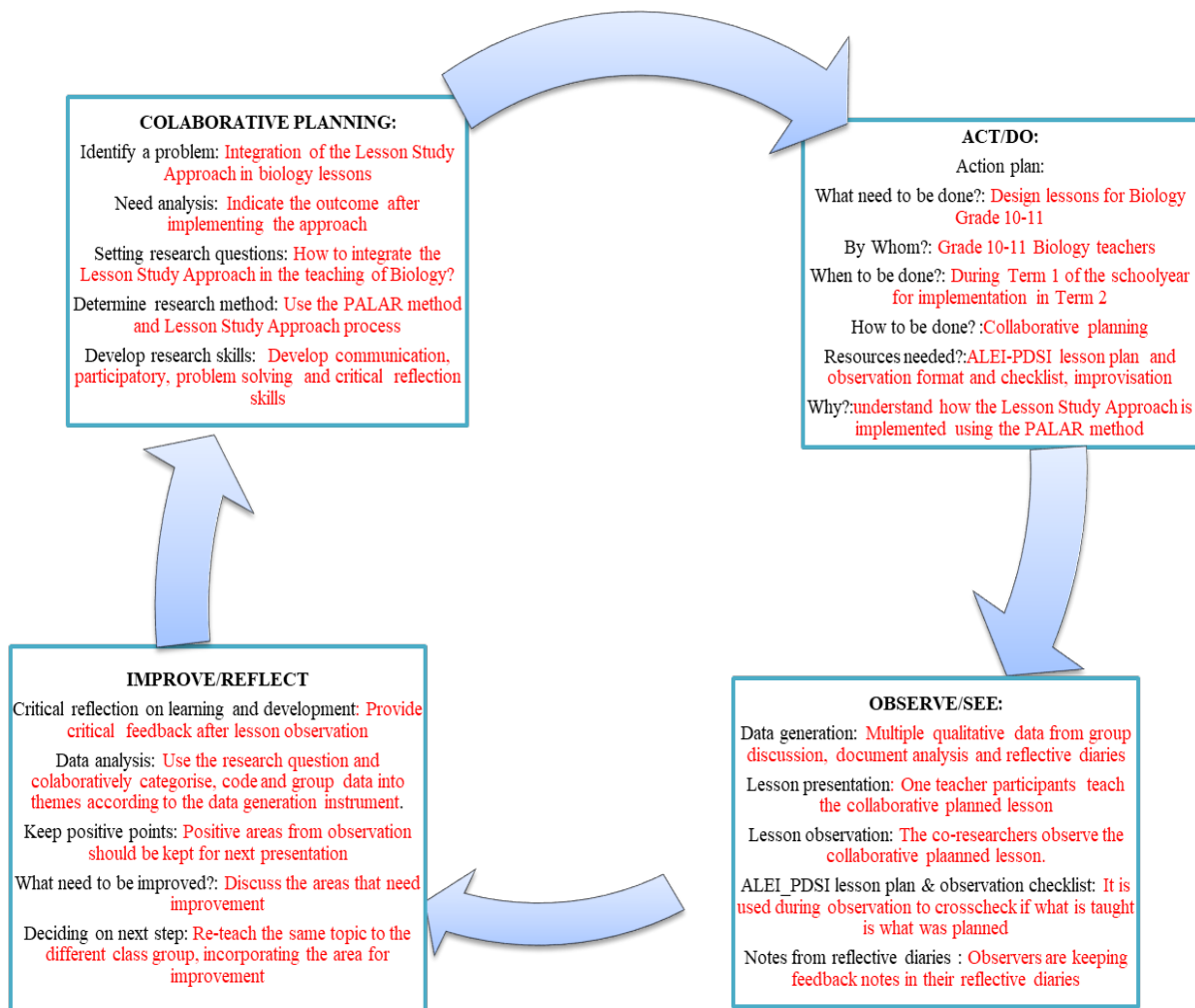


Figure 3.4: How this research process was carried out (adapted from Wood, 2020:106)

This research also addressed to bridge the gap between theory and practice concerning the planning and execution of lessons by using the above PALAR cyclical process steps. The PALAR and LSA afforded the PLG opportunities to engage in reiterative cycles of learning through ongoing dialogue and self-reflection (Kidd & Kral, 2005:189; Zuber-Skerritt, 2015:6).

In the next section, the theory of learning that shaped this research study is discussed.

3.2.3 Theory of learning

Many theories attempt to explain how people learn. The PALAR theory of learning includes action learning, experiential learning and adult learning (Zuber-Skerritt, 2018:518). These three components have many similarities but also some differences (Wood, 2019:39; Kolb, 1984:38) indicated that learning is the process whereby knowledge is created through the

transformation of experience. This research supported Kolb's experiential learning theory and especially the Lewinian interpretation as indicated in Figure 3.5.

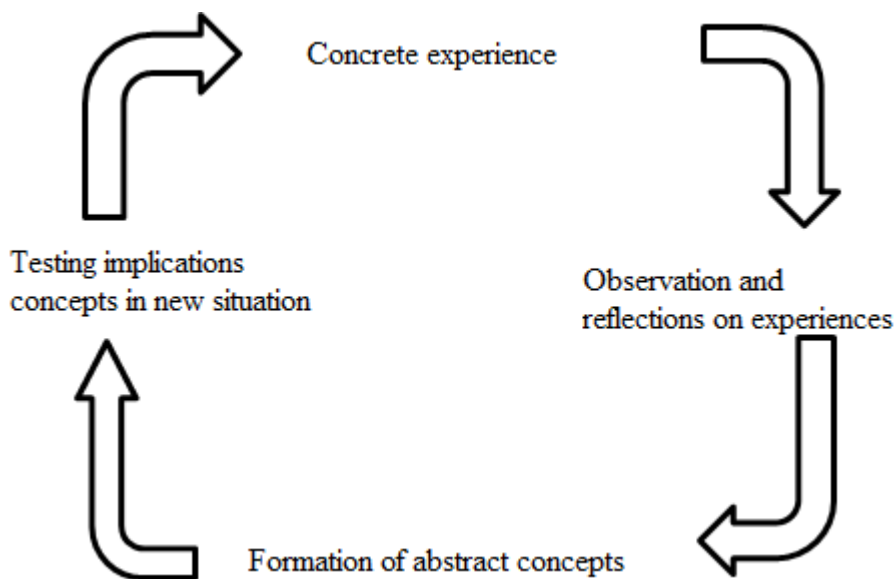


Figure 3.5: The Lewinian Experiential Learning Model (adapted from Kolb, 1984:21)

The experiential learning was the lens through which learning in this research study was conducted (Kolb, 1984:21). This lens was used by the research team to gather the correct data and make sense of it for this research. Experiential learning was linked with my research as follows:

- The Grade 10–11 Biology PLG learnt from each other, identified their own problems, created their own resources and found their own solutions when reflecting critically through the PALAR cyclical process (Schiller *et al.*, 2018:8; Zuber-Skerritt *et al.*, 2015:7). This PALAR study is a form of educational research that provided the PLG with an opportunity to study one another's lessons through reflection and improve their educational practices (Edelson, 2002:105).

The Lewinian model was applied as follows in my research:

- The cycle began with the formation of abstract concepts when the PLG collaborated to design a Biology lesson and then observed the lesson presentation by one member of the PLG.

- The existing knowledge of the PLG was improved through the experience shown by the PLG during lesson observation.
- The model was concluded when the PLG critically reflected on their experiences and shared what they learnt and how they might change their behaviour through experiential learning. The reflection allowed the PLG to indicate the positive and the challenges that were experienced throughout the whole cycle.

This application of the experiential learning theory as described by Zuber-Skerritt (2015:8) can lead to a lifelong cycle of learning and creating knowledge.

The next section discusses how experiential learning was facilitated in this research study.

3.2.4 Facilitation process

Embarking on a PALAR approach can be a valuable and life-changing experience when the research team creates a democratic, inclusive and productive space for dialogue (Wood *et al.*, 2017:2). One-way communication cannot lead to successful learning and development of a person – it is only through experiential, gradual and systematic learning for everyone involved in a research project that it can occur (Zuber-Skerritt, 2015:14). This research study used the characteristics and principles of the PALAR which are the 7Cs (Communication, Commitment, Competence, Compromise, Critical reflection, Collaboration and Coaching) and the 3Rs (Reflection, Relationship and Recognition) when reflecting on our facilitation of the PALAR process (Wood *et al.*, 2017:4) as follows:

- Communication in this research was based on respect and acknowledgement of the input of all members of the PLG. Novice and expert input were regarded as equally valuable.
- Commitment to the research resulted in the achievement of the research outcomes as well as in the members of the PLG's learning and development goals.
- Competence in this research was based on self-directed learning through critical reflection by all the PLG members and being able to learn how to be a lifelong action participant.
- Compromise in this research was based on the flexibility of all the PLG members when they compromised their personal standpoints which enabled them to progress towards mutual agreement.

- Critical reflection in this research was based on the PLG member's ongoing self and collective reflection at all stages of the research and the recognition of each member in knowledge generation.
- Collaboration in this research was based on the active participation of all members of the PLG using democratic decision-making processes throughout the research process.
- Coaching in this research was based on the sharing of learning among the PLG members by directing each other in their actions. Coaching resulted in increasing individuals' competence as part of the recognition and reward of participating in this research study.

In the next section, the context of the research site and the recruitment of the PLG are discussed.

3.3 CONTEXT OF RESEARCH SITE AND RECRUITMENT OF THE PROFESSIONAL LEARNING GROUP (PLG)

In the context of this study, all the Grade 10–11 Biology teachers in the Onathing circuit who showed interest and were willing to take part in the research formed the PLG and participated in the PALAR research process (Figure 3.2) – which included relationship building and research (Wood, 2020:106). This is because they were interested in changing a complex situation regarding lesson planning and its implementation (Zuber-Skerrit, 2015:14) and wanted to improve their educational services (Bergold & Thomas, 2012:3, Breitbart, 2012:141).

This research study was confined to a secondary school in the Oshikoto Region. The school, Gwaanampando Gweegonga SS (pseudonym) is on the northern side of Namibia. It has a population of about 412 learners, 18 teaching staff and three non-teaching staff. Figure 3.6 shows the Namibian map with its 14 regions and the location of the Oshikoto Region where the research was conducted.

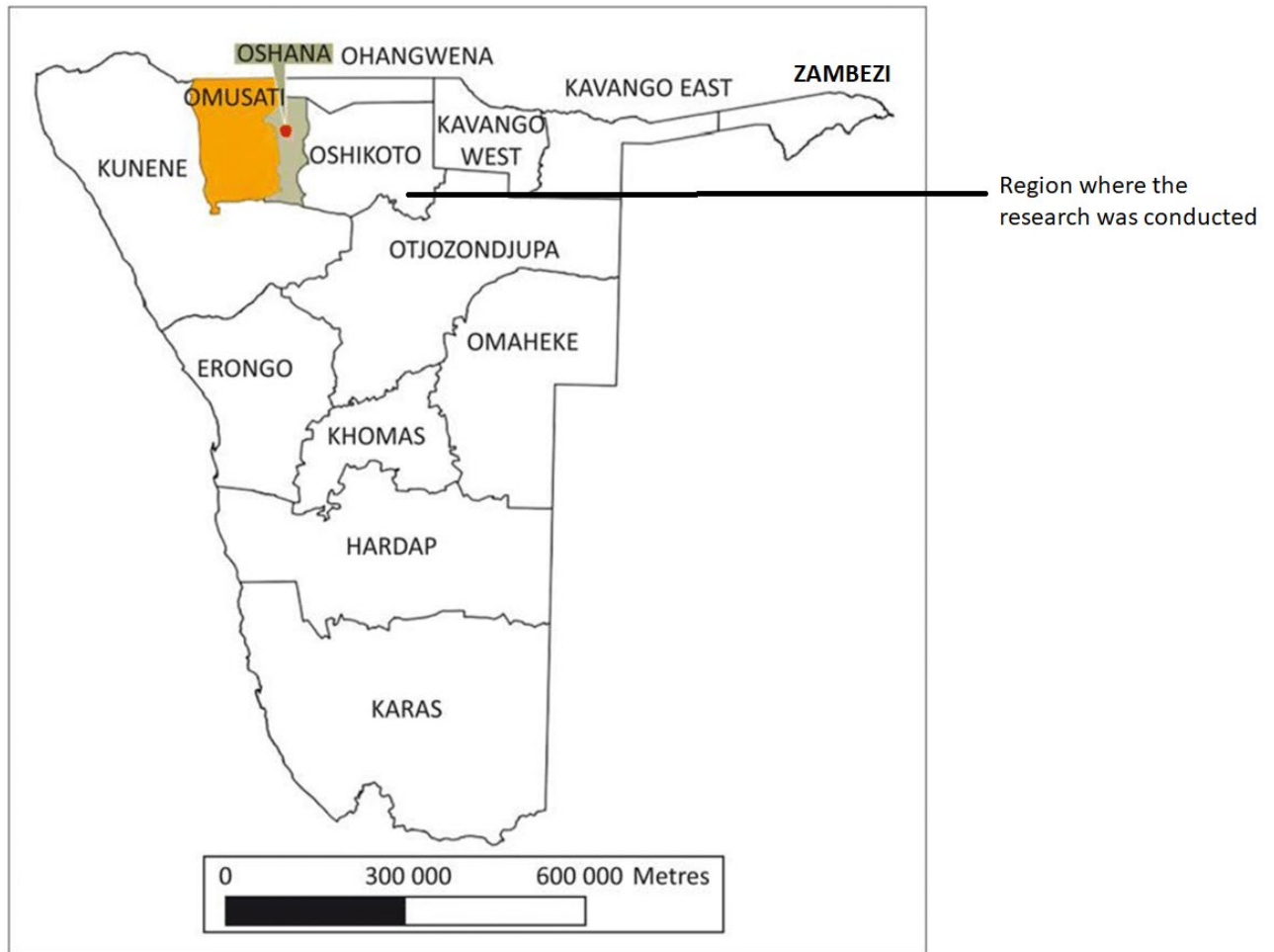


Figure 3.6: Map of 14 Education Regions of Namibia (Angula & Kaundjua, 2016)

The choice of a school in the Oshikoto Region was for convenience (Gay *et al.*, 2009:134), as I am a subject Senior Education Officer in the region. McMillan and Schumacher (1997:169) see convenience sampling as a “group of subjects selected on the basis of being accessible and suitable”. It was, therefore, easy for me to access the school because it is within 10km of my residential area. Another reason was that the school curriculum includes Biology, my field of subject expertise. I used an independent person to contact the school management to gain access. The independent person met with the principal, who became a member of the PLG for the participating school, to indicate the intent of the research. At a suitable time on 22 June

2021, the independent person met with the ¹PLG teachers at the school to discuss their role in the research and gained consent.

In our first meeting that took place at the school on 24 June 2021, the independent person introduced me to the PLG teachers, and I explained the research study to them. After greetings and welcoming each other, I indicated to the PLG teachers that this would be a collaborative research study, and everybody should feel free to discuss and share their experiences and concerns throughout the research study. I indicated to them that the research study was on the implementation of the LSA, and we agreed to discuss it in more detail at our second meeting.

The school offered Grade 8–12 in 2019–2020, but because of curriculum changes in 2021, at the time of the study, it was offering Grade 8–11. Most of the PLG teachers (TP1–TP4) involved in the implementation of the peer-teaching programme in the school were young, qualified university graduates. Table 3.1 shows the details of the PLG teachers who participated in the research study.

Table 3.1: Details of the PLG Teachers who Participated in the Research Study

The professional learning group codes	Gender (M or F)	Age	Highest qualification	Position in the school	Grade and subjects responsible for	Years of teaching experience (Biology)
TP 1	F	34	BEd (Hons)	Teacher	Life Science Grade 8B & C, Life Science Grade 9A & B, Agric. Science Grade 8C, 10A & C, Reading Grade 8C	11
TP 2	F	42	MEd	Principal	Biology Grade 10B	19

¹ PLG teachers refers to the four Biology teachers who were part of the PLG and any actions taken by them. PLG/PLG members refers to the four Biology teachers and me, the researcher, and any actions taken by us.

TP 3	F	32	BEd (Hons)	Teacher	Agric. Science Grade 11 A & C, Biology Grade 10A, PE Grade 10A–D, Life Science Grade 8A, Reading Grade 10A	9
TP 4	F	31	BEd (Hons)	Teacher	Biology Grade 11A & B, Agric. Science Grade 9B, PE Grade 8A–C, 11A–D, Arts Grade 10A & 11B, Reading Grade 11B	8

Nieuwenhuis (2013:79) refers to recruitment as the process used to establish a portion of the population (total number of people) for the study. According to Bertram and Christiansen (2016:59) recruitment involves making decisions about which people, settings or behaviours to include in the study. As indicated in Kearney *et al.* (2013:115), instead of a large number composing the PLG, in this PALAR approach, the focus was on a small number who were co-researchers who actively and collaboratively addressed important, complex problems that directly affected them and found solutions to them (Kearney *et al.*, 2013:115). Therefore, I was joined by the four Grade 10–11 Biology teachers who were identified in the meeting by the principal and the independent person who gave their consent and formed a PLG for this study.

The PLG teachers in this research study were recruited based on the following criteria:

- They teach Grade 10 and/or 11 Biology as one of the subjects that recognise ESD in its curriculum. The subject is often perceived to make a significant contribution to ESD (Creswell, 2009:178; Leedy & Ormrod, 2005:206).
- Biology teachers who had voluntarily attended a workshop on LSA training (Gay *et al.*, 2009:135).

In the next section, data generation procedures are discussed.

3.4 DATA GENERATION PROCEDURE

The methods that are used to gather and generate data in any research study are selected based on the ability to best address the research purpose and help answer the research questions (Bertram & Christiansen, 2016:71–72; Leavy, 2017:133). In this research study, multiple methods of data generation were used to gather data. This PALAR approach used qualitative data generation methods, namely lesson planning discussions, reflective discussions of observations and narratives on the observations of the presented lessons (that used the ALEI-PDSI lesson observation checklist to guide the discussions), reflective discussions on the PLG members' reflective diaries and my analysis of the reflective diaries. The tools used to gather data were personal lesson plans, collaborative lesson plans using the LSA lesson plan template, the ALEI-PDSI lesson observation checklist, reflective diaries and verbatim transcripts of informal discussions (Gay *et al.*, 2009:366–372). The choice of data-gathering methods was informed by Bertram and Christiansen (2016:83,94) who postulate that observation and discussions are good sources of qualitative evidence as they complement each other and serve as a means of triangulating data.

The LSA and design and implementation of lesson planning, as data-gathering methods, were used in the research study. The LSA, as part of the PALAR approach, was conducted as indicated: the four PLG teachers who volunteered to participate (Zuber-Skerrit, 2011:44) and me, as the researcher, met and drew up an action plan according to the LSA with its cycles. All members of the PLG collaboratively decided on what we would do, who would be doing what, how it would be done, and where and by when (Wood, 2020:106,113). Once all PLG members agreed to follow the LSA, four Biology lessons of 40 minutes each were designed during the respective cycles, then presented and audio recorded. The PLG members not teaching the lesson observed the lesson presentation and thereafter, shared experiences, perceptions, reflections and opinions as they progressed through the research stages.

Ten (10) group discussions not longer than 1h30 minutes, respectively, before and after each lesson observation were audio-recorded. With permission from the PLG teachers, all data were recorded to get the individual PLG teacher's perceptions of the implementation of LSA in Biology.

On 14 October 2021, the PLG discussed the LSA in detail and we all understood what was expected of us. The PLG teachers indicated being challenged with planning and observing lessons. I suggested that as a PLG, we could plan the LSA implementation using the LSA lesson plans and observe the lessons using the LSA observation tool, i.e. the ALEI-PDSI lesson observation checklist, and use the reflective diaries to note how we developed our skills when implementing the LSA. All the PLG members agreed to this suggestion. Before I present the methods and tools that were used to generate the data (*cf. Table 3.2*), I would like to first give the context of each data generation method and tool, and why they were used in this research study. The first data generation method to be discussed is lesson plans.

3.4.1 Data-gathering methods

3.4.1.1 Lesson plans

The lesson plans that were used to gather data in this research study included personal lesson plans and collaborative lesson plans (*cf. 3.6.1; 3.6.2; 3.6.5; 3.6.8; 3.6.11*). The above-mentioned tools formed part of the data-generating tools and were used in the analysis of data. Bowen (2009:27) describes data gathering using these tools as a systematic procedure for reviewing or evaluating printed and electronic materials. However, Creswell (2014:245) warns that the information gathered using these tools may be incomplete, inauthentic or inaccurate, thus, in this PALAR approach, unclear information from these gathering tools was handled during the interview (Rule & John, 2011:67). In this research study, a personal lesson plan was provided and two lessons per grade were designed using the LSA, therefore five lessons in total. The lesson plans were used to see how the PLG teachers applied the stages of LSA in their lesson plans and also to compare the personal lesson plans before the introduction of the LSA and the collaborative lesson plans after the introduction of the LSA. The above lesson plans helped to address the research questions for this PALAR approach: *How do the Grade 10-11 biology teachers integrate the Lesson Study Approach in their teaching praxis? What factors hinder or facilitate the teaching praxis of Grade 10-11 Biology teachers who make use of the LSA? What should a Namibian Lesson Study Approach framework look like for the Grade 10–11 Biology teachers to enhance their teaching praxis and to educate for sustainable development?* The next section is about discussion as the second data-gathering method.

3.4.1.2 Discussions

A discussion is a two-way dialogue between the PLG members (the researcher and the co-researchers) responding to the research questions for data-gathering purposes. A dialogue in a PALAR approach aimed to see the world through the eyes of the PLG teachers (Nieuwenhuis, 2010:87) as they critically reflected on the topic through discussions (Wood & Zuber-Skerritt, 2013:7). A discussion is one of the techniques that the PLG can contribute to the understanding of a research problem (Gay *et al.*, 2009:372). According to Fontana and Frey (2005:690), a discussion is not just a neutral exchange of asking questions and getting answers but a collaborative effort where two or more people are involved in a dialogue. In this research study, the PLG used the discussions as a method to generate data to answer all three research questions (*cf. Figure 3.2.1*). The discussions in this PALAR approach involved discussions of the lesson plan development and critical reflection discussions of the observed lessons (Zuber-Skerritt, 2015:14) as per the cycles and requirements of the LSA (*cf. Figure 3.3*). In this PALAR approach, the PLG met 10 times to reflect on each of the following – lesson plans and lesson observations (*cf. 3.6.4; 3.6.7; 3.6.10; 3.6.13*).

The next section is about lesson observation as the third data-gathering method.

3.4.1.3 Lesson presentation and observation

Watching the lesson to obtain data is termed ‘observation’ (Gay *et al.*, 2009:366). In this research study, the PLG chose observation as one of the data-generating methods since we wanted to see the reality of how the LSA was implemented in the teaching of Biology Grade 10–11. Observation provides a reality check, as Robson (2002:310) says that what people do may differ from what they say they do. Therefore, observation helped inform decisions as to how to work within this study. Learning by doing and critically reflecting on the action and self with others is the principle of the PALAR approach (Zuber-Skerritt, 2015:14). In this research study, the four lesson observations took place in a school where the PLG gathered in a classroom where one member taught the lesson and the rest of us observed it (Bertram & Christiansen, 2016:84) (*cf. 3.6.3; 3.6.6; 3.6.9; 3.6.12*). Observation in this research study helped the PLG to answer the research questions: *How do Grade 10–11 Biology teachers integrate LSA in their teaching praxis? What factors hinder or facilitate the teaching praxis of Grade 10-11 Biology teachers who make use of the LSA? What should a Namibian LSA framework look like for the Grade 10–11 Biology professional*

learning group who want to enhance their teaching praxis and to educate for sustainable development?

3.4.2 Data-gathering tools

The fourth data gathering was via a tool, namely reflective diaries.

3.4.2.1 Reflective diaries

Reflective diaries are useful tools in facilitating the development of the process of reflection and reflective learning (Tang, 2002:5). The purpose of the diaries in this research study was to answer all three research questions (*cf.* 3.5.1).

Each PLG member was provided with a diary book to gather rich data for this study. We used the diary to write our feelings, challenges and gains during the research process. The PLG agreed to also use the diaries to indicate how we felt about the presented lessons, and point out what we learnt in the discussions about the presented lessons. During planning and discussion meetings and every lesson observation, we used our diaries as a means to take down our critical reflections on their insights, feelings, emotions and ideas. The PLG used the diaries to jot down the responses to some of the following questions:

- *How do you understand the term ‘Lesson Study Approach?’*
- *What are the benefits of collaborative planning?*
- *As a Lesson Study Approach PLG expert, how do you make other teachers aware of the importance of the Lesson Study Approach?*
- *If you are given a chance to plan and present according to the criteria on the ALEI-PDSI checklist for the Lesson Study Approach, how would you do it differently?*

The next section, Table 3.2 shows how the above-mentioned methods, and their tools were used to generate the data.

Table 3.2: Methods and tools used to generate the data

Data generation Methods	Data generation tools	Purpose
<p>1. Lesson plans:</p> <ul style="list-style-type: none"> • Personal lesson plans <ul style="list-style-type: none"> • PLG swapped the individual lesson plans. • I explained how to evaluate the lesson using the ALEI-PDSI lesson observation checklist. • The PLG evaluated the individual lesson plan using the ALEI-PDSI lesson observation checklist. • Discuss each lesson aspect on the ALEI-PDSI lesson observation checklist and see how individual PLG members evaluate each other. • The PLG agreed to keep the results of the personal lesson plan and evaluate it against the collaborative lesson plans. • The PLG used their diaries to keep notes of what emerged from the discussion of the personal lesson plan and their progress in the research study. • Collaborative lesson plan 1 <ul style="list-style-type: none"> • I gave the LSA lesson plan template to the PLG. • The PLG discussed and understood the content of the LSA lesson plan template. • The PLG used the Grade 10 syllabus and textbooks to choose a topic from. • The PLG agreed to use the LSA lesson plan template to collaboratively plan a lesson on the challenging topic they have selected. 	<ul style="list-style-type: none"> • Personal lesson plan • Reflective diaries • ALEI-PDSI lesson observation tools • LSA lesson plan • Reflective Diaries 	<p>Help answer research Q.1, 2 & 3</p> <p>Help answer research Q.1, 2 & 3</p>

<ul style="list-style-type: none"> • Lesson presentation 4 <ul style="list-style-type: none"> • TP4 presented the collaborative re-planned lesson in Grade 11B while TP1, TP3, TP4 and I observed. • The observers again used the clean ALEI-PDSI lesson observation checklist to tick and evaluate the lesson. • The PLG's reflective diaries were used to note all the focal points for discussions. • The focus of the evaluation was on the aspects of the lesson of ALEI through PDSI. • Reflective discussions on lesson presentation 4 <ul style="list-style-type: none"> • The PLG sat together again after the lesson presentation and observation to reflect on the lesson. • They deliberated on the ticked ALEI-PDSI lesson observation checklists and shared the content of the reflective diaries. • The lesson presenter, TP4 self-reflected on the lesson and each observer shared their observations again. • PLG felt to end the cycle because all the areas that needed improvements were incorporated in the presentation as they reflected in the re-planned lesson. 	<ul style="list-style-type: none"> • Reflective diaries • ALEI-PDSI lesson observation checklist • Reflective diaries • Verbatim transcription discussion 	<p>Help answer research Q. 1, 2 & 3</p> <p>Help answer research Q. 1, 2 & 3</p>
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The next section discusses how the data were gathered through the personal lesson plans, the collaborative lesson plans of the two Grade 10 and 11 lessons respectively, lesson presentations and observations of the collaborative lesson plans and the reflective discussions on the presented lessons.

The next section explains the lesson plans used as a data-gathering tool to promote discussion.

3.5 PERSONAL LESSON PLANS

3.5.1 Personal lesson plans

In the third meeting, I requested the other PLG members to submit one of their personal lesson plans (see Appendix A). The reason for the personal lesson plans was to pilot the ALEI-PDSI lesson observation checklist (see Appendix C) by assessing their pre-knowledge of the philosophy of an **Actualisation Learner-centred Experiment Improvisation (ALEI)** lesson through the stages of LSA, namely: PDSI (JICA, 2010:7). The personal lesson plans were swapped amongst the PLG teachers, and we used the ALEI-PDSI observation checklist to assess how each teacher evaluated each other against the stages of the LSA. The outcomes of the personal lesson plans were used for data gathering alongside the four collaborative lesson plans against the stages of the LSA. All PLG members, including me, used our diaries to keep notes of what emerged from the discussion on the personal lesson plan.

The next section discusses how data were generated using collaborative lesson plan 1.

3.5.2 Collaborative lesson plan 1

The PLG teachers brought the Grade 10–11 syllabus, textbooks and the National EE & ESD Policy for Namibia to the third meeting on 21st October 2021. They were provided with an example of an LSA-planned lesson as a template, and we discussed what to cover in the lesson plan. The discussion included what to write under the following headings on the LSA lesson plan: the generic part of the lesson (name of teacher, subject, class, date, topic and sub-topic), lesson objectives, rationale, pre-requisite knowledge, teaching and learning resources/materials, lesson development/presentation (introduction, development, conclusion/consolidation and evaluation/assessment), reading and writing skills, and last but not least, learner support/inclusive. As the PLG,

we agreed to indicate the learning points and the remarks/reflections in the lesson plan and the time allocation at each stage of the lesson. The LSA lesson plan template aided us when planning the LSA lessons that were to follow. In this stage, we compiled an action plan for the study (*cf. Figure 3.2*). Then, we used the Grade 10 Biology syllabus and textbooks to identify the challenging topic and the LSA lesson plan template (see Appendix B) to collaboratively Plan for lesson 1 (Arani *et al.*, 2010:172; Cajkler *et al.*, 2015:197). We used our reflective diaries to jot down the crucial points that emanated from the planning meeting. Then we had a reflective discussion of the planned lesson to ensure that all the essential components of the lesson were included before the presentation. The collaborative lesson planning helped to answer the research questions: *How do Grade 10–11 Biology teachers integrate LSA in their teaching praxis? What factors hinder or facilitate the teaching praxis of Grade 10-11 Biology teachers who make use of the LSA? What should a Namibian LSA framework look like for the Grade 10–11 Biology teachers to enhance their teaching praxis and to educate for sustainable development?*

When conducting a discussion, it was important for me, as a researcher, to ensure that all the PLG teachers had an opportunity to share their experiences and interpretation and I tried to avoid the discussion from being dominated by any individual member. The PLG agreed that TP2 would teach the lesson in Grade 10A, and the rest of the members – TP1, TP3, TP4 and me – would observe the lesson.

The next section discusses how the observation of presented lesson plan 1 was used to generate the data.

3.5.3 Observation of lesson presentation 1

The Grade 10 lesson topic: Coordination in Plants was presented by TP2 and was observed by the other four PLG members on 25 October 2021. During the Grade 10 lesson observation, the four other PLG members sat in the classroom among the learners and observed the lesson. The main focus during the lesson observation was to see how the lesson was presented. While observing, we kept observational notes in our reflective diaries and used the ALEI-PDSI lesson observation checklist to tick the appropriate box that helped us evaluate the ALEI aspects of the lesson through the PDSI. To collect rich evidence, I also audio-recorded the lesson presentation with my cell phone. Observations

in the classrooms during lesson presentations helped triangulate data (Merriam, 2009:119) and answer all the research questions.

In the next section, I discuss the reflection discussions on lesson presentation one.

3.5.4 Reflective discussion on lesson presentation and observation 1

The reflection discussion took place on 25 October 2021 in the school library soon after the lesson observation. During the discussion, the PLG sat together to reflect on the lesson. We used our reflective diaries to share the verbatim transcripts of what went well and what could be improved from the lesson observation. The lesson presenter, TP2, self-reflected on the lesson and those of us who had observed shared our observations.

The ticked ALEI-PDSI lesson observations were also discussed and deliberated on during this reflective discussion. In this research study, the reflective discussion on lesson observation 1 was used to share the PLG's opinions when answering the research questions.

Soon after the lesson observation, the PLG listened to the recorded audio, discussed, analysed and tried to make sense of it. This is in line with Creswell (2014:235) and Leavy (2017:134), who argue that observation allows a researcher to see and record the information as it occurs in a natural setting. It was during the discussion meeting that we agreed to re-plan the lesson which incorporated the areas that needed improvement.

The next section discusses collaborative lesson plan two.

3.5.5 Collaborative lesson plan 2

In this meeting on 25 October 2021, the PLG members sat at their usual place in the school library to plan for lesson 2. We used the collaborated lesson plan 1 to make adjustments because the lesson did not change much. After planning, we discussed the adjusted lesson plan to verify if there were omissions in the plan that needed to be rectified. After that, we then agreed for TP2 to teach the lesson in Grade 10B, and the rest of the members – TP1, TP3, TP4 and me – would observe the lesson. We noted down in our reflective diaries the emerging points as we collaboratively adjusted the lesson.

The next section discusses the observation of lesson presentation two.

3.5.6 Observation of lesson presentation 2

The reviewed lesson plan 2 was then presented on 26 October 2021 to the Grade 10B class by the same teacher (TP2) and the rest of the PLG members observed. Once again, the observers used the ALEI-PDSI lesson observation checklist to evaluate the lesson and the reflective diaries to note the points for discussion. The same practices were followed as in the observation of lesson presentation 1.

I discuss the reflective discussions of lesson presentation two in the next section.

3.5.7 Reflective discussion on lesson presentation and observation 2

After the lesson observation on 26 October 2021, the PLG again sat in the school library and had a reflection discussion. As before, the presenter TP2 started by reflecting on her presentation and the observers shared their observations. The Grade 10 cycle ended with this discussion as it had been decided by us that there was no need to plan for another Grade 10 lesson because all the areas that needed improvement were well catered for in the reviewed lesson plan 2. Our reflections led to adjusted action and therefore for the two class groups to have the same content, and not to disadvantage the Grade 10A learners, we agreed for TP2 to reteach the revised lesson with the incorporated comments to the Grade 10A during study time, but no observation was done by the rest of the PLG members. We agreed to have a lesson planning meeting for the Grade 11 lessons in 2022.

The next section discusses collaborative lesson plan three.

3.5.8 Collaborative lesson plan 3

Lesson plan 3 was planned for 22 February 2022 when school started. The PLG met to plan the lesson for the Grade 11 classes under the topic ‘Cell structure, organisation & levels of organisms’. All members agreed for the lesson to be presented by TP4. This time we used the Grade 11 Biology syllabus and textbooks to choose a topic and used the LSA lesson plan template to collaboratively plan a lesson on the challenging topic which was agreed upon. After planning, we discussed the planned lesson and ironed out all the misunderstandings. During the lesson planning meeting, we used our reflective diaries to write up our reflection notes.

The next section is the discussion of the observation of lesson presentation three.

3.5.9 Observation of lesson presentation 3

The lesson was initially planned to be presented on 23 February 2022 in Grade 11A. Due to other equally important commitments of some of the PLG members, it was postponed to 7 March 2022. This time the Grade 11 lesson was presented by TP4 and observed by the three other PLG members – TP1, TP3 and me. TP2 could not join the observations due to other equally important activities. We followed all the procedures used when observing the Grade 10 lessons (*cf.* 3.6.3) and as observers, we used the ALEI-PDSI lesson observation checklist to tick and evaluate the lesson. We also used our reflective diaries to note all the focal points that emerged from the presentation. The evaluation was focused on the aspects of the lesson of ALEI through PDSI.

The next section discusses the reflection discussions on lesson presentation three.

3.5.10 Reflective discussion on lesson presentation and observation 3

This discussion meeting was held on 7 March 2022 soon after the lesson observation. The PLG sat together in the school library after the lesson observation to reflect on the lesson. In our discussion, we deliberated on the ticked ALEI-PDSI lesson observation checklists and the reflective diaries.

During the reflection discussion, we used our reflective diaries which reminded us of our verbatim transcription of the discussion and aided in identifying important aspects that were experienced during the lesson planning and observation. The lesson presenter, TP4 started with the self-reflection on the lesson and each observer shared their observations. Due to the detection of the areas that needed improvement during the reflection discussions, it was necessary to re-plan the lesson which incorporated those areas to improve on the lesson, to which we agreed. The reflective discussions in the presented lesson helped with the data gathering in this research study.

The next section discusses collaborative lesson plan four.

3.5.11 Collaborative lesson plan 4

On that same date, 7 March 2022, the PLG used lesson plan 3 and refined it. There was not much adjustment in lesson 4, therefore, this exercise did not take long. We agreed that TP4 would still teach the adjusted lesson in Grade 11B, and the rest of the members – TP1, TP3, and me – would observe the lesson. The adjusted lesson plan was discussed, and all inaccuracies were clarified. We again noted in our reflective diaries the emerging points as we collaboratively adjusted the lesson.

In the next section, I discuss the observation of lesson presentation four.

3.5.12 Observation of lesson presentation 4

The lesson was initially planned to be presented on 24 February 2022 in Grade 11B. Due to other equally important commitments of some PLG members, it was deferred to 8 March 2022. TP4 presented the lesson, and the observers were TP1, TP3 and me. TP2 had a very important managerial activity and therefore could not join the observations. As observers, we again used the clean ALEI-PDSI lesson observation checklist to tick and evaluate the lesson focusing on the aspects of ALEI through PDSI. Their reflective diaries were used to note all the focal points for discussion.

The next section discusses the reflective discussion on lesson presentation four.

3.5.13 Reflective discussion on lesson presentation and observation 4

This discussion meeting was held on 8 March 2022 soon after the lesson observation. The PLG sat in the school library to share their reflections on the lesson presentations. The presenter, TP4, started with self-reflection about the lesson, and then the rest of us shared our observations. The ticked ALEI-PDSI lesson observation checklists were deliberated on and the content of the reflective diaries was shared among us in the form of a discussion.

During the reflection discussion, the reflections in the diaries reminded us of our verbatim transcription of the discussion. The reflective diaries also helped us to identify the important aspects of the lesson that were experienced during the lesson observation. The cycle ended when we found out that all the areas that needed improvement that emerged from lesson presentation 3 had been incorporated into lesson presentation 4.

Having discussed the data-gathering methods and tools used, along with the reasons for using them, I now move on to discuss how we analysed and interpreted the data.

3.6 DATA ANALYSIS

In a study, the data analysis process helps to answer the research questions (Leavy, 2017:150). Furthermore, analysis is defined as summarising and organising data, while interpretation is making sense of something (Leavy, 2017:150). According to Bertram and Christiansen (2016:115), to analyse means to do a “close systematic study or the separation of a whole into parts, for the purpose of study”.

Qualitative research data from the lesson plans (personal and collaborative lesson plans), lesson observations, the ALEI-PDSI observation checklist and the notes from the reflective diaries were thematically analysed using the research questions as a directive (Kearney *et al.*, 2013:118, Schiller *et al.*, 2018:7). Braun and Clarke (2006:6) describe thematic analysis a “method for identifying, analysing and reporting patterns or themes within data”. When analysing the data from the above data generation instruments, the PLG were guided by Braun and Clarke’s (2006:35) phases of thematic data analysis (see Table 3.3 below), combined with the steps by Tesch (Creswell, 2014:248) for coding, which we adapted to fit with our data analysis procedures.

The analysis process was conducted collaboratively on a practical level which allowed for all the PLG members to collectively identify patterns, themes and relationships between and among the data sets through coding (Rule & John, 2011:77). All the PLG members were involved in the primary data analysis, and I also contributed to secondary data analysis where the data were linked to theory to ensure a theoretical lens was provided to view the data (Wood, 2019:114).

Table 3.3: Phases of Thematic Analysis

Phases of data analysis	Description of the process
<p>1. Familiarising yourself with your data:</p>	<p>Transcribing data, reading and re-reading the data, noting down initial ideas.</p> <p>First and foremost, I transcribed the recorded discussions. The PLG used the two lesson plans (Personal and collaborative) to compare the lesson planning before the introduction of the LSA and the lesson planning after the introduction of the LSA. The responses of the questions in the diaries that responded to all the research questions were analysed together with the two lesson plans.</p> <p>The PLG used the ALEI-PDSI observation checklist of all the PLG's personal lesson plans to compare with the observation checklist of the four collaborative lessons plans which were observed. The PLG used the 0-4 scale to see how they evaluated each other in the personal lesson plans and as well as how they evaluated the LSA in the four lessons for both Grade 10 and 11 respectively.</p>
<p>2. Generating initial codes:</p>	<p>Coding of the data in a systematic fashion across the entire data set, collating data relevant to each code.</p> <p>With the help of the research questions, the PLG sorted and organised the data to look for codes (Bertram & Christiansen, 2016:119). Colour coding was used to highlight what emerged from the preliminary data i.e. from the verbatim transcribed discussions, lesson observation, and from the reflective diaries.</p>
<p>3. Searching for categories</p>	<p>Collating codes into potential categories, gathering all data relevant to each potential category.</p> <p>The coded data were summarised by looking for relationship and patterns and then put them in categories according to the research questions (Esterhuyse, 2015:57).</p>
<p>4. Searching for themes</p>	<p>Collating categories into potential themes, gathering all data relevant to each potential theme.</p> <p>After allocating the categories, data were grouped into themes (Nieuwenhuis, 2010:78).</p>
<p>5. Reviewing, defining, and naming the themes:</p>	<p>Checking if the themes work in relation to the codes and the entire data set to generate clear definitions and names for each theme.</p> <p>The PLG used the research questions and separately analysed the content of the discussions of the lesson plans, lesson observations, and reflective diaries, then interpreted the data in terms of common themes</p>

	relevant to the characteristics of the data generation methods (Leavy, 2017:151; Leedy & Ormrod, 2005:32; Merriam, 2009:205).
6. Producing the report:	<p>The final opportunity for analysis. Final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a report of the analysis.</p> <p>The PLG finally produced a summary of the analysis which includes the lessons learnt when conducting the research.</p>

Source: Adapted from Braun and Clarke (2006:35)

In this qualitative action research study, the PLG used deductive reasoning to analyse the data. Analysing data deductively, according to Bertram and Christiansen (2016:117) and Bogdan and Biklen (1997:6) works from the more general to the more specific, thus words and short phrases are used during coding. The next section discusses how the data of the lesson plans were analysed in an integrated method.

3.6.1 Data analysis of the lesson planning

The personal lesson plans, collaborative lesson plans and the ALEI-PDSI lesson observation checklist were the documents used to gather data during the planning of a lesson in this research study. Data analysis of the mentioned documents was done to help me answer the following research questions: *How do Grade 10–11 Biology teachers integrate the LSA in their teaching praxis? What factors hinder or facilitate the teaching praxis of Grade 10 – 11 Biology teachers who make use of the LSA? What should a Namibian LSA framework look like for the Grade 10- 11 Biology teachers to enhance their teaching praxis and to educate for sustainable development?*

The ALEI-PDSI lesson observation checklist tool has a dual function. It was used in this research study to guide the discussions as the content of the discussions is what is important and that is what I wanted to analyse in this research study. The PLG also used the ticked ALEI-PDSI lesson observation checklist to see if there was a gap between the personal lesson plans and the collaborative lesson plans. We focused on the aspects of the lesson planning checklist under the plan, do, see and improve stages of the LSA. The ALEI-PDSI lesson observation checklists were analysed together with our verbatim transcription discussions and the critical reflection notes from the reflective diaries to search for categories and later combined them for

themes. The data from the above-mentioned data generation tools helped with the triangulation of the findings from other data generation methods (Rule & John, 2011:109).

The next section discusses how and why the data of the lesson observations were analysed.

3.6.2 Data analysis of the lesson presentation and observation

The data analysis of the lesson observations was done to answer the research questions: *How do Grade 10–11 Biology teachers integrate the LSA in their teaching praxis? What factors hinder or facilitate the teaching praxis of Grade 10 – 11 Biology teachers who make use of the LSA? What should a Namibian LSA framework look like for the Grade 10- 11 Biology teachers to enhance their teaching praxis and to educate for sustainable development?*

As the PLG, we used the content of the ALEI-PDSI checklist together with the audio recordings of the lesson presentations and the observation notes from the reflective diaries to analyse the extent that the PLG teachers integrated the LSA in their teaching. By using the above-mentioned data-gathering tools, we would see if there were challenges the PLG teachers had to face when applying the LSA in their teaching. The categories that emerged from this data analysis method were grouped into themes (Schiller *et al.*, 2018:7). We then compared the themes with that of the lesson plans for the purpose of triangulation and summarised them as one theme. The next section discusses how and why the data from the discussions were analysed.

3.6.3 Data analysis of the discussions

The data analysis of the discussions was done to answer the research question: *How do Grade 10-11 Biology teachers integrate the LSA in their teaching praxis?* Since the data from the discussion was gathered from multiple sources such as lesson plans, lesson observations and reflective diaries, each set of data were examined separately and then collectively (Morrell & Carroll, 2010:124). At this stage, together with the reflective diaries, as the PLG, we used the data from the personal lesson plans, collaborative lesson plans and the ticked ALEI-PDSI lesson observation checklists. The data that emerged from the discussions were analysed against the stages of the LSA, to see how much the PLG teachers understood about the concept of the LSA. Using the ALEI-PDSI lesson observation checklists, the analysis was done to find if the planning of the lesson was in line with the LSA stages of plan, do, see and improve.

During the discussion, the PLG sat down in a quiet room and each member had a chance to share their overall impression of the LSA. This was a good time for us to use coding to jot down the major ideas that emerged during the discussion. For the sake of triangulation, we also reviewed the reflective notes from the diaries and after gathering all the data, we listened to the audio recordings during discussions. We used the verbatim transcripts of the discussions and sorted and organised the codes to look for categories by pulling out important notes and quotes. When all the data from the discussions were categorised, we were then ready for analysis. It was during the discussions that we explored the challenges and positive things the PLG teachers experienced when implementing the LSA, thus answering research question 2: *What factors hinder or facilitate the teaching praxis of the Grade 10–11 Biology teachers who made use of the LSA?* The next section discusses how and why the data of the reflective diaries were analysed.

3.6.4 Data analysis of the reflective diaries

The PLG's recursive reflection in the diaries helped us to achieve the maximum benefit for professional learning and critical thinking (Zuber-Skerrit, 2015:18). When analysing the content of the reflective diaries, we shared the content during the discussions and soon after each lesson observation. At that time, we put down the important things that emerged from our reflections. The content of the reflective diaries was very important to share how the PLG teachers implemented the LSA, what challenged the implementation of the LSA for the PLG teachers, what experience the PLG teachers received from the implementation of the LSA, and last but not least, how we wanted the Namibian LSA framework for Biology teachers to be. After the data-gathering process, we analysed the content of the reflective diaries together with the content of the lesson plans, lesson observations and the discussions to put together all the themes that emerged. With the PLG teachers' consent, they physically handed their reflective diaries to me for verification, justification of facts and safekeeping.

The content of the reflective diaries was used to answer all the research questions as mentioned above. The next section discusses my role in this research study.

3.7 THE ROLE OF THE RESEARCHER IN THE STUDY

I entered into a partnership with the PLG teachers to gather and analyse quality data (Maree, 2013:41). In this research study, my role as a researcher was to develop a good relationship with the PLG teachers (Leavy, 2017:157) during the data gathering and data analysis process.

According to Mercer (2007:3), outsider researchers are non-members of specified groups. Although I was not a staff member of the school where the research study took place, prior to my research, I visited the school doing classroom observation as an Education Officer. I was, therefore, quite familiar with some of the PLG teachers, especially the school principal. I thus considered myself a co-researcher with the PLG teachers at the school (Bertram & Christiansen, 2016:47).

I also foresaw that my status as an Education Officer and my presence during observations and discussions in which I recorded the members' activities, may have influenced the PLG teachers. In order to overcome coercion among the PLG teachers and before the data-gathering stage of this research, I asked an independent person to talk to the school principal and explain how the research would be conducted with the PLG teachers in the Biology department. Upon agreement with the principal, they identified the PLG teachers. The independent person then met with the PLG teachers at a suitable time to inform them about the purpose of the research and how it would be conducted. After the PLG teachers gave their consent to the independent person, they established a day for me to meet them. During our first meeting with all the PLG teachers, I began to build a relationship and ensure smooth social interactions with them. I positioned myself as their peer in the research and a co-structor in teaching and learning Biology. I explained my purpose for being there, confirming the information provided by the independent person. I encouraged the PLG teachers to be open and comfortable in our conversations, and never to feel intimidated during the research study process. I also indicated to them that their participation in this research study was voluntary and that they had the right to withdraw from the research at any time. They were informed to contact the independent person if they wanted to withdraw and could do so, with or without providing any reasons, with no harm to them.

During lesson planning, presentations and observations, my role was to observe how the PLG teachers shared ideas and see how the lessons were presented (Leavy, 2017:157). As a researcher, during lesson observations, I kept in mind not to disturb the teacher, learners and other co-researchers (PLG teachers). Being an Education Officer, I was mindful of the observer effect, where my presence as a researcher in the room might affect what I observed and heard (Morrell & Carroll, 2010:79). The learners were informed that my presence in their lesson presentation would not disrupt their lesson and that I was just there for the lesson observation. I sat quietly at the back of the classroom, and sometimes with the learners, making notes of my

observations of the lesson in my reflective diary. While observing, together with the lesson plan which we prepared together with the PLG teachers, I cross-checked it with the ALEI-PDSI lesson observation checklist to evaluate and confirm the inclusions of all the important aspects of the lesson plan. I made sure that the LSA lesson plan, the ALEI-PDSI lesson observation checklist, the Grade 10–11 syllabus and the National EE/ESD Policy for Namibia were available to all the PLG teachers to aid with planning and observing the lessons.

It was my role as a researcher in this study to prepare and facilitate the discussions and capture the data. According to Stake (2000:372), the researcher needed constant participation from the PLG teachers to avoid ethical issues from arising. As a co-researcher, I transcribed the discussions of both lesson planning and lesson observations. Together with the PLG teachers, we analysed the data after it was gathered. As the researcher, I organised meetings and booked venues for meetings. COVID-19 protocols were adhered to during the research process.

The quality criteria that were ensured when carrying out this research study are addressed in the next section.

3.8 QUALITY CRITERIA

Table 3.4: Approach of linking action research goals with validity criteria

Quality/ Validity Criteria	Goals of Action Research
Dialogic validity	The generation of new knowledge
Outcome validity	The achievement of action-oriented goals
Catalytic validity	The education of both me, the researcher, and the PLG
Democratic validity	Results that are relevant to the local setting
Process validity	A sound and appropriate research methodology

Source: Adapted from Herr and Anderson (2015:68)

Lincoln and Guba (1985:991) considered qualitative research findings as valid if they are believable, consistent, applicable, convincing and credible. In contrast, in this PALAR approach, authenticity and the ability to bring about benefits for all PLG members became an important requirement (Wood, 2019:122). Wood (2019) further indicated that authenticity in PALAR is evident if the results are recognisable and confirmed by the PLG in terms of a shared benefit. What has been learnt through the study and the ability to encourage collaborative participation and democratic decision-making is vital to the validity of this PALAR approach (Wood, 2019:123). In this research study, a detailed explanation of how the study unfolded was very important to increase the validity of the findings as indicated in Table 3.4.

3.8.1 Dialogic validity

Dialogic validity refers to when space is created within the research process to enable every PLG member to engage and contribute to the research to enable mutual learning and understanding for the improvement of knowledge (Wood, 2019:127). When analysing the lessons and discussing the observations, every member of the PLG was allowed to discuss the findings. The discussions started with the critical reflections of the one who presented the lesson, who shared their reflections on how the lesson went and then later, the observers were given the chance to also reflect on what they observed. This was made possible to avoid domination by some members of the PLG. This type of validity is enhanced through the ability of the PLG to work in collaboration towards a common goal (Wood, 2019:133). The responses of individual members of the PLG were indicated in the analysis, and thus showed the contribution of all PLG members through ideas and actions.

3.8.2 Outcome validity

Outcome validity is concerned with the success of the research in reaching the goals of the research study (Wood, 2019:129). Due to the evolving nature of the PAR process, not every research produces a positive outcome; therefore, the possibility of unexpected outcomes might have occurred in this PALAR approach. The critical reflection notes from the reflective diaries helped to achieve the outcome of the research. Therefore, the emancipatory outcome (change in attitudes, beliefs and behaviour); practical outcome (improvement in the PLG's skills and ability to improve the situation at hand) and epistemological outcome (existing knowledge used to help others improve their lives) from this research study was provided in the analysis as they emerged (Wood, 2019:134).

3.8.3 Democratic validity

This type of validity refers to the extent to which the research was done in collaboration with everyone who had a stake in the problem under investigation (Wood, 2019:131). In this research study, the lesson plans were prepared by the PLG and observed in a unique setting, thus allowing the members to reach democratic validity (Wood, 2019:134). As a democratic validity research, member checking (Bertram & Christiansen, 2016:190; Nieuwenhuis, 2013:114) involved the generation and analyses of the raw data by the PLG teachers and me, as the researcher. After the data gathering, the transcripts of the lesson observations and discussions were submitted and discussed by the PLG teachers for verification and justification of facts (Nieuwenhuis, 2013:113). In this manner, the PLG teachers had the opportunity to confirm or insert omitted information. This was done to perform the democratic validity of the research (Herr & Anderson, 2015:68).

3.8.4 Process validity

It refers to the quality of the research process and includes the relationship between the PLG members (Herr & Anderson, 2015:68). In the research study, the PLG followed the LSA and PALAR approaches which are both cyclical. The PLG adhered to the PALAR principles and values of 7Cs and 3Rs (Wood, 2019:122, 126) throughout the process. The analysis of the research gave a clear and detailed explanation of how each cycle connected with the research questions. Process validity was enhanced through collaborative planning and critical self and collective reflection by the PLG (Wood, 2019:133).

3.8.5 Catalytic validity

Herr and Anderson (2015:68) indicate that catalytic validity refers to the reflection of the PLG's reality in the data. In this research study, the catalytic validity of the research findings was enhanced by allowing the PLG teachers to comment on the research findings and interpret and reach conclusions throughout the research (Herr & Anderson, 2015:68; Nieuwenhuis, 2013:114). The research was carried out in a unique context and the PLG teachers were allowed to infuse their viewpoints in the answering of questions. As the research process flowed, the PLG reflections allowed for the inclusion of new views. This increased the motivation during the research and refocused action to transform participant reality to aid with catalytic validity (Wood, 2019:131).

3.8.6 Triangulation of data

Maxwell (1996:75) refers to triangulation as a process whereby a researcher gathers data from a diverse range of individuals and settings, using a variety of methods. Triangulation involves using multiple data sources and methods to help ensure that the data gathered is accurate and a true representation of what is being studied (Rule & John, 2011:109). Triangulation was used in this research study not only to help clarify meaning, verify the findings from different data-gathering methods and help identify different realities but also to help confirm the trustworthiness of the research process (Stake, 2000:454). Triangulation of the findings was ensured by establishing and analysing the multiple sources of data, namely discussions of lesson plans, observations and reflective diaries, thus triangulation supported the aim of this research study as follows:

- The lesson planning and observations were used to establish how the PLG implemented the LSA.
- Group discussions were had to establish the views and perceptions of the PLG on the implementation of the LSA.
- The PLG reflected on the entire research study process by using the reflective diaries.

The next section discusses the ethical aspects of this research study.

3.9 ETHICAL CONSIDERATIONS OF THE RESEARCH

Ethics can be defined as a matter of principled sensitivity to the rights and human dignity of others (Cohen *et al.*, 2008:58). The principal goal of research ethics was to minimise the risk to the PLG; therefore, it was always my responsibility as the researcher to ensure that the research was ethically conducted (Bless *et al.*, 2013:28–29; Maree, 2013:306). In this research study, ethics clearance was sought after the approval of the research proposal by the COMBER Scientific Committee. I then applied for ethical clearance to conduct this research from the NWU-EduREC of the North-West University (Maree, 2013:306). The ethics reference number for this research study is **NWU-01113-20-A2** (see Appendix K). Approval to conduct the research was sought from the Oshikoto Regional Education Director, Namibia (see Appendix D & E). Permission was granted by the principal and the School Board Chairperson of the GwaaNampando Gweegonga Secondary School (see Appendix F & G) in a meeting where a colleague of mine, an independent person, explained the intent of the research.

The school principal was briefed about the research, focusing on the teaching praxis of Grade 10 and 11 Biology teachers through the LSA to foster ESD. The independent person indicated how the research would be conducted. The independent person also met with the identified PLG and they were requested to read and sign the consent form (see Appendix H). I waited for the confirmation date from the school principal, the gatekeeper, for the research to begin. Following ethical procedures, the data gathering began after the signing of consent by the parents and assent by the learners who took part in the study (see Appendix I & J).

The ethical principles of autonomy, non-maleficence and confidentiality were ensured in this research study for the PLG teachers, as indicated in the following sections.

3.9.1 Informed consent

The autonomy of all the PLG teachers was respected (Bertram & Christiansen, 2016:66). The PLG teachers were formally informed that they would be taking part in the research study and thereafter gave their consent. This denotes that in this research study, upon request, I obtained verbal consent and signed consent letters from every PLG teacher who participated in the study. The independent person handed a consent letter to every PLG teacher explaining the aim and objectives of the research. The PLG teachers were informed about what was required from them during their participation, whether and how their identities would be protected and how the results would be used (Louw, 2014:264). They were informed about the right to participate and that they could withdraw from the study without any harm by informing the independent person. All the procedures and the duration of the study were made known to the PLG teachers and a chance was given for them to respond, after which they agreed to sign the forms that are being kept by my supervisor. In the case of the learners whose classes were observed, those who were 18 years and above signed the consent letter, whereas the minor learners signed assent letters and the parents signed consent letters (see Appendix I & J).

3.9.2 Protection from harm

Before the commencement of the research, I ensured freedom from harm by not exposing the PLG teachers to undue physical or psychological risks (Gay *et al.*, 2009:21; Maree, 2013:306). I was, therefore, mindful of the fact that a school is a complex organisation. I respected the culture of the school and that of the PLG teachers, as well as their religious and gender preferences. This was to ensure that no one was emotionally or psychologically harmed. I treated the research site with respect, adhered to its cultural rules and guarded against disrupting

the process of teaching and learning. Furthermore, I tried not to hide the nature of my study from the PLG teachers and made sure the independent person informed them about the intent of the research. Therefore, the PLG teachers were made aware that the study would not cause them any harm but that rather they would benefit (Bertram & Christiansen, 2016:66–67).

3.9.3 Right to privacy and confidentiality

Both the PLG teachers and I had a clear understanding of the right to our privacy and confidentiality of the information. In order to protect the identity of all the PLG teachers, they were informed that the information from the study would be treated with a high degree of confidentiality. I ensured anonymity by not referencing names in recordings or writings (pseudonyms were used) (Bertram & Christiansen, 2016:66; Maree, 2013:42). I did not disclose the information to anyone apart from my supervisors. All the transcripts of the lesson observations and group interviews were put on a USB stick and locked in a cupboard in my office. When I met my supervisor, I handed the USB stick to her for safekeeping in her office for five years. The voice recordings were deleted once I completed the verbatim transcribing of them. Both the PLG teachers and I signed the confidentiality agreement before commencing with the research.

The conclusion of Chapter Three is discussed in the next section.

3.10 CONCLUSION

This chapter provided a discussion of the research approach and indicated the steps and procedures that were followed in the PALAR approach. The research design that was used in this research study was discussed as well as the data-gathering methods and tools, namely LSA lesson plans that included personal and collaborative lesson plans; lesson observations where the ALEI-PDSI observation checklist was used as a tool to gather the data; discussions and the reflective diaries. The methods of how the data were analysed were also discussed in this chapter. The validity criteria of the PALAR approach such as process validity, dialogic validity, outcome validity, democratic validity and catalytic validity of the research were discussed and the chapter concluded with ethical issues and limitations of the study. Next, Chapter Four will provide the presentation of the analysed data, its interpretation and then a discussion of the interpretation.

CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION

4.1 INTRODUCTION

This study aimed to establish how the LSA was integrated by the Grade 10–11 Biology teachers to enhance their teaching praxis in ESD. The purpose of this chapter is to present, discuss and interpret the analysed data gathered in this research study, and address the research questions posed in Chapter One, namely:

- How do Grade 10–11 Biology teachers integrate the LSA in their teaching praxis?
- What factors hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA?
- What should a Namibian LSA framework look like for the Grade 10–11 Biology teachers who want to enhance their teaching praxis to educate for sustainable development?

The qualitative data presented in this chapter was gathered from the PLG at Gwaanampando Gweegonga SS (pseudonym) in the Onathing circuit, Oshikoto Region. The PLG used their views and responses from the following data-gathering methods: lesson planning discussions, reflective discussions and narratives on the observation of the presented lessons (that used the ALEI-PDSI checklist to guide the discussion) and the discussions of the PLG's reflective diaries and my analysis of the reflective diaries. The discussion in this chapter also includes the analysed data of the personal lesson plan discussions that used the ALEI-PDSI checklist to guide the discussions. The transcribed verbatim audio recordings from all the discussions of the lessons planned and observed, the response notes from the reflective diaries and my own analysis of the reflective diaries are also included in the discussion of this chapter.

To protect the participants' identities, I gave them individual codes and we used colour coding for the data. The four PLG teachers were coded as follows: participant 1 (TP1), participant 2 (TP2), participant 3 (TP3), and participant 4 (TP4). I used these codes throughout this chapter when referring to a specific person. After gathering the data from all the data-gathering methods, all PLG members analysed the data together, sorted and organised the data to look for codes, categories and themes. The themes are discussed in relation to the literature.

In the next section, I present the analysed data that transpired from the research study to answer the research questions.

4.2 PERSONAL LESSON PLANNING OF PLG TEACHERS

Before I explained the detailed LSA to the ²PLG teachers, I requested them to each submit one of their personal lesson plans. The aim of the personal lesson plans was to see how the PLG teachers planned their lessons and if there were some elements of the LSA in their individually planned lessons. I also wanted to compare the PLG teachers' personal lesson plans before their involvement in this research study with the collaborative lesson plans after the implementation of the LSA. After swapping the personal lesson plans among the PLG teachers, I distributed and explained the ALEI-PDSI lesson observation checklist which the PLG teachers would use to evaluate their personal lesson plans. As indicated in Chapter Three, the ALEI-PDSI lesson observation checklist is a tool used to evaluate the LSA lessons (*cf.* 3.6.3; 3.6.6; 3.6.9; 3.6.12). This ALEI-PDSI lesson observation checklist forms part of the training of the LSA that was shared with me in Kenya in 2010. I decided to use this tool in my research study because it was used in my training on the LSA. The PLG teachers then used the ALEI-PDSI lesson observation checklist to evaluate their personal lesson plans against the stages of the LSA, namely plan, do, see and improve. The ALEI-PDSI lesson observation checklist has various indicators with numerical scales ranging from 0–4 for each component. The numerical scale is interpreted as follows: 0 = not at all, 1 = a little, 2 = fairly adequately, 3 = adequately and 4 = a great deal.

Even though, as the PLG, we did not observe the personal lesson of each PLG teacher, the evaluation focused on what each PLG teacher considered essential elements in their personal lesson planning. The PLG teachers used the scale to tick the corresponding lesson aspect, which they indicated as a bit challenging when using the ALEI-PDSI lesson observation checklist due to having not observed the lesson. After the PLG teachers were done assessing the personal lesson plans using the ALEI-PDSI lesson observation checklists, they gave back the personal lesson plans and the checklist to the owners. Together, we discussed and shared what emerged from the personal lesson plans.

² PLG teachers refers to the teachers who were part of the PLG and any actions they undertook. The PLG/ PLG members refers to all members, including me, as the researcher, and any actions we undertook.

During the discussion of the personal lesson plans, it was established that TP1, TP3 and TP4 used the same lesson planning template, while TP2 used a different lesson planning template from the rest. When I asked if the PLG teacher had implemented the LSA stages, namely plan, do, see and improve as agreed during the circuit-based training, they indicated that no one had because of time constraints. This supports the findings from Alamri (2020:4) who indicated that non-participation in the activities was due to participants not having enough time.

Using different lesson plan templates was not a problem to me, because, during the circuit-based training I conducted, I told them to use their own lesson planning format when planning the lessons as there was no uniform lesson plan template provided to the schools from the region. The PLG teachers were supposed to follow the LSA stages as mentioned earlier in this section. My concern was the fact that they did not follow the LSA stages as agreed upon when returning to school after the circuit-based training.

Despite the PLG teachers teaching the same subject at the same school but using two different lesson plan templates, we discovered in our discussions that all the templates had some common components; namely lesson objectives, teaching and learning resources, lesson presentation, lesson evaluation and monitoring of the lesson. During the discussions, I shared my request that to **improve good working relationships** among all the PLG members, I suggested that, as the PLG teachers were teaching the same subject at the same schools, we should use the same lesson plan – an LSA lesson plan template. During the LSA training I attended in Kenya, we used the LSA lesson plan template to collaboratively plan a lesson. I then shared with the PLG teachers the LSA lesson plan template which I knew fitted well with the standard tool that is used to assess the LSA lesson – an ALEI-PDSI lesson observation checklist. As the PLG, we then compared the personal lesson planning and the collaborative lesson planning templates contents. They found that there were some good components in the LSA lesson plan template which were lacking in the personal lesson plan templates, namely rationale, pre-requisite knowledge and learning points. We then agreed to use the LSA lesson plan template to plan lessons together in this research study because it would ensure comprehensive lesson planning.

The following are the findings from the personal lesson planning discussions:

- It was not easy for the PLG teachers to evaluate the personal lesson plans using the ALEI-PDSI observation checklist, because they were not trained on how to use it, and again, no lesson observation took place.
- The LSA stages were not followed when planning the initial lesson.

An interesting finding for me was that the PLG teachers did not follow a training request during the circuit-based training to use the LSA stages in their lesson planning. They had agreed to do so in their training at the circuit meeting.

It made me rethink training and that I should not assume that teachers would implement all that is requested of them. I should revisit teachers, not only to monitor them but also to inquire about their progress and implementation of what was agreed upon during training. As the PLG, we agreed to use the LSA lesson plan template, due to its comprehensive nature and for the purpose of this research study, after which we decided to collaboratively plan lessons and follow the LSA as per the stages of Copriady (2013:179).

The findings in this section help answer research question 1: *How do the Grade 10–11 Biology teachers integrate the Lesson Study Approach in their teaching praxis?*

In the next section, the findings from the group discussions on collaborative lesson planning are discussed.

4.3 GROUP DISCUSSIONS ON COLLABORATIVE LESSON PLANNING

The PLG planned four lessons in total (two Grade 10 and two Grade 11) in this research study. In this section, I present the findings of the group discussions held during and after each of the four lessons that were planned collaboratively and presented according to the LSA. As the PLG, we planned the Grade 10 lessons and then the Grade 11 lessons. The LSA lesson plan template and the Grade 10–11 syllabus and textbooks were used to **collaboratively plan** the topics to be presented (*cf.* 3.6.2; 3.6.5; 3.6.8; 3.6.11). As supported by Bocala (2015:351) the selection of the topic from the syllabus and looking for resources was done to help learners learn a particular concept or skill. The lesson plan for Grade 10, lesson 1 was collaboratively planned by TP1, TP3, TP4 and me (Bocala, 2015:351) when we discussed the teaching approach we could use to present the lesson. TP2 could not join the planning exercise because she had to attend to other managerial activities. She was later provided with feedback because she was the one who presented the lesson. In the beginning, TP1 and TP3 were concerned about

the lesson components of the LSA that they were not used to it in their personal lesson plans template (see Appendix A & B). These two PLG teachers felt that there were “*too many lesson components*” in the LSA lesson plan template which they thought took up **much of the time**. TP3 shared that: “*The lesson components are too many, unlike my personal lesson plan ... the rationale and the pre-requisite knowledge are new to me and they require a lot of thinking time*”. TP1 also lamented: “*Eish, then the learning points also... took much of the time. I don't see the need*”.

As indicated in the excerpts above, TP3 and TP1 were **challenged with the meaning** of some of the components of the LSA lesson plan, for example, the rationale, pre-requisite knowledge and the learning points. They also felt that the LSA lesson plan template had **too many components**. This was because they were not familiar with the aforementioned LSA lesson plan template components. Therefore, TP4 had to clearly elaborate that the rationale is “*what the topic, in general, is telling us*” and the pre-requisite knowledge refers to “*what do the learners know about the lesson topic*”; the learning points are “*what do the learners should learn*” about the topic. Our discussions and the elaboration of the lesson components were challenging, supporting the findings of Cajkler *et al.* (2015:197), who indicated that the “*planning meetings begin with the elaboration of the learning challenge to be addressed in the lesson*”. This helped us, as the PLG, to **better understand** the content of the LSA lesson plan template.

After elaborating on the challenges and agreeing on the generic part of the lesson (*cf.* 3.6.2), we then collaboratively planned the Grade 10, lesson plan 1. The lesson topic for Grade 10 was ‘*Coordination in plants*’. TP1, TP3, TP4 and I started with what to complete on the LSA lesson template. The discussion of the lesson planning included the following: the kind of teaching and learning materials used, time spent at each stage of the lesson, the teaching and learning activities, the types of questions asked and the expected answers for each question. The conclusion and evaluation of the lesson were discussed and agreed upon by all of us during the lesson planning discussion meeting. After we were done with the lesson planning, TP4 went to the principal’s office where she met with TP2, who was the presenter, and handed over the lesson to her. TP4 explained what was expected from her when presenting the lesson. Bocala (2015:351) indicated that “*in Lesson Study Approach, one of the team members present the lesson and the other team members observe*”, thus, in this research study, lesson plan 1 was presented by TP2 and observed by TP1, TP3, TP4 and me in Grade 10A (*cf.* 4.4).

In the lesson observation discussion meeting held after the presentation of lesson plan 1, we focused on the strengths and the areas that needed improvement in the lesson plan. TP1 discussed the observation of the introduction, the use of teaching and learning resources as well as the conclusions. She indicated that TP2 asked, “*questions that draw learners’ attention to the activity*”. TP1 explained that the fact the “*learners were taken outside to observe the trees encouraged them to relate their prior knowledge to the lesson topic*”. Observer TP3 indicated that the introduction was good but did not indicate why. She further explained that she was happy with the conclusion because “*all the lesson objectives were reached*”. The fact that TP2 took the learners outside the classroom to observe the trees was evidence that TP2 was teaching using a learner-centred approach. This supports the SMASE-WECISA (2010:8) that stated that the teaching and learning strategies used in the LSA assist the PLG to shift from teacher-centred to learner-centred strategies.

Opposing the view of TP1 and TP3, observer TP4 felt that the lesson introduction, the presentation and the conclusion needed some **improvement**. She indicated that “*the introduction was too long ... took too much of the time*”. In the presentation, it was observed that the presenter, TP2, **missed** explaining and emphasising the lesson content well on the function of auxins. Therefore, TP4 indicated that “*auxin can respond well in the presence of light*” and “*that was missed in the presentation*”. Both observers, TP3 and TP4, felt the need for a diagram on the chalkboard or on a flipchart to explain the content well for **better understanding** of learners. Due to mentioned reasons, TP2 did not join the planning discussion meeting and was only provided with a lesson plan template to use when presenting the lesson. Though it was indicated that TP4 explained the lesson plan content to her, it seems as if TP2 was not provided with all the information on the lesson topic as discussed in the planning meeting. The findings indicated that TP2 did not present the lesson exactly as planned. It could be because of the way she was given feedback, or she could have missed some of the information as TP4 explained (Kihwele & Guoyuan 2020:50), because she missed the planning meeting, which we believed led to there being areas that needed improvement. I felt there was a need for TP2 to take part in the planning meeting discussion to avoid and minimise the challenges experienced in her teaching as supported by Ilmu (2016:177), that collaborative planning offers guidance for quality teaching and learning processes.

During the collaboration discussions, lesson plan 1 for Grade 10 was reviewed, and after lesson observation 1 (*cf.* 4.4), the planning for lesson plan 2 for Grade 10 began. This time all of us, TP1, TP2, TP3, TP4 and I, modified the lesson on the components that needed improvement as agreed during the feedback discussions. The components were: the introduction – which the observers thought took “*too much time*” because it was too long and not focused; the content (auxin) which was not well emphasised in the presentation; and the use of a diagram to explain the content well. During the planning meeting of lesson plan 2 for Grade 10, we made changes to the aforementioned lesson components in lesson plan 1.

In the discussion, three themes emerged from the reflections on the collaborative planning of lesson 2 of the Grade 10 lesson. As the themes exist in coherence, they will be explained in such a way:

- *Theme 1: Collaborative LSA planning and discussions allow for **better lesson presentations***
- *Theme 2: LSA planning and discussions allow for **better learner engagement and understanding***
- *Theme 3: LSA planning and discussions bring changes by **improving time management***

As the PLG, we discussed and agreed on how to make an introduction short and appropriate without using too much time, and also agreed on the teaching approach to be used to explain the lesson content for learners’ better understanding. During the lesson 2 planning discussions, we felt a sense of enablement and TP2 shared her **excitement**: “*This is the best planning I have been involved in my teaching life. I like the way we plan and discuss the lesson together ... unlike planning alone*”. This showed a positive attitude towards lesson planning 2 using the LSA template when compared to the first collaborative planning when TP1 and TP3 commented on the time factor which was shared in the reflection discussion of lesson observation 1. As the cycle continued, we grew and saw the potential of collaborative planning. The changes in the lesson presentation were made possible **through collaboration** – Cajkler *et al.* (2015:194) indicate that collaboration in an LSA enables the PLG to share their knowledge and skills about the lesson topic. Lesson plan 2 was then prepared to be presented in Grade 10B by the same presenter, TP2 who presented for Grade 10A (*cf.* 4.4).

After the presentation and observation of lesson plan 2 in Grade 10B, the PLG members observed an improvement in their planning of lessons through the presentation. These discussions involved TP1, TP2, TP4 and me. TP3 could not join the discussions because she was conducting the end-of-year assessment practical activity for Grade 11 Agriculture. During the discussions, the lesson presenter, TP2 reflected on the lesson. She indicated that she **improved on time management** in the lesson by changing her teaching strategy in both the introduction and the presentation. She indicated: *“I was able to speed up the learner’s involvement by pointing any group to respond to the question rather than waiting for individual learners to raise their hands”*. On the issue of the chalkboard as advised by the observers, TP2 shared: *“I was able to use the chalkboard to draw the diagram that helped explaining the content clearly”*. The observers too shared how they saw the **improvement** in the lesson presentation. TP4 shared: *“This is huge improvement from yesterday to today ... time was well managed ... the use of chalkboard to elaborate even further ... and the conclusion part when learners do the comparison, they get a deeper understanding”*. In support, TP1 indicated that all of yesterday’s comments to better the lesson were included by the presenter. She said: *“You can tell that there is an improvement between the first lesson and this one”*. The introduction, TP1 indicated, made learners get involved and *“the chalkboard was well used”*. The discussion was rounded off by TP2 who indicated the importance of the LSA implementation in their teaching planning. She said that *“the activity [LSA] is worth it because planning together helped us to come up with good activities”*. The outcome of the discussion on collaborative planning of the Grade 10 lesson 1 and 2 indicated that there was a huge improvement from lesson planning 1 to lesson planning 2. The findings indicated that through the LSA process in which we, the PLG, were involved, we saw ourselves contributing to our own **professional development** (Stigler & Hiebert, 1999:xii) by gaining knowledge of our methods of planning.

In this discussion meeting we unanimously agreed that the presenter, TP2 had incorporated all the comments and suggestions of the observers. After lesson plan 2 of Grade 10, we were satisfied with all the changes and presentation and did not feel it was necessary to **rework** the lesson and present it.

As indicated in Chapter Three (*cf.* 3.6), we agreed to plan what became four lessons in total (two Grade 10 and two Grade 11). During this discussion meeting, we then agreed to plan a new lesson for a different grade, which for the sake of **empowering** us, would be taught by a different PLG member to different learners. This time, TP2 was again excused as she had

another meeting to attend. TP1, TP3, TP4 and me collaboratively planned lesson 3 which TP4 presented in Grade 11. This time, we did not take long to complete the lesson plan template for the Grade 11 lesson because we were **becoming familiar** with the content of the LSA lesson plan template which we used when planning lesson plan 1 and 2. The lesson topic for Grade 11 was ‘*Organisation and maintenance of the organisms*’: Sub-topic: ‘*Cell structure organisation and level of organisation*’ which we chose from the Grade 11 syllabus. When planning the new lesson topic for a different grade, we shared and discussed what to write in the rationale and the pre-requisite knowledge components of the lesson plan. After agreeing on what to write in each of the lesson components, we decided on the learners’ activities and how to conclude the lesson, we then completed the LSA lesson plan template before going to the observation (*cf. 4.4 and Table 3.2*). Lesson plan 3 was then ready to be presented by TP4 in Grade 11A. In the absence of TP2, the lesson was observed by TP3 and TP1 who joined in the middle of the presentation and me.

Collaboration of the group is indeed obligatory in all the LSA stages (Ilmu, 2016:173), and the planning stage is not exclusive, therefore, as the PLG, we felt a need to collaboratively review the lesson after the lesson observation. We sat and discussed what to change and/or add to the reviewed lesson. We analysed the **strengths** and the **areas that needed improvement** in the lesson and its plan. The strengths that were highlighted from lesson plan 3 were, among others, an introduction which the presenter, TP4 and I said was good because I observed that the presenter, TP4, asked about the “*pre-knowledge of the learners*” in the introduction. The lesson presentation was highlighted by TP3 as good because she said that “*learners were participating ... use their prior knowledge ... all were paying more attention ... and they were free to ask questions*”. The fact that the **learners were participating** in the lesson and were free to ask questions was evidence of the **active involvement** of the learners, and thus, TP4 made the lesson more learner-centred (SMASE-WECSA, 2010:8) when reflecting on the experience from the lesson planning 1 and 2. In lesson 3, TP4 used Kolb’s (1984:38) experiential learning theory to transform the experience from lesson planning 1 and 2 and created the knowledge used in lesson planning 3.

The area that needed to be improved in lesson 3 was the lesson presentation. During the lesson presentation, unfortunately, TP4 forgot to explain all the parts of the cell and could also not label both the plant and animal cells as was planned. When the presenter, TP4 got the chance to **reflect** on the lesson, she **self-critiqued**: “*I missed to describe the cytoplasm and learners*

did not finish labelling the animal cell". It was very important when TP4 **reflected** on her own teaching because the **reflective practice** of LSA allows for the ability to **self-critique** which supports Fernandez (2005:283), that participating in the LSA helps the PLG become more **reflective** about their practices. An observer, TP3, felt that the presenter, TP4, needed to highlight "*the shape*" of the cells more. I observed that the choice of teaching and learning materials by us during planning for lesson 3 did not serve the purpose of the lesson. For example "*the diagram*" which was "*used to explain the shapes of the cell structures was a bit confusing*" because it had unclear cell structures. I, therefore, felt the need for the presenter TP4 to "*explain clearly the difference between chloroplasts and mitochondria which structures were a bit blurred*".

The active participation of all the PLG members in a **democratic decision-making** process helped us come up with the strengths and the areas that needed improvement in the lesson. This happened because we **collaborated** in the discussions (*cf. 3.2.1.4*). We then agreed to incorporate all the areas that needed improvement in lesson plan 4, which was presented again by TP4 while TP3, TP1 and I observed. After the presentation and observation of lesson plan 4, we sat down again to reflect on the lesson. In the discussion, we shared our reflections on the lesson observation, and it was observed that all the areas that needed improvement were taken care of by the presenter, TP4. The presenter, TP4 indicated her personal development once comparing lessons 3 and 4 when she saw an improvement in lesson presentation 4: "*This time I explained well the cytoplasm ... we correctly labelled both plant and animal cells together ... explained the structures of the chloroplasts and the mitochondria using a clear diagram*". All the observers agreed with the presenter as they also appreciated that she incorporated all the areas that needed improvement in the lesson presentation. The presenter, TP4, also improved on the use of time by improving her teaching approach when she used a Venn diagram to explain the structures of the two cells at the same time – that not only saved time but also supported the teaching approach. The use of diagrams according to Novick (2006:1), helps learners to understand structures that are not easily open to visual check.

In the four lesson plans, it was observed that we had **progressed well** from planning lesson 1 to lesson planning 4. The findings of the collaborative lesson planning of the four lessons indicated that the LSA had contributed to our **professional development** as the PLG in various ways. The **collaboration** discussion meeting on the LSA process gave us the chance to **exchange ideas** about how to solve the problems of the PLG teachers' learners and to find out

about different new teaching methods and practices (Özdemir, 2019:46). We consistently collaborated when planning and reflecting on the lessons. The lesson planning and discussion meetings of the four lessons 1, 2, 3 and 4 indicated that we were guided by the characteristics and principles of PALAR as the 7Cs (communication, commitment, competence, compromise, critical reflection, collaboration and coaching) and the 3Rs (reflection, relationship and recognition) as explained (*cf.* 3.3.4). Though the lessons were taught by different presenters to different learners, we applied the experiential learning theory as described by Zuber-Skerrit (2015:8). We went through the process whereby **knowledge** is **created** through the **transformation of experiences** (*cf.* 3.3.3). Through recurrent deliberations and designing the lessons collaboratively, we all felt it helped us develop good lessons. Therefore, TP4 indicated that collaborative efforts helped her to develop a “*well-thought lesson plan*” and improved teaching and learning. Similarly, TP2 claimed that “*if teachers are planning together, they share ideas on how to come up with the good lessons*”. The sharing of ideas during the discussions helped us, as the PLG, to learn **different teaching approaches** and thus helped us **develop good lesson plans**. This finding supports the study conducted by Alamri (2020:5), that the LSA helped in preparing good lessons and helped in dealing with challenges in the lesson topics through collaboration. After lesson plan 2 of Grade 11, which was the 4th lesson planned in collaboration during this research study, we were **satisfied** with all the changes and presentation and did not feel it was necessary to **rework** the lesson and present it. Therefore, Dudley (2014:2), as well as Özdemir (2019:48), indicate that in collaboration, ideas are exchanged and those involved have the opportunity to observe different practices other than their own. Thus, as was noted in the discussions, the collaborative lesson planning improved the PLG teachers’ teaching and learning approach, time management and the teaching and learning materials used. This whole process of the LSA also helped us, as the PLG, to gain a **deeper understanding** of the LSA (Watanabe *et al.*, 2008:135).

The findings in this section helped answer research question 1: *How do the Grade 10–11 Biology teachers integrate the Lesson Study Approach in their teaching praxis?*

In the next section, the findings from the group discussions on the lesson observation checklist **ALEI-PDSI** are discussed.

4.4 DISCUSSION OF THE LESSON OBSERVATIONS USING THE ALEI-PDSI LESSON OBSERVATION CHECKLIST

The discussion in this section includes the findings from the observations of the four collaborated planned lessons (*cf.* 4.3) (two Grade 10 lessons and two Grade 11 lessons). The observations of the collaborated planned lessons were done by the PLG members when the lessons were presented. The two Grade 10 lessons were presented by TP2 while TP1, TP3, TP4 and I observed the lessons collaboratively. The Grade 11 lessons were presented by TP4 while TP3, TP1 and I observed. TP2 could not join the two Grade 11 lesson observations because she had to attend to other activities.

In this section, I use the word ‘observers’ when I am referring to the PLG members who observed the lessons and ‘presenter’ when I am referring to the member who taught the lessons. During the observation of the presented lessons, the observers sat down among the learners without any disturbances. The observers used the ALEI-PDSI lesson observation checklist to tick the corresponding aspects aimed to **evaluate** the lesson. The reflective diaries were also used to note down the focal points that emerged from the lesson presentations (*cf.* 3.5.2.1). The observers were focusing on the aspects of the LSA lesson plan components; namely introduction, lesson development, conclusion and instructional materials. The main aim of the lesson observations was to determine if what was planned was taught.

After the lesson presentations, the observers and the presenter sat together in the school library to reflectively discuss the lesson presentations. During the reflection discussions of the presented lessons, the presenter, TP2 was given chance to **self-reflect** on the lessons and thereafter the observers **shared their observations** (*cf.* 4.3). The reflective discussions of the presentations and observation feedback were audio-recorded and transcribed verbatim. The following themes emerged from the verbatim transcribed discussion and will both be discussed as the themes exist in coherence and are explained in such a way:

- *Theme 1: LSA discussions and observations **raised confidence** in the planning and implementation of the LSA*
- *Theme 2: LSA discussions and observations **raised professional skills** in planning and implementation of the LSA*

During the reflective discussions of the lesson observation, the Grade 10A presenter, TP2 shared her reflections: *“I was a bit nervous when the colleagues observed my presentations, but in these discussions, I got confidence to even do well in the next presentation”*.

Observer TP1 indicated she felt confident about peer observation. TP1 claimed that lesson observation taught her *“observation skills”* and that she now knows how to behave *“when sitting among the learners”*. She further added that to her, *“observation skills matters more”* in the LSA because she felt an **improvement** in her observation skills and learnt to **respect** the classroom atmosphere and natural flow of the lesson (Leong *et al.*, 2021:31) Observations also helped TP1 to be conscious of how she reacts to learners or her body language. The findings of the discussions of lesson observation 1 indicated that the PLG members had learnt how to perform observations, thus opening their minds and improving their **observation skills** (Copriady, 2013:181).

The discussion of the lesson 1 observation indicated that TP2 needed to improve on the introduction which was not done well. She also needed to improve on *time management* as she did not finish the lesson within the allocated time of 40 minutes. The use of teaching and learning materials needed some improvement and the conclusion needed some emphasis (*cf.* 4.3). This led to the review of lesson plan 2 which incorporated the above-listed areas that needed improvement (*cf.* 4.3). Lesson plan 2 was presented again in Grade 10B by the same presenter, TP2, and observed by TP1, TP3, TP4 and me.

During the presentation and observation of lesson plan 2, in Grade 10B, the presenter, TP2 tried to improve on the areas that needed improvement from the planning discussion indicated in section 4.3. The observers also tried to see if what was planned in lesson plan 2 (*cf.* 4.3) was taught as they completed the ALEI-PDSI lesson observation checklist. During feedback discussions after lesson observation 2, the presenter TP2 indicated that after listening to the feedback discussion for lesson observation 1, she *“showed an improvement on her presentation skills”* and she *“even showed confidence”*. She further claimed that *“peer observation guides the colleagues”* and herself to *“improve”* on the presentations. The presenter and the observers also indicated that the reflection discussion of lesson planning 1 helped them to improve on lesson observation 2. Thus, TP2 shared that the lesson observation discussion helped them to *“work on their mistakes”*. The findings indicated that the recurrent reflective practice in the

LSA led to the improvement of the teaching and learning of the PLG lessons (Özdemir, 2019:46).

The findings of the ALEI-PDSI lesson observation checklist indicated that from the presentation of lesson 1, the lesson introduction was **improved**, the lesson content (cytoplasm) was well explained and the two cells, plant and animal, were well explained by using the Venn diagram in the presentation of lesson 2. As reflective practitioners, the reflection discussions helped the PLG to become **confident** when presenting a lesson which led to an **improvement** in the **presentation** and their **critical reflection skills** as indicated by Bruski (2016:1).

All the observers, TP1, TP3, TP4 and I, did not struggle with the completion of the ALEI-PDSI lesson observation checklist because they indicated having developed the **observation skills** while observing lesson plan 1 – as Dudley (2014:2) maintained, collaboration in exchanging ideas in the LSA helps the PLG members in the observation of different practices, other than their own. Therefore, TP3 narrated: “*Peer observation increased my confidence level and improved my teaching*”. She further stated that now she knows “*where she used to fail learners*” in her presentation because she believed that from the discussions of the presented lessons, “*one can make an improvement*”. This enhanced the PLG members’ experiences through experiential learning as supported by Zuber-Skerritt (2016:8) as they **recurrently** observed, then reflected on the lesson presentations and shared what they had learnt (*cf.* 3.3.3).

After the PLG observed lesson plan 2 in Grade 10B, they also agreed to observe lesson plan 3 which was taught by a different person, TP4, in Grade 11A. TP1, TP3 and I observed lesson plan 3. During lesson observation of lesson plan 3, the observers followed the same steps as with the observation of lesson plan 1. The feedback from the ALEI-PDSI lesson observation checklist for lesson 3 indicated that TP4 needed to improve on **time management** and the **use of materials** (*cf.* 4.3). From the discussion feedback of lesson plan 3, the PLG reflections led to another observation of lesson plan 4 which they all planned, except for TP2 (*cf.* 4.3). In the discussion feedback for lesson observation 4, the presenter, TP4 considered the **reflective discussions** of the presented lessons in the implementation of the LSA to be ideal. She indicated that in the reflection discussion meeting of the observation of the presented lesson, she learnt “*different skills*”, as stated by Bruski (2016:1). The skills developed in TP4 were those such as observation and critical reflection as noted in the discussion when the PLG observed and reflected on the lesson in collaboration after the presentation of lesson plan 3.

The observers shared their reflections and the results of the ALEI-PDSI lesson observation tool which indicated improvement in the above-mentioned skills.

The discussion feedback of lesson plan 4 revealed the **professional growth** of the PLG which supports the findings from Rahim *et al.* (2015:4) that in the LSA, the opportunity is given to the PLG to improve their content and their pedagogical knowledge through peer collaboration, reflections and feedback discussions. TP3 indicated that the recurrent observation discussions in which the PLG was involved, gave her the **confidence** to learn how to use the ALEI-PDSI observation checklist. As stated by the DoED (2000:2), TP3 had developed professionally through participating in the LSA activities. She shared that “*now I know from this exercise and ... will be able to use this lesson observation checklist confidently*”. The LSA cycle ended after the PLG observed and agreed that their participation in all the stages of the LSA led to their collaboration when they worked together as a team, **shared their reflections with confidence** (Wood *et al.*, 2017:4) and **grew professionally** as supported by Copriady (2013:177-180). This research study helped the PLG members to **grow professionally through collaboration and reflection**. As indicated by the DoED (2000:5), professional development for the PLG is needed to help them rejuvenate their teaching careers and thus become fearless when observed, and develop confidence instead. All PLG members indicated that their **observation skills, critical thinking skills, critical reflections skills and presentation skills** had developed through their involvement in this research study (*cf.* 4.4). All the above-mentioned skills, as they came out through the reflection discussions were developed in the PLG members (*cf.* 3.3.2). This was supported by Ebaegu (2018:13) as he indicates that **reflections** provide evidence for **professional growth**. Thus, professional growth helped the PLG members **update their skills** and **polish their expertise** as they were involved in the LSA process (DoED, 2000:5). In this way, it was seen that the LSA provided transformation of and improvement in the PLG members’ professional development in the teaching process as confirmed by Gero (2015:10).

In this research study, the process of learning developed over time when the PLG members began weaving simpler components of the LSA, such as collaborative planning of the lesson with their pre-knowledge. They then later comprehended the significance of other ideas and then documented their own learning as alluded to by Ilmu (2016:171). In other words, the ongoing cycle of the LSA that the PLG went through led to the creation of knowledge as described by Zuber-Skerritt (2015:8). This simply means that the LSA is time-consuming, but

the longitudinal process followed by the PLG members in this research study benefitted them. The next section discusses the reflections of the PLG from the reflective diaries.

The findings in this section help answer research questions 1: *How do the Grade 10–11 Biology teachers integrate the Lesson Study Approach in their teaching praxis?*

4.5 REFLECTIONS FROM THE REFLECTIVE DIARIES

Each PLG member was provided with a reflective diary. The diary was used by the PLG to write down their reflections on their insights, feelings, emotions and ideas regarding the entire research process. The PLG was also given the following open-ended questions to reflect on and answer at leisure during the cycles of research.

- *How do you understand the term ‘Lesson Study Approach’?*
- *What are the benefits of collaborative planning?*
- *As a Lesson Study Approach PLG expert, how do you make other teachers aware of the importance of the Lesson Study Approach?*
- *If you are given a chance to plan and present according to the criteria on the ALEI-PDSI checklist for the Lesson Study Approach, how will you do it differently?*

The PLG deliberated on these questions about the LSA process. The diary was used to collect rich data for this research study. The PLG used their reflective diaries to keep their observational notes and serve as evidence for the pre- and post-lesson reflection discussions during the discussion meetings on lesson planning and observations (Ono & Ferreira, 2010:64). I also wanted to find out how far the PLG teachers had progressed through the whole process of the research study in terms of the LSA. Therefore, with their permission, the PLG teachers gave me their reflective diaries and I analysed the responses to the above-listed questions:

The following are the themes that emerged from the discussion of the reflective diaries:

- Theme 1: Understanding the concept of the LSA
- Theme 2: Collaboration in LSA leads to improvement
- Theme 3: Continuing Professional Development (CPD) and the LSA
- Theme 4: LSA implementation
- Theme 5: The value of reflective practice
- Theme 6: Repetitive action leads to perfection

4.5.1 Theme 1: Understanding the concept of the LSA

The PLG reflected on what they were involved in during the process of this research study and responded in accordance with what they learnt. The following are the PLG responses to the first question on how they understand the term ‘Lesson Study Approach (LSA)’. TP1 indicated that the LSA “*encourages teachers to **reflect on their teaching practice** as well as **reflecting on lesson planning, lesson observation for improvement**”.* TP3 stated that the LSA is “*an approach which **allows teachers in the department to plan together, teach and analyse the presentations together and reflect**” on their teaching practices.* TP4 also shared her understanding of the LSA that it is a “***collaborative lesson planning**” among the teachers in a department, “**observing of fellow teachers**” as they are presenting a lesson as well as “**evaluating**” the presentations to “**improve**” for future teaching.* The understanding of the LSA by TP2 was as follows: An “*exercise*” that requires teachers to “*reflect*” on their teaching methods through lesson planning and lesson observation. She further stated that LSA can be seen as “*professional development*” as teachers “*work on the mistake*” made, through “*support conversation*” with other colleagues.

The findings from the diaries on how the PLG understood the LSA revealed that the PLG teachers had a common understanding of the LSA as they indicated that LSA is a method, an approach and an exercise that involves a group of PLG members. This is in line with Chong and Kong (2012:265) who stated that in LSA, the PLG members **collaborate when planning, presenting, observing and discussing the lessons together** (Copriady, 2013:179) for their professional growth. As indicated in Copriady (2013:179), in this research study, the PLG members agreed that there was an **improvement** in their collaborative lesson planning, presentations and observation through **reflection discussions** by working on their mistakes when **reflecting and re-planning** the lesson plans. In conducting this research study, it is therefore my understanding that collaboration and recurrent reflection are the key components for the successful implementation of the LSA.

4.5.2 Theme 2: Collaboration in the LSA leads to improvement

As indicated in Theme 1 above, collaboration is one of the key components for the successful implementation of the LSA, therefore in this research study, the PLG planned in collaboration. They were then asked to share and indicate the benefits of collaborative planning as learnt in this research study. TP1 indicated that from the **collaborated planning** she was involved in,

she learnt how to “*plan a good lesson*” and also learnt how to “*present a well-planned lesson*”. In addition, TP3 stated that in collaborated planning, she learnt many “*skills*” and it made her “*understand the lesson objectives better*” as they discussed them in detail while planning together. Further to that, TP4 indicated that collaborative planning “*deepens her understanding*”. She also felt that the reflection discussions of the lesson planning helped to “*improve*” and “*make the presentations better*”.

The findings on the collaborative planning were that, in this research study, the PLG worked together in planning the lessons which helped them to come up with good lessons, present well-planned lessons and make them better lessons presenters – this is part of professional development and supports Ebaegu (2018:10), who stated that involvement in the LSA helps when constructing a good lesson plan. In line with Nishimura *et al.* (2018:1), collaboration when planning the lessons also helped the PLG teachers to better understand the lesson objectives and also deepen their understanding of the lesson topics (Arslan, 2018:10).

The most interesting part of this research study was that the PLG members who took part in this research study showed **good working relationships** among themselves as supported by Wood *et al.* (2017:4). This helped them find solutions to the challenges they faced during the lesson planning, presentations and observations (*cf.* 4.5) and **bring change** in the classroom (Zuber-Skerritt, 2015:14). As specified in Theme 3, the PLG teachers showed a willingness to share the experiences learnt from this research study with other teachers in their school, unlike what was experienced by Peters (2016:251). The study conducted by Peters (2016:251) on the investigation of the professional development of teachers based on the principle of RME and the process of LSA in Namibia, indicated that the teachers who took part in the implementation of LSA were **reluctant to share** ideas and experiences. The PLG who took part in this research study indicated the **willingness to share** the LSA ideas and experiences they got from this research study with other Biology teachers in the Oshikoto Region as well as all of Namibia (*cf.* Theme 3).

4.5.3 Theme 3: Continuous professional development and the LSA

In this research study, the PLG teachers were asked to share their feelings on how they would make other teachers understand the importance of the LSA and how they would share their expertise from this research study with the other teachers. The findings indicated that all the PLG teachers felt a need for the other teachers in their school to be made aware of the

importance of the LSA. For example, TP1 indicated that she would “*encourage other teachers to participate in the LSA by **providing information***” needed which states the importance of the LSA.

Adding to what TP1 said, TP4 indicated that she would make other teachers aware of the importance of the LSA by “***emphasis[ing] the benefit of LSA to both the teachers and the learners.***” TP3 also shared her reflection that she would “*share the good part of the LSA to the school management, educate them on what LSA is all about and how it assists both teachers and learners in the teaching profession*”. She further stated that she would “***request the school management to give time for experts (the PLG) to train others and educate other teachers on what LSA is all about and its benefits***”.

The fact remains that LSA is important in **rejuvenating the teaching career** of teachers, therefore I felt that the PLG needed the **continuous development programme for teachers on professional development (CPD)** as supported by the DoED (2000:9), which indicates that the involvement of the PLG in the CPD helps the PLG to **gain confidence** to overcome any obstacles faced in the classroom. By taking part in this research study, the PLG were involved in doing, learning and researching and I believe they gained new perspectives on educational matters and improved their education practice as indicated by Edelson (2002:105). Therefore, I am in support of the CPD programme for the teachers because I feel the necessity for the other teachers to also have the same information as the PLG.

4.5.4 Theme 4: LSA implementation

The term ‘Lesson Study’ is indeed a **teaching approach** which originated from Japan and is a direct translation from the Japanese words “*jugyou kenkyuu*” (Gutierrez, 2015:119). The word “*jugyou*” means **lesson** and “*kenkyuu*” means **study** or research. Ilmu (2016:172) describes the LSA as an effort to **build and improve the teaching and learning process through recurring reflections.**

Responding to the question of how the PLG should plan an LSA lesson using the ALEI-PDSI lesson observation tool, this is what they said. TP 4 indicated that she “*will not change anything*” which was the same as TP3: “*I will not do it differently but the same, because I felt this one is suiting me*”. More so, TP1 indicated that she would present an LSA lesson by “*presenting using four different stages together*” as stated below:

1. Study and plan a lesson
2. Present a lesson (teach)
3. Observe and debrief the lesson
4. Revise and reflect on the lesson and reteach when necessary.

The findings indicated that, if they were to plan and present the lessons, all the PLG teachers stated that they would not do it differently. They would follow the LSA process that they used in this research study. At the beginning of this research study, the PLG teachers were concerned about the use of the LSA lesson plan template which they indicated was **too long and took time to complete**. As indicated in their reflective diaries, by being involved in the LSA process, I could see that the PLG teachers had **developed confidence and become professionals** (*cf.* 2.3), thus corroborating the choice to use the LSA lesson planning template.

The discussion of the reflective diaries was based on **understanding the concept of the LSA**, its **implementation** as well as its **benefits**. Based on the excerpts on the understanding of the PLG teachers on the LSA, their reflections had a lot in common. They referred to the LSA as an approach that involves a **group of teachers** (Chong & Kong, 2012:265) who gather to **plan a lesson collaboratively**. TP1 indicated in her reflective diary that the LSA process allowed the PLG to collaboratively teach, analyse and reflect on the presented lesson. The PLG teachers' understanding of the LSA worked well with the stages of the LSA programme as indicated in Copriady (2013:179). In their responses to the implementation of the LSA, all the PLG teachers indicated that they would follow the stages of the LSA as indicated in Figure 2.5 (*cf.* 2.4.2). As stated in Kanellopoulou (2019:19), the PLG was challenged by the time taken to complete the lesson plan template, but in the end, they managed to make time available and plan all four lessons. I also strongly recommend that the PLG teachers refer to the LSA steps in Figure 2.5 and modify them depending on their research needs that fit their available time. Figure 2.5 will obviously be a great help for the PLG teachers when they are to train other colleagues in the implementation of the LSA as indicated in section 4.5.3 because the recurrent reflection during the planning and observation discussions developed their confidence and they became professionals.

4.5.5 Theme 5: The value of reflective practice in LSA

What the PLG did in this research study is an indication that they learnt a lot during the LSA process in which they were involved. As indicated in Chapter Three, the PLG teachers attended training in which they were introduced to the stages of the LSA but did not go into the practical part of it. Connecting the content of the training to what they did in this research study has

narrowed the gap between **theory** and **practice** as supported by Kanellopoulou and Darra (2019:18). The study indicated that as the PLG, all the members were allowed to **reflect together** on what was **discussed theoretically** and **put it into practice** as supported by Rock and Wilson (2005:78). Therefore, the **recurring reflections** during lesson planning and presentation, as well as lesson observation reflections discussions, was **evidence of the cyclical process of the LSA** in which the PLG were involved. The PLG followed Chikamori *et al.*'s (2013:14) LSA cyclical process during the process of this research study (*cf. Figure 2.5*) because in the LSA, critical reflection on the lesson is the most important pre-requisite for the effective implementation of the LSA (Kanellopoulou & Darra, 2019:32).

4.5.6 Theme 6: Repetitive action leads to perfection

As mentioned in the preceding sections, this research study followed the **PALAR cyclical process** of the LSA (*cf. Figure 2.5*) as follows. All PLG members collaboratively planned the four lessons, two each for Grade 10 and 11, using the LSA lesson plan template. They **planned the lessons** before the observation of the planned lessons and **had reflective discussions** about them, which support Cajkler *et al.*, (2015:197) who indicated the need for reflection discussion of the planned lesson in order to shape the lesson and clear out the misunderstandings among the PLG. The **lessons were presented** by one of the PLG members whom they chose for both Grades 10 and 11. **After each cycle**, the PLG **reflected and improved** on the next lesson **until everybody** was **satisfied**. The observers used the ALEI-PDSI lesson observation checklist to evaluate the lessons. After the lesson observations, the PLG shared their reflections for the improvement of the next lesson (Dudley, 2014:2). The cycle continued until all four lessons were presented. This **repetitive action** of the stage of the LSA of plan, do, see and improve indicated by Figure 2.5 in which the PLG was involved **led to lesson perfection**. Zuber-Skerritt (2015:8) describes the action as an ongoing cycle of learning through the experiential learning theory which the PLG used to collect data in this research study. I felt that the repetitive cycles allowed the PLG to reap the benefits of the LSA implementation in the lessons and also contributed to their success. I, therefore, felt that Figure 2.5 could be a good tool that could be used to develop an LSA framework for the Namibian teachers who are teaching Biology in Grades 10–11 which will be presented in Chapter Five.

The findings in this section helped answer research question 1: *How do the Grade 10–11 Biology teachers integrate the Lesson Study Approach in their teaching praxis?*

The next section discusses the challenges that the PLG experienced in the implementation of the LSA.

4.6 CHALLENGES OBSERVED IN IMPLEMENTING THE LSA

Various challenges emerged during the LSA cycles. The following challenges that emerged as themes were *the challenge of workload, the challenges of a lack of time, time allocation and management and the challenges of a lack of teaching and learning resources.*

4.6.1 Theme 1: The challenge of extra workload in the implementation of the LSA

During the discussion meetings of the lesson planning and lesson observation, not all PLG members attended all the meetings. An individual PLG member either missed the planning meeting of a Grade 10 or missed an observation meeting of a Grade 11 lesson. This was due to **demands of teaching** at the school as teachers have different roles like being part of the management team, subject heads and sport trainers. For example, TP2 could not attend any discussion meetings for the Grade 11 lessons, she was always **busy with managerial activities**. I audio-recorded her in her office when I wanted her reflections on lesson presentation 2. The same with other PLG members, they indicated they were overloaded with much work (*cf. 4.4*) and could not participate fully in the discussion meetings. This supports Rahim, Tajularipin and Sulaiman, (2015:4) who stated that the LSA imposes an **extra workload** on top of teachers' existing work.

This was noted in this study as follows: TP1 could not attend the full Grade 11 lesson observation and joined in the middle of the lesson presentation as she was **attending to a parent** who came to pay her children's feeding money. Likewise, TP4 missed part of the discussion meeting for the Grade 10 lesson which was held in the afternoon, because she had to **attend to a netball practice**. TP3 joined the Grade 11 planning discussion late because she had to **compile the agriculture practical activities assessment** forms. The workload which the PLG teachers experienced (*cf. 4.4*) was one of the factors that hindered the effective implementation of the LSA. Thus this research study echoes what Chin Mon *et al.* (2016:81) stated, in that the heavy workload affected the commitment of the PLG towards the LSA because they could not attend all the LSA cycles fully. Thus, I felt a need to train the PLG on how to cope with the burden of extra workload when involved in the LSA.

The second theme was a lack of time, time allocation and management.

4.6.2 Theme 2: The challenges of a lack of time, time allocation and management in the implementation of the LSA

The **lack of time** to plan and discuss lessons collaboratively also came out in the discussions of the lesson observation. The PLG members indicated it was difficult for all to come together at the same time. This supports the findings from Ono and Ferreira (2010:70) that indicated that **securing the time** to meet regularly is a **big challenge** in the implementation of the LSA. This was also the case with Kanellopoulou (2019:19), who indicated that the **time required to complete all the stages** of the LSA is **the most difficult** part in its implementation. In this research study, it was observed that not all the PLG teachers attended all the stages of the LSA fully. This was evident when TP4 indicated that “*there is **not enough time** for all the teachers to meet and make the lesson plans*” while TP3 claimed that “*time for observation may lead to observers missing their own classes*”. This also supports Alamri (2020:4), who indicated that the LSA activities lead to the postponement of some of the lessons.

More so, TP2 indicated a “*lack of time to come together and do the team planning as sometimes teachers **fail to cooperate***”. I fully agree with all the PLG teachers on the issue of time management, more especially with TP2 when she talked about “*failure to cooperate*” (Kanellopoulou & Darra, 2019:19). In this research study, the planning of the Grade 11 lesson was postponed from October 2021 to March 2022, the reason being that some PLG members could not abide by the agreement date. When I called TP1 on the date preceding the lesson observation, I was told that she was not around, and she referred me to TP3. I called TP3, only to be told that she was the only one at the school and the observation could not go ahead.

Time was regarded as a major obstacle in this research study because I felt that the implementation of the LSA research study was not incorporated into the school action plan (Hiebert & Stiegler, 2000:15). Teachers did not allocate time for this research study despite having agreed to voluntarily take part in it, they found it **difficult to commit** to its requirements. Having the LSA implemented at the school was going to take a **lot of commitment** from the PLG teachers and time would have to be set for that. If the PLG teachers could not commit to time for reflections and planning, the LSA would not be able to be practised and implemented fully (Huang & Shimizu, 2016:9). Having reflection discussions with everyone helped the PLG to grow and learn from each other. In this research study, though the PLG improved on **lesson time management** during lesson presentation 2 and 4, they felt that the **LSA process required time management** for the effective implementation of the LSA as indicated in Saito

(2012:780) as well as Ogegbo *et al.* (2019:1). The study conducted by Özdemir (2019:49) stressed that a lot of time and effort is required to successfully cover a full cycle of the LSA. Therefore, it is very important for everyone to commit to the reflective discussions for the effective implementation of the LSA.

The LSA is **time consuming**, and the PLG needed training to implement it. To me, all the data from the reflection discussions of the lesson planning and observation as well as from the reflective diaries confirmed the same findings about the **lack of time, time allocation and management**. The lack of time, time allocation and management were the major themes in this research study. This is exactly what was mentioned in one of the collaborative lesson plannings where the PLG teachers indicated they needed a lot of **time for planning the lesson**. It was reinforced in the discussions of the lesson observations where the PLG teachers indicated they needed **time during the lesson presentations**. Everything was time consuming, however, when the PLG worked through the LSA cycles, they **made the time** to do that, and it gave the PLG **good results at the end**. What was apparent in the reflective diaries, is that the PLG teachers realised the **importance and benefit of time**; they indicated they needed a **lot of time to plan and discuss** in order to improve the lessons.

A third theme emerged as a challenge, namely a lack of teaching and learning resources.

4.6.3 Theme 3: The challenge of a lack of teaching and learning resources

The use of teaching and learning materials was discussed by the PLG as a challenge for the presented lessons. During the lesson presentation of the Grade 10 lesson, the PLG teacher wanted to do a laboratory experiment to see how auxin plays a role in plant growth. Instead, because the school does not have a laboratory, TP2 took the learners outside to observe the growth of the trees. In the absence of a laboratory and its equipment at the school, the PLG teacher indicated that when she wanted to do the Biology practical work, she is “*always asking learners to bring the examples of locally available materials at school to be used as teaching aids*”.

TP1 and TP4 also commented on the issue of not having a science laboratory. They lamented that the school experienced a lack of teaching resources, because there was “*no science laboratory, and the government did not provide the teaching resources*”. Textbooks as teaching and learning resources were also in short supply at the school as indicated by the PLG teachers.

One PLG teacher indicated that the “*school was not supplied with enough textbooks and therefore disturbs the LSA to be implemented effectively*” This is supported by Watanabe (2018:6) who stated that the lack of teaching and learning resources leads to the ineffectiveness of the implementation of the LSA. My own observation found that three to four learners were sharing a textbook, while most of the time the PLG teachers made copies from the textbook and asked the learners to paste them in their notebooks.

The lack of appropriate teaching and learning materials and Biology textbooks which was experienced at GwaaNampando Gweegonga SS was a major concern to all the PLG members who took part in this research study. I felt that the lack of textbooks in the school limited the learners to reading for understanding the lesson content; it was also not easy for four learners to use one textbook when doing their homework as the book had to go with one learner. Therefore, as one of the requirements of the LSA lesson plan template, the lack of appropriate teaching and learning resources as observed in the study conducted by Ogegbo, Gaigher and Salagaram (2019:1) posed a threat to the PLG’s participation in the LSA. In this research study, the PLG learnt about improvisation, an aspect of the LSA in the ALEI-PDSI lesson observation checklist, which they used to evaluate the LSA lesson plan template. I believe that the situation of the lack of teaching and learning materials where the PLG teachers found themselves can be done away with when PLG teachers are able to improvise (SMASE-WECSA, 2010).

The findings in this section helped answer research question 1: *How do the Grade 10–11 Biology teachers integrate the Lesson Study Approach in their teaching praxis?* and 2: *What factors hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA?*

I now summarise the findings to conclude this chapter.

4.7 CONCLUSION

In this chapter, I presented and discussed the analysis of the data gathered from lesson planning discussions, reflective discussions on the observation of the presented lessons (that used the ALEI-PDSI checklist to guide the discussion) and the discussions of the PLG reflective diaries and my analysis of the reflective diaries. The reflections from the PLG teachers indicated that individual teachers had a common understanding of the implementation of the LSA. Though there were some challenges experienced throughout the LSA process, for example, the

workload in the implementation of LSA, lack of time, time allocation and management, and lack of teaching and learning resources, as the PLG continued reflecting during the discussions before and after the lesson presentation, they found solutions to and improved on the challenges. In this research study, all PLG members felt the importance of the LSA in the teaching fraternity. They felt a necessity for the LSA to be introduced to other teachers as well as other schools in the region. In this research study, the PLG members were guided by Kolb's experiential learning theory whereby they communicate when planning and discussing the observed lesson. The PLG members showed their commitment and competence throughout the research study process. The compromising through critical reflection of the PLG throughout the research study was made possible by collaborating and coaching each other (*cf. 3.2.1.4*). In the next chapter, I present an LSA framework that can be adapted by Namibian Biology teachers.

CHAPTER FIVE: A NAMIBIAN LESSON STUDY APPROACH FRAMEWORK FOR GRADE 10–11 BIOLOGY TEACHERS TO ENHANCE THEIR TEACHING PRAXIS TO EDUCATE FOR SUSTAINABLE DEVELOPMENT

5.1 INTRODUCTION

The purpose of this research study was to determine what the LSA should look like for Grade 10–11 Biology teachers in Namibia to enhance their teaching praxis to educate for sustainable development. As the research study topic dictates, the teaching of ESD was never attended to by the PLG, though it was well structured in the NCBE in Namibia to teach the ESD cross-curricular themes, namely HIV, environmental learning, among others (*cf.* 2.2.3). The National EE/ESD Policy (MEFT, 2019:iv) for Namibia supports the implementation of sustainable development activities and programmes through education. Therefore, the teaching of ESD is something that is supposed to be given attention by teachers. Education for Sustainable Development (ESD) did not even feature in the discussions as a priority by the PLG teachers, because they were concentrating on how to teach the Biology lessons using the LSA cycles. It was also evident in the findings that the teachers who participated in the PLG struggled to first implement the LSA but later found it easy and suitable to implement in the Biology classroom. Since there was a clear lack of attention given to ESD implementation in lessons by the teachers, I felt it necessary to include ESD as part of the framework for the Grade 10–11 Biology teachers because teachers must educate for sustainable development even though they are faced with challenges (*cf.* 2.2.2 and 2.2.3).

In Chapter Two, the literature review revealed how the different authors and researchers explained the implementation of the LSA process by following the LSA steps of plan, do, see, and improve. In Chapter Four, I discussed how all members of the PLG, who took part in this research study, followed the steps cyclically when implementing the LSA (*cf.* 4.3–4.4). I also discussed the main themes that emerged from this research: A lack of time, time allocation and management and the lack of teaching and learning resources (Watanabe, 2018:5–6), as well as the workload of the PLG teachers (Rahim *et al.*, 2015), which were the major challenges to

emerge in the research study that hampered the effective implementation of the process of the LSA.

After presenting the findings on the implementation of the LSA by the PLG members in Chapter 4, in this chapter, I develop and present the LSA framework for Grade 10–11 Biology teachers that can be adapted by Namibian Biology teachers. By doing this, I will be trying to answer the research question: *What should a Namibian Lesson Study Approach framework look like for the Grade 10–11 Biology teachers who want to enhance their teaching praxis to educate for sustainable development?* The developed framework aims to improve lesson planning, classroom observation and reflective praxis for CPD, rather than being used to make judgements (Ilmu, 2016:172). In other words, the framework will aid Biology teachers to develop professionally by involving them in a comprehensive process of collaborative planning, observation, reflection on a lesson and identifying the best teaching and learning approaches (Copriady, 2013:178). I need to admit that the Namibian unique context that applies to the LSA emphasises specific elements or steps to be included in the framework. I will first discuss the steps in the implementation of the LSA. In this section, the literature discussed in Chapter Two (*cf.* 2.4) will be revisited to guide the development of the proposed framework, together with the findings presented in Chapter Four.

5.2 STEPS IN THE IMPLEMENTATION OF THE LSA

Chapter Two shared researchers' explanations of how individuals have implemented the LSA to suit their needs. The LSA is implemented in cycles with steps to plan, do, see and improve. The literature review revealed that the LSA is based on Kolb's (1984:21) experiential theory of learning which the PLG used to gather data regarding lesson planning, observation and reflection. Therefore, through the application of experiential learning by the PLG teachers who took part in this research study, they contributed to their professional development by creating and attaining knowledge of this method of teaching. The PLG were involved in collaborative planning, presentations and observations as well as reflections on the lessons.

Different researchers indicate steps to follow in the LSA. Stigler and Hiebert (1999) consider the following steps in the implementation of the LSA process:

1. Defining and researching a problem
2. Planning the lesson
3. Teaching and observing the lesson
4. Evaluating the lesson and reflecting on its effect
5. Revising the lesson
6. Teaching and observing the revised lesson
7. Evaluating and reflecting a second time
8. Sharing the results

In Doig and Groves (2011), the participants collaboratively used the following steps in the LSA process:

1. Goal setting and planning the lesson
2. Establishing long-term goals
3. Planning the research lesson
4. Teaching and observing the research lesson
5. The post-lesson discussion

The study conducted by Leong *et al.* (2021) followed these steps:

1. Study and plan the lesson
2. Teach, observe and debrief the lesson
3. Review and reteach the lesson
4. Reflect and report on the lesson

All the steps refer to similar properties, but the researchers preferred to name them differently. As per the LSA requirements, the activities in each of the above-mentioned steps were done in collaboration (Doig & Groves, 2011:79; Leong *et al.*, 2021:9). To develop the framework that I have proposed from this research study for the Namibian Grade 10 and 11 Biology teachers, I also considered the LSA requirements at each step (*cf.* 5.3).

In developing the framework for the Namibian Biology teachers, I preferred to use the cyclical steps used by the PLG in this research study and adapt the steps of Stigler and Hiebert (1999), because they encompass the steps of Doig and Groves (2011) as well as those of Leong *et al.*

(2021). Based on the findings from this research study, I adapted the steps of Stigler and Hiebert (1999) to suit the Namibian Biology teachers' framework as follows.

In the LSA, collaborative learning necessitates the involvement of teachers who meet to share responsibility for the success of their learners (Chong & Kong, 2012:264). Thus, the first step in the cyclical stages of a Namibian framework for Biology teachers teaching Grade 10 and 11 is as follows.

- **A PDT must be formed** that collaboratively defines and researches a problem before **designing an ESD lesson**.
- The designed lesson should be collaboratively **discussed and reflected** on before it is taught.
- The reflection discussion of the designed lesson is followed by the **presentation of the lesson** by one of the PDT members while the other PDT members observe and critique the lesson.
- The **reflection discussion of the presented lesson** should follow, whereby the PDT members gets together to share the outcomes of the presented lesson and their observation.
- The lesson and the lesson design are **reviewed based on the observations**. If necessary and subject to the areas of improvement that emerge from the reflection discussion of the presented lesson, the lesson is reviewed and then discussed before it is presented again.
- The **reviewed lesson** is then **presented** and the **cycle of observation, critiquing and sharing of results** through critical reflection is **repeated**. If the **PDT members feel satisfied** with all the changes in the presentation and do not feel the need to rework the lesson, then **the cycle ends** (*cf.* 5.3).

The LSA framework for the Grade 10 and 11 Biology teachers that I developed consists of eight cyclical steps. I, therefore, summarise my version of the LSA steps as follows:

1. form a PDT through informal group discussions;
2. design the lesson;
3. reflection discussion on the designed lesson;
4. teaching, observing and critiquing the lesson;

5. sharing the results of the observed lesson through a reflection discussion;
6. reflection discussion and reviewing the lesson plan;
7. re-teaching, observing and critiquing the review lesson; and
8. sharing the results of the review lesson through reflection discussion.

I preferred to use the above steps in the framework for the Namibian Biology teachers because this was how the PLG implemented the LSA in this study and it worked well. I also believed that the framework could work well for other Namibian teachers who are teaching Biology Grade 10–11. The LSA framework that I developed because of the findings presented in Chapter Four is illustrated in Figure 5.1.

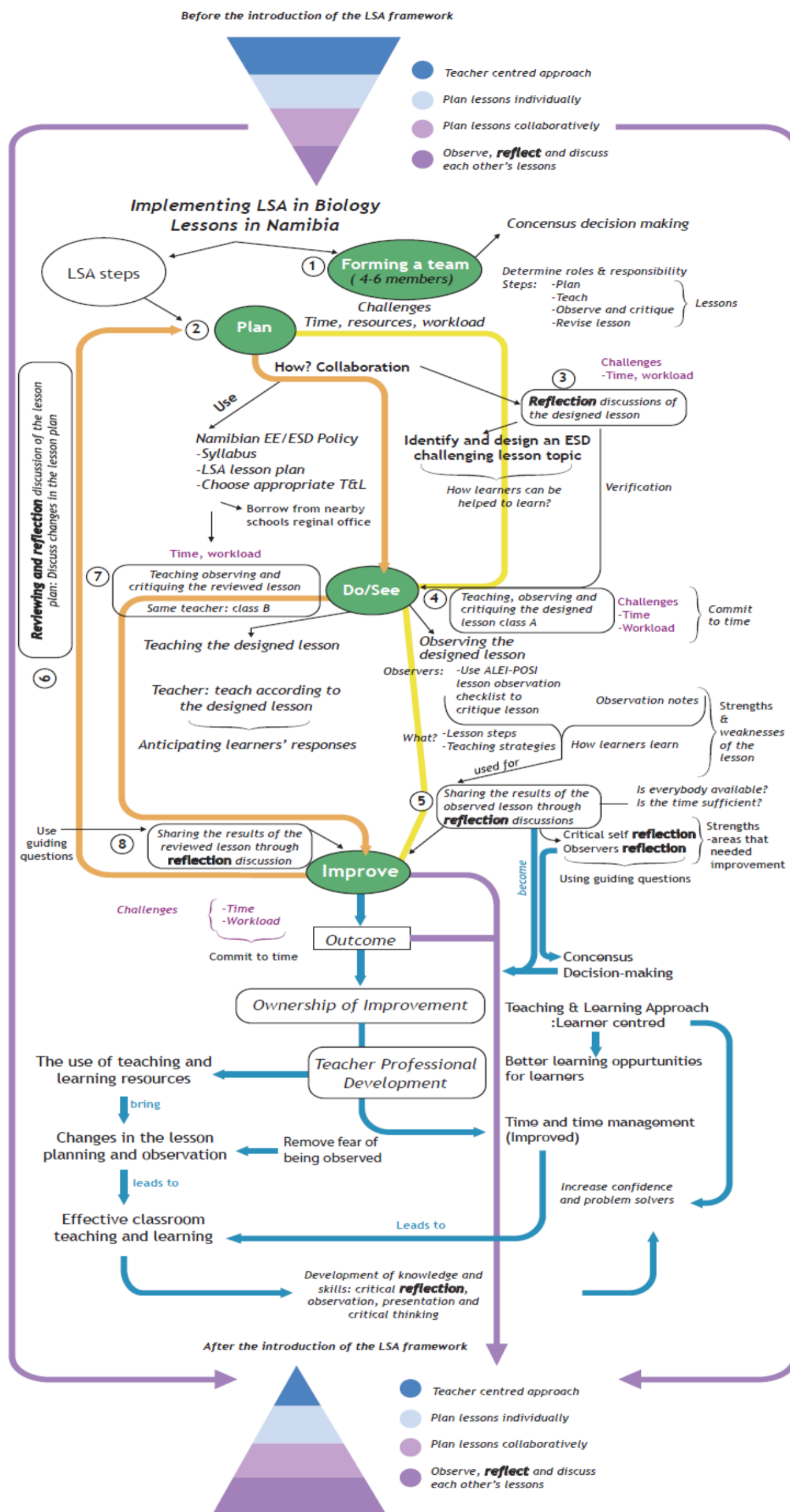


Figure 5.1: A Lesson Study Approach Framework for Grade 10–11 Biology teachers in Namibia

In this research study, as the PLG, we were involved in a **repeated cycle process** of steps of **plan, do, see and improve**. The aim was to bridge the gap between theory and practice in the planning and execution of lessons (Wood, 2020:106). I will now reflect on each of the implemented steps and indicate why I included them in my proposed framework. This reflective practice also allowed me the freedom to consider what and how I can change a step to allow for the better implementation of the LSA.

5.2.1 Forming a team

In the implementation of the LSA process, the first thing the teachers should do is to **form a Lesson Study Approach PDT** (Ilmu, 2016:174). As indicated by Kolb's experiential learning theory, learning is a process that transforms experience into knowledge creation (Kolb, 1984:38). As indicated in the findings, the PLG were working in **collaboration**, the purpose being to **share knowledge to improve the quality of teaching** (Copriady, 2013:179) through **collaborative planning, observation and reflection discussions** of the lessons. The PDT should consist of two to six novice, advanced beginner and experienced teachers who are teaching the same subject, e.g. Biology teachers, in the school. The combination of expertise should be valued because novice teachers will learn good practices through their PDT participation (Bocala, 2015:353). If novice teachers are learning new teaching strategies from experienced teachers in the early years of their careers, they will apply and master them for years and develop professionally. The experienced and advanced teachers will share their expertise with the team members (Bocala, 2015:353) during the reflection discussions of the lessons. The PDT should determine the schedule to conduct the LSA process. Through **consensus decision-making**, the PDT should identify the **roles and responsibilities** of every PDT member in the LSA process of planning, doing, observing and improving the lesson (Cohan & Honigsfeld, 2006:28; Saito, 2012:779). The significance of PALAR in this framework is that it will enable the PDT to learn how to help themselves through self-directed, lifelong action learning (Zuber-Skerritt, 2015:14) and it will demand commitment from every PDT member at every step of the LSA process.

In Chapter Three, I indicated the years of teaching experiences of the PLG teachers as follows: TP1 =11 years, TP2 = 19 years, TP3 = nine years and TP4 = eight years. This was a good combination because the PLG PDT was composed of the more experienced TP2, the experienced TP1 and the advanced beginners who had less teaching experience, TP3 and TP4

respectively. In this research study, the PLG teachers were considered novices in the implementation of the LSA process (Rock & Wilson, 2005:79), but they differed in their teaching experience. My observation in this research study showed that TP3 and TP4 were learning the different teaching and learning approaches from the more experienced TP1 and TP2 respectively (Rock & Wilson, 2005:79). It worked well for them when they collaboratively shared ideas through reflection discussions. Thus, the Namibian implementation of the LSA confirmed that forming a PDT as part of the framework for Biology teachers is a necessity and also contributes to a diversity of skills.

The next section discusses the design of the lesson.

5.2.2 Plan a lesson

Designing a lesson involves proper planning and time management which the PDT should consider. Doig and Groves (2011:77, 80) indicated that the LSA takes place across all curriculum areas in Japan, but is most practised in Mathematics. The framework that I developed is meant for the Grade 10–11 Biology teachers in Namibia. The framework will guide the Biology teachers as a PDT to design good lessons around solving problems in a topic which they find challenging. Committed to the time and finding and choosing the best materials will help the PDT to plan good lessons which will then assist with learners' learning and help the PDT to achieve their objectives (Doig & Groves, 2011:81). The findings in Chapter Four indicated that when **planning** the four lessons in **collaboration**, the PLG showed **improvement** through **reflection discussions** of the planned lessons. The findings further indicated that collaborative planning allows for better lesson presentations and better learner engagement and understanding (*cf.* 4.3). In this framework, the PDT should consider the following when planning a lesson:

- collaboration;
- agree on the elements that should be included in the lesson plan;
- the use of available and appropriate resources and materials; and
- a lack of time, time allocation and management.

Therefore, this framework considers that the PDT should **collaboratively plan** the lesson which is realistic in terms of lesson content and the learners' ability, skills and interests. The Grade 10–11 Biology syllabus, the Namibian EE/ESD Policy and textbooks should be used to

guide the planning of lessons to identify a **challenging topic** or the **concept** that learners have **difficulty learning** (Huang & Shimizu, 2016:2). The choice of topic determines the teaching approach to be used, the teaching and learning resources needed and it also determines the needs of the learners and what they are able to do. It is at this stage that the PDT must begin to consider the ESD focus of their lesson as stipulated in the NCBE in Namibia for 2018 (*cf.* 2.2.3).

It was indicated in the findings in Chapter Four that the **lack of teaching and learning resources** was one of the factors that **hampered the effective implementation** of the LSA in the planning of the lesson. The Japanese teachers used improvised materials but in Namibia, most teachers lack the idea of improvisation (*cf.* 4.5 Theme 3). Therefore, the framework which I developed aims to overcome these above-mentioned challenges by showing the LSA team how to use the **appropriate teaching and learning** resources available. The PDT in **collaboration** should prepare **adequate** and **appropriate** teaching materials which are **available** and **relevant** to the lesson topic (Leong *et al.*, 2021:29) with the use of **locally available materials** (re-use and repair) to suit the needs of the lesson topic. The PDT is also advised to **borrow** some teaching and learning resources from the **nearby schools** or the **Biology department at the Regional Office** and take them back after using them. But to do all these requires time, therefore every PDT member should always commit to the time needed for the successful implementation of the LSA process.

The findings indicated that a **lack of time, time allocation and management** and the workload for the PLG were the **challenges** in the implementation of the LSA in this research study. In Japan, the LSA implementation worked well for them because time was not an issue. In Japan, teachers met once/twice a month and once/twice after school in the cross-school and the cross-district LSA respectively (*cf.* 2.4.1.1). The Japanese teachers are believed to be very strict with the time needed for the LSA, but Namibian teachers were not strict on allocating time (*cf.* 4.5).

The PDT should then use the amended LSA lesson plan template (*cf.* Figure 5.2) to **collaboratively** plan the lesson. This framework can be amended to suit the needs and the situations of the teachers and learners. In planning the LSA lesson, the PDT should also think about their **‘why’** teaching, rather than getting overwhelmed by their **‘how’** teaching the lesson (Leong *et al.*, 2021:23). In other words, when planning a good lesson, the PDT should think

about what the learners will think, do, feel and learn, rather than what the teacher will do (Lewis *et al.*, 2021:24).

Thus, for the Biology teachers to plan a good lesson, the framework recommends the PDT consider the following elements when designing the lesson plan:

- how to engage learners in learning;
- develop questions that promote discussions and thinking;
- anticipate learners' responses and do forward planning;
- plan for responding to misconceptions and or misunderstandings;
- plan the lesson conclusion;
- plan how to assess if learners understand what was taught;
- plan the time allocation for each lesson stage; and
- plan for the implementation of ESD.

The adapted lesson plan template provided, as shown in Table 5.1 below, **provides space** for **time allocation** at each lesson component so that the Biology teachers can agree to the time allocation during lesson planning and stick to the **time spent** on each component during the lesson presentation.

Table 5.1: The Lesson Study Approach Lesson Plan Template

LESSON STUDY APPROACH LESSON PLAN TEMPLATE
Name of teacher: Subject:
Grade: Date:
Duration:
Topic: <i>(from the syllabus)</i>
Sub-topic: <i>(from the syllabus)</i>
Lesson objectives: <i>(from the syllabus)</i>
Rationale: <i>How is the topic important or difficult for learners' learning?</i>
Pre-requisite knowledge: <i>What are common challenges and misconceptions the learners have about the topic?</i>
Teaching/learning resources/materials: <i>Biology syllabus, textbooks, Teachers' Guide (if any) and others depending on the choice of the ESD topic for an individual teacher</i>
<p>Lesson development/presentation: <i>(The following should serve as a guide when the PDT are planning a lesson):</i></p> <ul style="list-style-type: none"> • <i>Indicate why the team selected the topic</i> • <i>Explain why the topic is important</i> • <i>Indicate learning difficulties learners could have with the topic</i> • <i>Indicate challenges and misconceptions that the learners might have about the topic</i> • <i>Indicate the purpose of the tasks and activities included in the lesson in terms of skills</i> • <i>Indicate the informed instructional decisions learners need to make in the lesson</i> • <i>Indicate how the tasks and activities support the lesson objectives</i> • <i>As a team, identify the understanding (knowledge) and skills (be able to do) learners must have by the end of the lesson</i> • <i>Indicate the learners learning task</i> • <i>Indicate ways that learners may use to approach and solve the learning task</i> • <i>Indicate how the team establish class discussion so that learners can share their thinking</i> • <i>Indicate how the team summarises the main ideas of the lesson and loops back to the lesson objective</i>

<ul style="list-style-type: none"> Indicate how the team implements ESD in this lesson 			
Stage/Time	Teaching and learning activities	Learning point/s: <i>What did the learners learn?</i>	Remarks/Reflection
Introduction: <i>(Time)</i>			
Development: <i>(Time)</i>			
Conclusion/consolidation: <i>(Time)</i>			
Evaluation/assessment: <i>(Time)</i>			
Reading and writing skills: <i>Which ESD activities can you give to the learners to learn how to read and write?</i>			
Learner support/inclusive: <i>Which ESD activities would you give to learners with different learning abilities?</i>			

The workload could be addressed together with the time needed because if teachers are loaded with many school activities, they should try to manage and divide their time well. Together with planning, in this framework, the PDT need to decide on setting **time** aside for the LSA; when to plan and how long to plan the lesson. The PDT should then discuss the lesson topic and decide who will present the lesson and who will observe the lesson (*cf. 5.3.1*). In the next section is the reflection discussion of the designed lesson.

5.2.3 Reflection discussion on the designed lesson

The findings in Chapter Four indicated that during the **reflection discussion**, the PLG had a chance **to reflect** on the lesson. In this framework, the PDT will have a chance to reflect on the designed lesson before it is taught. The reflection discussion of the designed lesson will help the PDT to make possible changes in the lesson plan before it is presented. During the reflection discussion of the designed lesson, in **collaboration**, the PDT members would **verify** and **confirm** if what they want to achieve was what was **planned**.

The data of the research study which I conducted revealed that the completion of the LSA lesson plan template is a **timely exercise** because the PLG first planned the lesson. The PLG used their available time to compile the lesson and then have a reflection discussion on the lesson that they had planned. Therefore, to save time which is a scarce commodity for Namibian teachers who have a large teaching and administrative load (*cf. 4.5: Theme 1 & 2*), the Namibian LSA framework for the Grade 10–11 Biology teachers is suggesting that the PDT reflect on their planned lesson during the lesson planning stage.

5.2.4 Teaching, observing and critiquing the lesson

This stage involves the **implementation** of the teaching activities. In the Grade 10–11 framework for Biology teachers, teaching the lesson will provide the opportunity for the teacher to **test the lesson plan** in the classroom and provide the chance for **observation and critiquing** of the lesson. This stage of the lesson requires much time; a minimum of 40 minutes. The literature revealed that the Japanese LSA involves many observers from the same school or the local schools observing the lesson (Doig & Groves, 2011:84) because most of the Japanese teachers are used to **committing** their **time** to the LSA activities. In my research study, I could not include teachers from the other schools because of the long distances which require time for the teachers to travel from one school to the other. Therefore, to avoid the inconvenience of a lack of time, time allocation and management, the framework that I developed will only cater for teachers who do not need to travel. The teachers who are teaching Grade 10–11 Biology at the same school who will teach, observe and critique the lesson will be involved in the LSA process.

When one of the PDT members teaches the planned lesson (Ono & Ferreira, 2010:64; Copriady, 2013:180) the rest of the PDT members should gather in the classroom to **observe** the teaching and learning process (Huang & Shimizu, 2016:2) (*cf. 5.3.1*). The teacher should use the lesson plan and teach according to what the PDT has planned and should anticipate the learners' responses. During the lesson observation, the observers should **respect the classroom atmosphere and natural flow of the lesson** (Leong *et al.*, 2021:36). The observers should sit among the learners, listen carefully and without any disturbance watch what the teacher and the learners do in each stage of the lesson (Lewis *et al.*, 2021:27; Ogegbo *et al.*, 2019:4; Ono & Ferreira, 2010:64). The above statement was supported by the findings that during the lesson observation, the PLG learnt **how to behave** when observing the lesson by not interfering in the

learners learning, and thus developed their observation skills. At times, not all the PLG teachers arrived on time for lesson observation, but in most cases, they were delayed due to other managerial activities in the school. Therefore, the framework makes it compulsory for all the observers to make sure they **arrive** at the lesson **on time** and **stay** for the **entire** lesson to capture all the lesson stages. In this stage, the observers should use the amended LSA ALEI-PDSI lesson observation checklist indicated in Table 5.2 to critique the LSA lessons.

Table 5.2: The Amended Activity Learner-centred Experiment Improvisation: ALEI-PDSI Checklist

Please evaluate each of the following aspects of the lesson on the following descriptors				
Insufficient, Slight, and Sufficient				
Plan	Aspect	Insufficient	Slight	Sufficient
P1	The lesson plan took into account learners' backgrounds, such as learning difficulties, their needs/ interests/ misconceptions, growth of experimental skills and previous experience in relation to the topic.			
P2	The lesson plan was appropriate and realistic in light of the lesson content and learners' abilities/ skills/ interests.			
P3	The teacher prepared appropriate and adequate materials for learners' use.			
Do (teach)	Introduction	Insufficient	Slight	Sufficient
D1	The introduction incorporated previous knowledge/ skills/ everyday experience and linked them to the new topic.			
D2	The introduction was clear on what the teacher wanted the learners to learn.			

D3	The introduction was stimulating enough to arouse the interest and curiosity of the learners.			
	Development	Insufficient	Slight	Sufficient
D4	The lesson encouraged learners to express their prior experiences and explain their ideas related to the content.			
D5	The lesson encouraged learners to give their own hypotheses/ predictions and helped to discuss how they differed from those held by others and to verify them through experiments, facts, etc.			
D6	The lesson encouraged learners to give their own observations/ results in the experiment and to discuss how they differed from others.			
D7	The lesson facilitated process skills such as observing, measuring, identifying variables, planning experiments, etc.			
D8	The teacher dealt with learners' questions, misconceptions and reinforced learning at each step.			
D9	The lesson encouraged the active participation of learners as much as possible in the main teaching steps.			
D10	The lesson promoted ESD.			
	Conclusion	Insufficient	Slight	Sufficient
D11	The lesson encouraged learners to draw conclusions.			

D12	The teacher summarised the lesson and gave follow-up activities.			
D13	The lesson assisted in viewing the content in relation to what they come across in society.			
D14	The teacher checked the accuracy and appropriateness of the content through question-and-answer techniques.			
	Class management	Insufficient	Slight	Sufficient
D15	The teacher organised and conducted the lesson taking into account the individual differences in learners' capabilities.			
	Instructional materials/ media	Insufficient	Slight	Sufficient
D16	The teacher made effective use of the teaching/ learning materials and media.			
See (evaluate)	Aspect	Insufficient	Slight	Sufficient
S1	The teacher supervised class work.			
S2	The teacher was attentive to the needs of learners with low and high academic abilities.			
S3	The teacher kept eye contact with learners to monitor their feelings.			
S4	The teacher invited questions from learners.			
S5	The teacher asked questions to check the quality of understanding.			

Improve	Aspect	Insufficient	Slight	Sufficient
IM 1	The teacher rephrased questions or instructional statements as necessary.			
IM 2	The teacher interjected when necessary and called inattentive learners to attention.			
IM 3	The teacher gave further guidance to learners on lesson activity /ies.			
IM 4	The teacher made appropriate adjustments when conducting the lesson			
ALEI	Aspect	Insufficient	Slight	Sufficient
Activity	The lesson was activity focused.			
Learner involvement	The lesson was learner centred.			
Experiment effectiveness	The experiment(s) and activities helped to achieve the objective(s) of the lesson.			
Improvisation	Improvisation was practised during the lesson.			
PDSI	Aspect	Insufficient	Slight	Sufficient
Plan	The planned lesson was realistic and doable.			
	The planned lesson led to better learner engagement.			

Do	The teacher was confident and taught according to what was planned.			
	The learners were assessed towards becoming active participants.			
See	The teacher became a reflective practitioner.			
	The observers respected the classroom atmosphere.			
Improve	Allocating time and time management were improved.			
	The teacher grew professionally and developed positive attitudes towards the learners.			

ALEI-PDSI is an acronym which simply stands for **Activity, Learner-centred, Experiment, Improvisation - Plan, Do, See, Improve**. The above-mentioned lesson observation checklist is used to **measure** the **strengths** and **weaknesses** of the lesson (Ilmu, 2016:174). It helps to gather information about the **extent to** which teachers use the different components through the indicators of each component and the usage of the teaching and learning approach. The indicators are allocated descriptors as follows: **slight, insufficient** and **sufficient**. I decided to use the above descriptors in the framework because this shows the uniqueness of my framework.

Depending on the teaching topic, the results of the ALEI-PDSI will be used to guide the PDT on how to review the lesson that can nurture learners to learn to understand the risks and challenges of the planned topic and how to address them to make informed decisions for a sustainable future (*cf.* 2.2.3).

In this research study, the PLG used the ALEI-PDSI lesson observation checklist for the purpose mentioned above. The findings in Chapter Four indicated that the PLG was challenged with the completion of the checklist in the first lesson observation because of their first

experience. Through **sharing ideas** and discussion on the content of the ALEI-PDSI lesson observation checklist, the PLG became **confident** as they progressed in using it. When completing the ALEI-PDSI lesson observation checklist, the PLG teachers who took part in this research study were happy to critique the ALEI aspects but were concerned about the non-inclusion of the summarised PDSI aspects. I felt it very necessary to include the summarised aspects of the PDSI. I, therefore, included the PDSI aspects in the ALEI-PDSI lesson observation checklist for the PDT to critique the *Activities* which were **Planned** for the *Learners* to **Do** and to *Experiment* with what they **Saw** intending to *Improvise* if there was a lack of teaching and learning resources for **Improving** the lesson (*cf. Table 5.2*). In this framework, the aspect of PDSI will be critiqued as follows: **PLAN** will critique if the designed lessons are **doable** and have **incorporated the elements of learner engagement**. In the **DO** and **SEE** aspects, the framework will have the provision **for critiquing the gains of the teachers, observers and learners from the lesson presentations**. In the **IMPROVE** aspect, the framework will **provide space** for the PDT to **work on and improve on time allocation and time management** as well as to **determine the improvement developmental changes** that were **visible** in the **LSA process**.

The framework for the Grade 10–11 Biology teachers suggests that, as the lesson is taught, the observers are expected to note down the **critical remarks** by and/or **behaviours** of the teacher and the learners throughout the lesson steps to achieve the lesson objectives. This was experienced in this study when the PLG used the reflective diaries to note down the critical points for reflection discussions. In such a way, the PDT will note the **value of critical reflection** and in turn, **develop their reflection skills**.

In Chapter Four, it was reported that TP 4 did not complete labelling the cell structures due to **time management**. As indicated earlier in this section, time is very important in the LSA process. Therefore, it is a necessity for the Biology PDT who are going to use this framework to note down the **time used** for each of the lesson plan components during the presentation stage (*cf. Table 5.1*) to see if the activities and or the lesson is completed during the **lesson time** (Chong & Kong, 2012:266). This will help in the reflection discussion which leads to the **improvement** in the reviewed lesson plan. The observation note on the lesson plan and the results of the ALEI-PDSI lesson observation checklist will be used by the PDT as evidence for the reflection in a post-lesson discussion meeting.

The next section discusses the post-lesson reflection discussion.

5.2.5 Sharing the results of the observed lesson through the reflection discussion

Literature indicates that reflection cannot take place without time. Therefore time should be made available for reflection discussion. Soon after the lesson observation, the team members should make sure that they have **sufficient time** for **an in-depth discussion** on the observed lesson as well as **make sure** that **everybody** who participated in the LSA process is **available** (Ogegbo *et al.*, 2019:6). The team should put all other activities aside and commit to the LSA process. They should then gather in a quiet place to conduct a comprehensive **post-lesson discussion**. In the LSA framework I developed, the PDT should **choose a moderator** and a commentator at the same time to lead the discussion and use a **recorder** to audio-record the discussion (Leong, *et al.*, 2021:42). The evaluation from the ALEI-PDSI lesson observation checklist and the observation notes will **help with the reflection discussion** of the observed lesson. During the post-lesson discussion, the PDT should **highlight the valuable critique** collected during the lesson observation (Ono & Ferreira, 2010:64). Each of the PDT members should have a chance to share their reflection on the lesson (Leong, *et al.*, 2021:42). The purpose of reflection is to help with individual and team critiquing of the observed lesson. It also helps the PDT to share and implement the changes observed in the lesson observation. The PDT will get a chance to share their feelings about the lesson content through the reflection discussions.

The **self-critique** in an LSA will allow the teacher to become a **reflective practitioner** (Fernandez, 2005:283). In the reflection discussion of the observed lesson, the PTD teacher that presented the lesson should start by **conveying** their noted **feelings** during and after the teaching to improve **the quality of teaching** (Copriady, 2013:180; Chong & Kong, 2012:266; Ilmu, 2016:174). The observers would then **share the strengths** as well as the areas that **need improvement** and indicate with reasons if the lesson objectives have been achieved or not. Through consensus decision-making by the PDT members, the comments on the areas that need improvement would then be incorporated into the review lesson plan. In their **reflections**, the PDT members are expected to identify the **teaching and learning gaps** that could be used for **future planning** as well as to improve individual classroom teaching (Copriady, 2013:180; Ogegbo *et al.*, 2019:4). When the PLG shared their reflections on the observed lesson, they indicated challenges with **time allocation** and **time management**, as well as the **lack of**

appropriate teaching and learning resources. The first Grade 10 lesson was not finished within the allocated time, therefore the PLG discussed the ways **to manage time.** The findings from this research study revealed that, in the second lesson for Grade 10, the teacher **improved on time management** (*cf. 4.4*) which stemmed from the PLG **reflection discussion** of the first lesson. Therefore, the framework for the Grade 10–11 teachers **provides a space** in the ALEI-PDSI lesson observation checklist **under the PDSI aspects** where the PDT should **evaluate and see how** the **allocated time and time management** were **used** in the LSA.

During an informal discussion with the PLG, I was very curious to find out how they were reflecting on the other lessons. Most of them indicated that they **did not reflect** on the lesson presentation because of lack of time and reflection seemed to be of **no importance to them.** The framework suggests that the PDT should always commit the time for reflection on the lesson. Therefore, I deemed it fit to **develop** the **guiding questions** as part of Grade 10–11 framework for the Namibian Biology teachers which help the PDT **during the reflection discussion** of the observed lessons. The guiding questions **will guide** the PDT to **note down the critiqued points while observing** the lessons and the **notes will be used** in the **reflection discussions** of the observed lessons. In this framework, together with the ALEI-PDSI lesson observation checklist and the observation notes from the guiding questions, they will serve as a guide to the reflection discussion. The guiding questions will also help the PDT to **value reflection** in the LSA process and to have a **deeper focus** on the reflection discussion (Leong, *et al.*, 2021:43). The following are the guiding questions (*cf. Table 5.3*) that I developed for all the PDT members who will use the framework for Grade 10–11 teachers in Namibia.

Table 5.3: Guiding questions

- Have you included assessment tools to determine if learners meet lesson objectives?
- Can you identify concepts with which learners have difficulty?
- Did you indicate strategies to incorporate difficult concepts in appropriate ways in lesson components?
- Was the assessment appropriate for all the learners?
- To what **extent** did the whole class learn what you **intended them to learn**? Cite specific examples.
- What did you **learn about** your **learners** as learners?
- How **well** did your lesson support the **diverse needs** of your **learners**?
- **Why** do you believe your **choice of knowledge** was **appropriate** for this lesson/unit?

- **What changes**, if any, might you make in:
 - **Planning**
 - **Management**
 - **Instruction**
 - **Assessment**
- What have you learnt about yourself as a teacher (**self-reflection/critiquing**)?
- What **goals** do you have for yourself as you plan **future lessons**?
- To what extent did learners learn about ESD?

The above questions are the overview of all the LSA steps and learner activities as well as the reflection on the lesson. The review lesson plan is discussed in the next section.

5.2.6 Reflection discussion and reviewing the lesson plan

The LSA allows for the repetition of cycles. This means that in this framework the concepts like planning, doing, seeing and improving will be revisited. At this step, the framework requires the PDT to commit time to review and discuss the lesson. The availability of every PDT member is very important so that everybody can acquaint themselves with all the LSA processes. Considering the concept of planning in the framework for the Grade 10–11 Biology teachers that I developed, reviewing the lesson plan offers the opportunity for the team members to **reflect** on what they learnt and to **act** on it (Leong *et al.*, 2021:45). In reviewing the lesson plan, the PDT should think about the **changes** they can **make in the lesson plan** which will help to **improve the lesson** and **help the learners** to **reach the lesson objectives**. When reviewing the lesson, the PDT should consider all relevant recommendations and review the lesson accordingly. The PDT must agree if they want to rewrite the lesson plan or make amendments to the original lesson plan. If the PDT agree to amend the original lesson plan, they can make a copy and then highlight, italicise or use a different font to identify new changes (Leong *et al.*, 2021:47). The original lesson plan should always be kept in a safe place for future reference. The PDT can then use the reflection discussion questions (*cf.* 5.3.5) to verify if they planned what they wanted to achieve.

The next section discusses the re-teaching and observation of the reviewed lesson plan.

5.2.7 Re-teaching, observing and critiquing the reviewed lesson

In this section, as part of the Grade 10–11 framework for Biology teachers in Namibia, the concepts of doing and seeing will be revisited. Time allocation and time management are very important in this LSA step (*cf.* 5.3.4). Therefore, the PDT members should ensure that they

allocate enough time for this activity. The aim is to improve the reviewed lesson. After reviewing the lesson, the **same** PDT member who taught the first lesson should also reteach the reviewed lesson to a different group of learners. The reviewed collaborative lesson plan should be used to teach the lesson and the teacher is expected to teach as planned. The teacher should consider the suggestions made during the **post-lesson reflection discussion** (Huang & Shimizu, 2016:4). This time during observation, the observers should again use the ALEI-PDSI lesson observation checklist to critique the lesson and **determine** what **developmental changes** are **visible between the two lessons**.

In the results of this study, it was observed that TP2 stated in the **reflection discussion** of the lesson observation that she was nervous when teaching the first lesson, but the reviewed lesson discussion helped her to become more **confident** when teaching the second lesson. From the reflection discussion of the reviewed lesson observation, the findings indicated that presentation skills were developed in the teacher, the observation skills were developed in the observers, while the reflection and critical thinking developed in all the PLG members (Bruski, 2016:1). In this framework for Grade 10–11 Namibian Biology teachers, the PDT should be **involved** in recurrent **collaborative teaching** and **observation** of the lessons to **remove the fear of being observed** and to improve on the observation skills by the PDT members.

When one of the PDT members is presenting the reviewed lesson, the process is continued with other PDT members observing and taking notes. The observation for the reviewed lesson follows the same procedure as in section 5.3.4. The lesson observation checklist should be used to critique the reviewed lesson plan and together with the reflection notes, they serve as evidence used in the reflection discussion of the reviewed lesson plan. From the research study I conducted, I noticed the improvement in the PLG teachers' use of teaching and learning resources, changes in the teaching and learning approach as well as the knowledge and skills that were developed. This adapted framework has been designed in such a way that the PDT will be involved in the recurrent teaching and learning of the lessons, in thinking of ways to find and use the appropriate teaching and learning resources to teach lessons, and lastly, to consider good approaches they can use to teach lessons sustainably.

The next section discusses the final step, namely the reflection discussion of the reviewed lesson.

5.2.8 Sharing the results of the reviewed lesson through reflection discussion

At this stage, the concept of **improvement** will be visited. Making the time available and the attendance of all the PDT members will provide justice to the reflection discussion of the reviewed lesson. The PDT members should then meet again and **reflect** on the lesson to determine the strengths of the lesson and areas that need improvement in the reviewed lesson. The reflection discussion for the reviewed lesson follows the same format as described in section 5.3.5. The amended ALEI-PDSI lesson observation checklist and the reflection notes will be used during the reflection discussion of the reviewed lesson. If the PDT shows satisfaction with the **lesson improvements**, then the **cycle ends**, if not then the team should **refine further** to their **satisfaction**. The framework for the Grade 10–11 Biology teachers in Namibia **provides opportunities** for the PDT to **become involved** in the **eight cyclical steps** of the **LSA process** and the **recurrent collaboration discussions, presentations and observations** of the lessons **throughout the whole process**. The recurrent collaborative discussions of the planned and presented lessons will **lead to** the PDT's **satisfaction and development of professional growth** which will then **increase** their **confidence** (*cf. Figure 5.1*) (Wood *et al.*, 2017:4).

5.3 DEVELOPMENT OF THE FRAMEWORK FOR GRADE 10–11 BIOLOGY TEACHERS IN NAMIBIA

The framework for the Biology Grade 10–11 teachers in Namibia that I developed is based on the theory of situated learning and constructivism through social constructivism (Clancey, 1995:3). The PDT should be **aware** of the **situations** in which **they find themselves** as well as **their learners** when planning the lessons. This framework advises the PDT to **consider** the **active involvement** of the **learners** in all the **planning, doing, seeing and improving** steps of the LSA. We know that learners become actively involved in the lesson when their prior knowledge is considered, thus the PDT are advised to **plan lessons** that **give learners the chance to engage with real-life situations, problem solving and challenging activities that require critical thinking abilities** (Schunk, 2012:2021). In Chapter Two, I discussed learning through **social constructivism** as supported by Vygotsky (1978).

In social constructivism, the **learning** which is supported by the framework for the Grade 10–11 Biology teachers in Namibia should **be shared**. The social constructivist theory emphasises teacher motivation to reflect on their expertise, and create and evaluate their understanding to

be able to share them with others (Vygotsky, 1978). Therefore, the framework for the Grade 10–11 Biology teachers in Namibia that I developed allows opportunities for the PDT to analyse, reflect, critique and share their understanding through the reflection discussions of the planning and observation of the lessons. In this research study, in the collaborative discussions of the lesson planning and observation and the contents of the reflective diaries, knowledge was a shared responsibility among all the PLG members (Vygotsky, 1978:90). Thus, in the processes of the LSA, the PLG were involved in the construction of knowledge through social compromise, reflection and clarification of thoughts and ideas (Vygotsky, 1978:90). From this research study, I could see that co-planning led to more active learning of learners and a better lesson. This framework is informed by the **theory of experiential learning** whereby the lessons are planned in such a way that **knowledge is created** by the PDT members, who through the reflection of what they have learnt and experienced gain new knowledge that develops them professionally – this is an important component of this framework (Kolb, 1984:38; Wood, 2019:39).

The framework for the Grade 10–11 Biology teachers recommends that the PDT use the amended LSA lesson plan template when planning an LSA lesson (*cf. Table 5.1*). The framework further recommends using the amended ALEI-PDSI lesson observation checklist to critique the LSA lessons during the lesson observations (*cf. Table 5.2*). In the framework that I developed, I wanted to include good planning with appropriate teaching and learning resources that are suitable for all learners' needs. Planning was a challenge that emerged in this research study. I am aware that teachers' workload is a challenge in schools. I, therefore, wanted the user of this framework to think about time allocation and time management, and also to reflect on the lesson throughout the entire LSA process. In the framework for the Grade 10–11 Biology teachers, schools and teachers must be very careful when planning. When talking about **planning** and **workload**, schools and teachers have to **allocate time** to plan and how long to plan. They also need to find out if every member of the PDT is available for planning, presentation and observation and reflection discussions. In this framework, everyone should be committed to collaborative planning, reflection discussions and reviewing the lessons. As indicated in Chapter Two, Namibian teachers are expected to participate in and pay attention to the professional development activities, namely conferences, workshops and peer observation for the lessons on a topic of their interest (*cf. 2.3–2.3.2*), and the LSA is one of these activities, so allocating time for it is non-negotiable.

The following diagram, Figure 5.2 indicates the status quo of the Grade 10 Biology teachers before they are introduced to the LSA framework (left pyramid) and how I want them to be after they are introduced to the LSA framework (right pyramid) that I have developed.

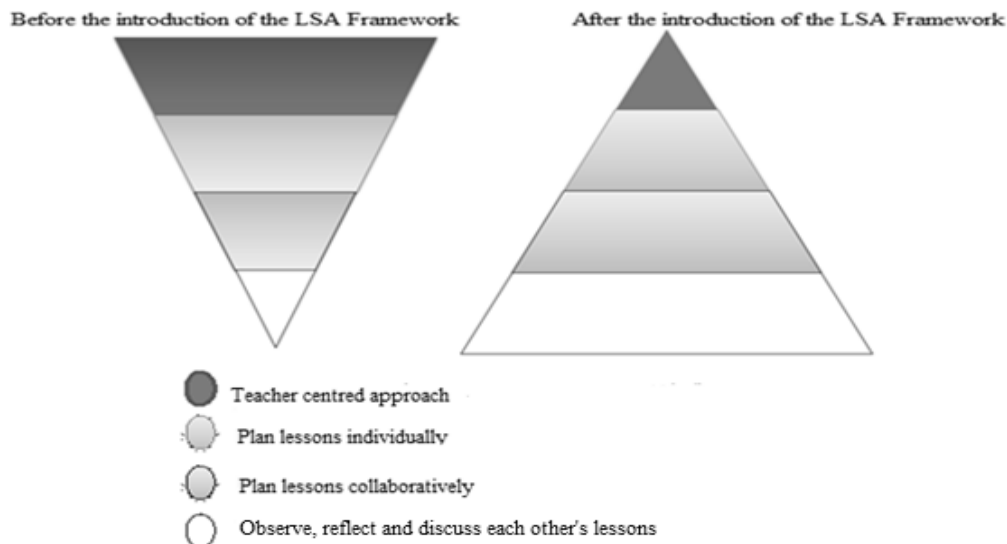


Figure 5.2: The Biology teachers' activities to improve teaching (adapted from Lewis, 2004:130)

Figure 5.2 as a component of the framework for the Grade 10–11 Biology teachers in Namibia was developed in a way that it is obligatory for the teachers who will be involved in an LSA process to spend their professional development time in collaborative planning of the learner-centred lessons (*cf.* 4.3). These teachers are also expected to allocate and commit their time to observations, reflection discussions and reviewing the actual classroom lessons (*cf.* 4.4) as shown by the two bottom sections of the right-hand side pyramid. The framework is appealing to the teachers to try refraining from the individual planning of the lesson and teaching in a teacher-centred manner. Therefore, reflection and time allocation and time management are important commodities and very prominent in the implementation of the LSA process and every PDT member is expected to commit to it to ensure the effective implementation of the LSA. The effective use of time will make reflection possible, which will then lead to the professional development and improvement of the PDT members in terms of:

- the use of teaching and learning resources;
- changes in lesson planning and observation;
- effective classroom teaching and learning;
- teaching and learning approach;

- consensus decision-making;
- better learning opportunities for the learners;
- problem solving;
- knowledge and skills development: observation, presentation and critical thinking (*cf.* 3.3.2 and 4.5); and
- promotion of ESD in the lesson.

5.4 CONCLUSION

This chapter provided the Namibian LSA framework for Grade 10–11 Biology teachers who want to enhance their teaching praxis to educate for sustainable development that can be adapted by Grade 10–11 Namibian teachers who are teaching Biology. The framework will help the Grade 10–11 Biology teachers to grow professionally when they are involved in recurrent reflection discussions to improve learners' learning. I discussed the LSA cyclical steps of plan, do, see and improve that other authors and researchers applied in their research.

The ways to overcome the lack of time, time allocation and management, the lack of teaching and learning resources and the workload of the PLG as the factors that hamper the effective implementation of the process of the LSA were discussed in this chapter (*cf.* 5.3.2–5.3.8). The developed framework for the Grade 10–11 Biology teachers will help the teachers who are using the framework to find solutions to the lack of teaching and learning resources in schools when implementing the LSA. The developed framework requires Biology teachers to understand the value of time and reflective practice when involved in a repetitive cycle of plan, do, see and improve.

In the final chapter, I summarise the main findings of the research study and make recommendations for future research. Limitations of this research study are also pointed out, after which the thesis concludes.

CHAPTER SIX: SUMMARY, CONTRIBUTION, RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

6.1 INTRODUCTION

The preceding chapter presented a Namibian LSA framework for Grade 10–11 Biology teachers to enhance their teaching praxis to ESD. In this chapter, I discuss the main findings that emerged from this research study. To achieve the aims and objectives of the research study, the data were gathered with the participation of the PLG teachers in the lesson planning discussions, reflective discussions on the observation of the presented lessons (that used the ALEI-PDSI lesson observation checklist to guide the discussion), the discussions of all PLG members' reflective diaries and my analysis of the reflective diaries. This chapter presents the summary of the literature and empirical research study and the contributions of the study. The recommendations and limitations of the research study will be presented in this chapter. A self-reflection will precede the conclusion of this chapter. In the next section, I move to the purpose of the research study.

6.2 PURPOSE OF THE RESEARCH STUDY

The purpose of this research study was to establish how the LSA was integrated by the Grade 10–11 Biology teachers to enhance their teaching praxis in ESD. The three objectives of this research study were to:

- establish how Grade 10–11 Biology teachers integrate the LSA in their teaching praxis;
- determine factors that hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA; and
- design a Namibian LSA framework for the Grade 10–11 Biology teachers to enhance teaching praxis to educate for sustainable development.

The summary of the literature and empirical study is discussed in the next section.

6.3 SUMMARY OF THE LITERATURE AND EMPIRICAL RESEARCH STUDY

The research study was divided into six chapters as follows.

6.3.1 Summary of findings from Chapter One: Orientation of the study

This research study was conducted to establish how the LSA was integrated by the Grade 10–11 Namibian Biology teachers to enhance their teaching praxis and foster ESD. This chapter was an orientation to the study and presented the key elements of the research process. These included the background introduction of the study, the rationale of the study, the research problem, research questions, research objectives and the clarification of concepts. The chapter also outlined the research design, the methodology and the paradigm of the research study. The chapter further discussed the recruitment and context of the research site and elaborated on the data generation methods and tools and the data analysis strategies. The chapter concluded by explaining the roles I had to fulfil and the ethical aspects of the research study and provided the possible contribution of this research study to the teaching of the subject of Biology.

6.3.2 Summary of findings from Chapter Two: Review of the literature

This chapter presented a detailed discussion of the review of related literature that was related to the ESD and the LSA. The ESD is a teaching and learning approach that enables people to acquire the necessary knowledge and skills to shape a sustainable future (Jucker & Mathar, 2015:3). United Nations Educational Scientific and Cultural Organization (UNESCO) is the body that is responsible for the advocacy of ESD goals (*cf.* 2.2) and advocates that teachers should be trained to infuse ESD in the curriculum in schools. The literature revealed that most Japanese schools implement LSA and promote ESD in their country as members of the UNESCO School Association. It was also indicated that the Finnish and Kosovan education systems have undergone reform to incorporate ESD in their curricula. Finland promotes ESD by implementing it in its school curriculum, but Kosovo does not encourage the implementation of ESD in their schools. The literature revealed that the implementation of ESD in the school curriculum increases the ability to solve problems and develop commitment, self-confidence, self-esteem and self-awareness of learners. There are some problems experienced in the implementation of ESD globally, such as a lack of teaching and learning resources and teachers who lack the background regarding ESD and cannot effectively implement it (*cf.* 2.2.1).

In Namibia, the literature revealed that progress has been made by the Namibian government towards environmental sustainability. Land, poverty, deforestation, water management pollution and HIV/AIDS are some of the environmental challenges faced in Namibia and have slowed the progress towards sustainability. The 5th National Development Plan, Harambee Prosperity Plan and Vision 2030 outline how to curb the aforementioned challenges in Namibia. The above-listed document was supported by the Life Science and SEEN projects (*cf.* 2.2.2) that develop the teaching and learning resources that can be used to teach ESD across the curriculum. The Life Science and SEEN projects have trained teachers on how to use available resources to acquire knowledge and skills, for both teachers and learners, to promote sustainable development. In addition, the Namibian government developed the EE/ESD Policy in 2019 which is fundamental to the implementation of ESD. The aim of the EE/ESD Policy was to incorporate ESD in teaching so that teachers and learners are equipped with new knowledge and promote new ways of thinking. The EE/ESD Policy provides guidance and different strategies to education stakeholders on how to promote environmental sustainability in society. The development of a framework to infuse ESD into the teaching of Grade 10–11 Biology is a possible way to promote the teaching of ESD using the LSA.

The literature revealed that the LSA, as a teacher professional development activity that originated in Japan in the 1800s, became a global pedagogical model and has been practised by many teachers to improve their lessons. The implementation of the LSA involved four stages, namely plan, do, see and improve. This simply means that teachers come together to plan a research lesson, one teacher teaches the lesson while the others observe. After teaching and observing the lesson, the teachers sit again to discuss and share their observations on the lesson to make improvements to the lesson. The LSA in Japan is practised as a school-based, a cross-school and a cross-district approach (*cf.* 2.4.1.1). The literature revealed that the American LSA is organised like the Japanese, as a cross-school or a cross-district approach but not as a school-based approach (*cf.* 2.4.1.2). The LSA was also implemented in Europe, and the study conducted by Özdemir in a Turkish school revealed that most primary school teachers involved in the implementation of the LSA had the opportunity to observe different practices other than their own (*cf.* 2.4.1.3). The literature revealed that in Africa, Kenyan teachers have been trained at the Centre for Mathematics Science and Technology Education (CEMASTE) during holidays to share problems experienced in teaching. Kenya has put a teaching and learning programme together called SMASE to train the Mathematics and Science teachers to

plan a learner-centred activity that can be done through experimenting for improvement (*cf.* 2.4.1.4.1). In South Africa, the LSA was first introduced in the Mpumalanga province with the launch of the project called MSSSI. The project aimed to train in-service teachers to improve their Mathematics and Science teaching (*cf.* 2.4.1.4.2). In Zambia, the LSA was introduced in 1990 and the Ministry of General Education in Zambia introduced the two-year programme called SMASTE and STEPS. The two Zambian projects helped the Mathematics and Science teachers with capacity development and to improve their teaching skills (*cf.* 2.4.1.4.3). In Namibia, the term ‘LSA’ was heard for the first time in early 2010 when Namibian teachers, who were teaching Mathematics, Biology, Chemistry and Physics, participated in the training held at CEMASTE in Kenya. These Namibian teachers were trained on how to teach their subjects in a way that learners could better understand. The Namibian government could not follow up with those teachers to see how they implemented the LSA because the LSA was not on their list of priorities (*cf.* 2.4.1.4.4). The literature revealed that the implementation of the LSA helps with the professional development of the teachers when involved in the LSA steps of plan, do, see, and improve the lessons (*cf.* 2.3; 2.3.1; 2.3.2; 2.4.2). Despite that, the literature indicated some challenges that teachers experienced in the implementation of the LSA, namely a lack of time, a high workload and the lack of appropriate teaching and learning resources (*cf.* 2.4.3).

6.3.3 Summary of findings from Chapter Three: The research methodology

Chapter Three presented the detailed research study methodology. It included a description of the cyclical steps and procedures that were followed in the qualitative PALAR approach. I used the PALAR approach because it helped the PLG to engage in reiterative cycles of learning through ongoing and self-reflection when planning, teaching and observing the lessons (*cf.* 3.2.2). The research study took place at GwaaNampano Gweegonga Secondary School in the Onathing Circuit, Oshikoto Region, Namibia and involved four PLG teachers who were teaching Grade 10–11 Biology. Their teaching experience ranged from eight to 19 years. This research study was based on Kolb’s (1984) experiential learning regarding the gathering of data (*cf.* 3.2.3). The data in this research study were gathered through lesson planning, lesson observation and reflective discussions and narratives on the presented lessons, the reflection discussions of the PLG members’ reflective diaries as well as my analysis of the reflective diaries. The tools used to gather the data were, namely personal lesson plans, collaborative lesson plans using the LSA lesson plan template, the ALEI-PDSI lesson observation checklist,

reflective diaries and the verbatim transcripts of the informal group discussions (*cf.* 3.4). It was important to authentically bring about benefits for all the PLG members in the research study process (Lincoln & Guba, 1985:991). In this PALAR approach research study, the ability to encourage collaborative participation and democratic decision-making were vital to the validity of this approach. Therefore, the validity of this research study was obtained through the generation of new knowledge (dialogic validity), the achievement of action-oriented goals (outcome validity), the education of both me, as the researcher, and the PLG teachers (catalytic validity), the results that were relevant to the local setting (democratic validity) and a sound and appropriate research methodology (process validity) (*cf.* 3.8.1 – 3.8.5). Triangulation was also used in this research study to confirm the trustworthiness of the research process (Stake, 2000:454) (*cf.* 3.8.6).

In conducting this research study, the ethical aspects were considered. I submitted the research proposal to the COMBER Scientific Committee for approval of the proposal. Therefore, ethical clearance was approved by the Research Ethics Committee of the Faculty of Education, (EduREC) of the North-West University (Maree, 2013:306) with the reference number **NWU-01113-20-A2**. I obtained approval to conduct this research study from the Oshikoto Regional Education Director and permission was granted by the principal of the school where the research was conducted. All participants provided consent to participate in the research. By conducting a research study of this kind, I was aware of abiding by the three ethical principles of “autonomy, non-maleficence and confidentiality” concerning the PLG teachers (*cf.* 3.9.1-3.9.3).

6.3.4 Summary of findings from Chapter Four: Data analysis, presentations and discussions

This chapter presented, discussed and interpreted the analysed data gathered from the lesson planning discussions, reflective discussions and narratives on the observation of presented lessons, the reflection discussions of the PLG members’ reflective diaries as well as my analysis of the reflective diaries. All PLG members involved in this research study collaboratively planned the four lessons using the LSA lesson plan template, observed using an ALEI-PDSI lesson observation checklist and took part in the reflective discussions on them. The findings of the LSA lesson planning and discussions indicated that it brought a change in the lesson presentation. A huge improvement was indicated from the planning and presentation of lessons 2 to 4. The findings revealed that the LSA lesson planning and discussions brought

changes in the personal teaching and learning approaches of the PLG teachers. The collaborative planning and discussions in the implementation of the LSA helped the PLG members who were involved in planning good lessons. The LSA planning and discussions helped them to improve on time management during the lesson presentation of lessons 2 and 4. The collaborative planning and discussions of the four lesson plans helped the PLG to progress from lesson planning 1 to lesson planning 4 when the LSA cycle of this research study ended (*cf.* 4.3).

The four collaborative lessons that were planned were observed using the ALEI-PDSI lesson observation checklist. The observers determined if what they planned was taught by ticking a number from 0–4 that corresponded to the aspects of the LSA. The reflection discussions of the observed lessons raised the confidence of the PLG in the implementation of the LSA. It helped the PLG to work on their identified challenges in the first lesson and thus improved the presentations. The discussions and observations of the PLG on the LSA raised professional skills in the planning and implementation of the LSA.

The findings indicated challenges that were experienced in the implementation of the LSA, namely workload, time, time management and the lack of teaching and learning resources. The PLG teachers could not attend all the lesson planning and observation discussions due to the heavy workload. The time allocated was not enough for the PLG to come together for planning, observation and discussions of the lessons as some of the PLG teachers were not available and could not commit time to these activities. The lack of science laboratories and textbooks disturbed the effective implementation of the LSA. The recommendations in Chapter Five were made to help the teachers who will be using the framework for the Grade 10–11 Biology teaching to improve the lack of teaching and learning resources in schools when implementing the LSA. The recurrent planning, discussions and reflection discussions of the PLG in the PALAR cyclical process of the LSA led the PLG to perfect the planning and execution of lessons (*cf.* 4.3 - 4.5). The findings from this chapter answered research questions one and two, namely: *How do Grade 10–11 Biology teachers integrate the LSA in their teaching praxis?* and *What factors hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA?*

6.3.5 Summary of findings from Chapter Five: The Namibian Lesson Study Approach Framework for Grade 10–11 Biology teachers

This chapter presented new knowledge that emanated from the research study. The outcome of this chapter answered research question 3: *What should a Namibian LSA framework look like for the Grade 10–11 Biology teachers to enhance their teaching praxis to educate for sustainable development?* This chapter provided a detailed description of the Namibian LSA framework that I developed. The developed LSA framework emanated from the findings of this research study and was adapted from the LSA steps of Stigler and Hiebert (1999) as follows.

I recommend that four to six teachers form a **professional development team (PDT)** to **collaboratively design a Biology lesson that addresses ESD**. The PDT must be able to identify content in the prescribed curriculum that addresses ESD. The PDT must be able to **design a lesson** collaboratively and **observe it as a team** while it is **presented**. After the lesson observation, the lesson is **reflected** on before it is **re-planned and retaught**. The PDT must be able to **set time aside** for **reflection discussions** and **ensure the availability of every PDT member**. The developed framework requires collaborative recurrent planning, observation and reflection discussions from the committed PDT members for effective classroom teaching and learning. The developed framework will help to **create better teaching and learning opportunities** for both the PDT and their learners. The planning component in the framework can help the PDT to find ways to make use of **appropriate teaching and learning resources**. The PDT must **show a good working relationship** through the **LSA process**. The framework is developed to be accessed and adapted by the Namibian teachers who are teaching Grade 10–11 Biology to guide them on how they can develop professionally in their teaching of Biology.

The next section discusses the achievement of the overall aim of the study.

6.4 ACHIEVEMENT OF THE OVERALL AIM OF THE STUDY

This study developed an LSA framework for the Grade 10–11 Biology teachers to enhance their teaching praxis to ESD. The framework can direct teachers to develop professionally and bring changes in their classroom teaching by implementing the LSA. The involvement of the PLG teachers to provide guidelines for this framework and the recurrent collaborative planning, observing and reflection discussions helped increase their confidence and remove the fear of being observed.

The overall aim of this research study was achieved by addressing the research objectives of this study through the development of an LSA framework for Grade 10–11 Biology teachers that was presented in Chapter Five. The research study familiarised the involved PLG teachers with the LSA, and therefore, teaching using a learner-centred approach. The PLG collaborated and critiqued the planning and presenting for the betterment of both planning and presenting the lesson. The PLG shared the challenges of Biology teaching, namely time and resources and opened up possible ways to address these challenges. The research study familiarised the PLG teachers with the LSA lesson planning template and the lesson observation checklist. In this research study, I re-designed the lesson plan and the observation checklist to be used together with the developed framework.

The following section shares how each of the objectives was addressed.

6.5 ACHIEVEMENT OF INDIVIDUAL OBJECTIVES OF THE STUDY

This research study was founded on the achievement of three objectives. The objectives are mentioned and then an indication of how they were met will be discussed.

***Objective 1:** Establish how Grade 10–11 Biology teachers integrate the LSA in their teaching praxis*

The findings for objective 1 indicated that after the implementation of the LSA, the PLG members had the common understanding that the implementation of the LSA process involved the cyclical steps of plan, do/see and improve. The findings also indicated that the LSA process was done and implemented as follows: The PLG planned a lesson in collaboration using the LSA lesson plan template. Initially, the PLG teachers had problems planning because they indicated the lesson plan template took too long to complete and had many components. Later, they found it simple after discussing its content. All PLG members planned four lessons, presented and observed them using the ALEI-PDSI lesson observation checklist and then critiqued it.

The PLG teachers experienced the challenges of workload, and lack of time and resources in their implementation of the LSA. The challenge of time was addressed during the reflection discussions of the observed lesson and the presenter showed improvement from the teaching of lesson 1 to the teaching of lesson 2. Some PLG teachers missed some of the LSA processes

due to their workload. The workload and resources were addressed by the framework that I developed in Chapter Five.

It emerged that when all the PLG members were collaboratively involved in the LSA process, they showed a good working relationship, became knowledgeable and skilful and brought a change in the classroom through the recurrent collaborative planning, observation and reflection discussions of the lesson (*cf. 4.6*). The findings indicated that repeated practice, which the PLG was involved in, allowed for better implementation of the LSA. The findings also indicated that ESD was not addressed by the PLG teachers, because to them, it was not their priority in this research study. They were more interested in the LSA process using the steps of plan, do, see and improve. Education for Sustainable Development (ESD) can be addressed if the teachers make use of the framework that I developed in Chapter Five.

Objective 2: Determine factors that hinder or facilitate the teaching praxis of Grade 10–11 Biology teachers who make use of the LSA

The findings indicated that the PLG teachers' workload, lack of time and resources and time management (*cf. 4.5*) were the challenges that hindered the teaching praxis of Grade 10–11 Biology teachers who made use of the LSA in this research study.

The findings revealed that the workload of the PLG teachers (*cf. 4.5: Theme 1*) resulted in them not attending the meetings, namely some planning and reflection discussions and lesson observations. Instead, these PLG members had to attend to other managerial activities or to the demands of teaching, which in the end resulted in them not fully participating in the planning, observations and discussion meetings.

The findings also indicated that time is needed for collaborative planning, observation and reflection discussions of the planned and observed lessons (*cf. 5.5: Theme 2*). The study further indicated that the issues of time allocation and time management could only be addressed if the PLG members commit to the time in the LSA process. Therefore, securing the time for the LSA activities will help in the effective implementation of the LSA process.

The research study revealed that teaching and learning resources are some of the factors that also hinder the implementation of the LSA. As there was no science laboratory at the school and the government also did not provide teachers with the needed teaching and learning

resources (*cf. 4.5: Theme 3*), it was not easy for the PLG teachers to conduct proper activities in the laboratory. The sharing of a textbook by four learners was also revealed by the research study (*cf. 4.5: Theme 3*), which resulted in the learners not getting a chance to do their homework activities for reading and understanding the lesson content. The research study indicated that the lack of teaching and learning resources could be addressed if the PDT consults the neighbouring schools as well as the Regional Office for assistance. Schools can allocate a budget for laboratory apparatus for better implementation of the LSA.

The research findings revealed the following factors that facilitate the effective teaching praxis of the LSA which were included in the developed framework in Chapter Five:

- committed PDT members;
- recurrent collaborative planning, observation and reflection discussions (repetitive action of plan, do/see and improve);
- the use of appropriate teaching and learning resources;
- improvement of the lesson planning and observation;
- effective classroom teaching and learning;
- consensus decision-making by the PDT;
- use of effective teaching and learning approach (learner-centred approach);
- better learning opportunities for learners;
- knowledgeable and skilled PDT members; and
- good working relationships among the PDT.

Objective 3: *Design a Namibian LSA framework for the Grade 10–11 Biology teachers to enhance their teaching praxis to educate for sustainable development*

Results from the research findings and the literature that was consulted revealed that the LSA has been mostly implemented in Japan in Mathematics education. Most of the countries that have practised the LSA used the LSA framework developed by the Japanese. Developing an LSA framework for the Namibian Grade 10–11 Biology teachers to enhance their teaching praxis to ESD in a uniquely African context can aid to promote LSA implementation. The fact that Namibia has an EE/ESD policy in place has to be addressed by the teachers. The framework was developed in a way that requires the teachers to form a PDT that will involve a cyclical process of planning, teaching and observing as well as reflecting on the lesson in

collaboration. The amended LSA lesson plan template can be used when designing an LSA lesson. Together with the reflection guiding questions, the amended ALEI-PDSI can be used when observing the LSA lessons and for the reflection discussions of the observed lessons. The framework that I developed requires the PDT to commit the time, ensure good time management and make sure that everyone is available at each LSA step of plan, do, see and improve. They must also be able to organise the correct and appropriate teaching and learning resources for the teaching of ESD lessons.

6.6 CONCLUSIONS OF THE EMPIRICAL STUDY

This theoretical and empirical study revealed that this research study followed the PALAR's theory of learning, specifically the Lewinian experiential learning theories which I adapted from Kolb (1984) (*cf.* 3.3.3). The learning in this research study was developed as a process whereby knowledge was created through the transformation of experience. The experience in the implementation of the LSA in this research study revealed that the PLG teachers were learning from each other through the identification of their own problems and finding solutions to their own problems through critical reflection in a PALAR cyclical process. The PLG shared their experiences during the planning, observing and critical reflection of the planned and observed lessons.

The conclusions of the empirical study also found the following:

- The LSA, as professional development for teachers, which undergoes the four steps of plan, do, see and improve in a cyclical process, was and still is implemented in different countries including Namibia (*cf.* 2.4).
- The recurrent reflection discussions of the planned and observed lessons in which the PLG is involved led to lesson improvements (*cf.* 4.6).
- The Grade 10–11 framework was developed for the benefit of Biology teachers in the form of professional development. The developed framework expects the Namibian teachers to refrain from planning their lessons individually, from teaching in a teacher-centred manner and to move to collaborative planning, observing and reflecting on learner-centred lessons (*cf.* 5.4).
- Teachers must address the National EE/ESD policy in their teaching and learning.

6.7 CHALLENGES AND LIMITATIONS OF THE STUDY

It is a fact that every situation has a limit. This research study had limitations too. The major concern in conducting this research study was time. I personally feel that the period for generating the data was not enough, as it was during the National External examination for the Grade 10 and 11 learners. The PLG teachers were more focused on spending plenty of time preparing learners for the end-of-year examination. This could have been avoided during the setting up of the PLG plan of action. I had to re-schedule the data lesson planning activity to a date that suited all PLG teachers. The workload of some of the PLG teachers resulted in the postponement of some of the lesson planning and discussions due to their unavailability and some could not attend all the steps of the LSA process. This resulted in less shared learning during the planning, observations and reflection discussions as some were absent from the reflection discussions (*cf* 4.6).

In Chapter One, I indicated that little attention was given to ESD in the school curriculum. It was evident in this research study that ESD did not feature in the discussions of the PLG teachers as their priority. They instead prioritised how to plan and teach the lessons using the LSA cycle. The developed framework in Chapter Five will make it possible for ESD to be part of the PDT lesson planning.

6.8 RECOMMENDATIONS FOR FUTURE PALAR RESEARCH STUDIES

I recommend the following areas for further research:

(a) As this study identified that lack of time, time allocation and time management, teachers' workload and the lack of appropriate teaching and learning resources as challenges in the implementation of the LSA, I recommend that future research be conducted that focuses on how Biology teachers dealing with those challenges are managing to overcome them when implementing my proposed framework that I developed in this research study.

(b) In this study, I developed a framework that can be adapted by the Grade 10–11 Biology teachers in Namibia. I am recommending that a study be conducted on how Namibian school teachers are implementing ESD across the curriculum using my proposed LSA framework.

6.9 REFLECTION ON THE RESEARCH STUDY

This qualitative PALAR LSA research study attempted to gain insight into the implementation of the LSA by the Grade 10–11 Biology teachers in one Namibian state secondary school in the Oshikoto Region. The study has addressed the stated aim and objectives and answered the research questions.

Through this study, I got to experience how the LSA is understood by teachers in schools. As a Senior Education Officer, through the literature on the implementation of the LSA, I gained a better understanding of how the LSA is implemented and this will now help me to share deeper researched findings and learnings with the Biology teachers in my region, Oshikoto. I believe this research study was necessary because it is a learning experience for the PLG teachers and myself.

From the findings, it can be concluded that Grade 10–11 Biology teachers can develop professionally when they implement the LSA. I have also realised through this study that the implementation of the LSA faces some challenges as was revealed. Such challenges include workload, a lack of time, time allocation and management and a lack of teaching and learning resources. This study made the PLG teachers aware of the above-mentioned challenges and helped them to realise the importance of addressing them. Through the recurrent reflection discussions and observations of the lessons, the PLG teachers gained confidence when sharing ideas during planning, teaching and observing the lessons. Through the recurrent reflection discussions, the PLG teachers developed the skills of planning, collaboration, observation, critical reflection and critical thinking.

I have learnt that developing a meaningful framework for teacher professional development is necessary for Namibia because teachers will then be taking ownership by using teaching and learning resources which bring changes in lesson planning and observation, thus leading to effective classroom teaching and learning.

The framework designed for this research study will be presented to the Oshikoto Education Directorate, the NIED, the TRCs and the Oshikoto Regional Council. The framework will be shared with the PLG teachers and other staff members at GwaaNampando Gweegonga SS and other schools through the Inspectors of Education.

6.10 CONCLUSION

This research study aimed to answer the research question: *How can the Lesson Study Approach be integrated by Grade 10–11 Biology teachers to enhance teaching praxis that will foster education for sustainable development?* It answered this question by explaining how the LSA was implemented by the Grade 10–11 Biology teachers at GwaaNampando Gweegonga SS. It was established that the LSA can be implemented in Namibian schools. The research question was also answered by indicating that teachers develop professionally through the implementation of the LSA. Lastly, this research study aimed to contribute to new knowledge which it achieved by developing a Namibian LSA framework for Grade 10–11 Biology teachers to enhance their teaching praxis to ESD.

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APPENDICES

Appendix A: Personal lesson plan template

LESSON PREPARATION	
TEACHER:	GRADE: 11A+B DATE: 25.03.21
SUBJECT: Biology	
TERM AND TOPIC: Excretion in humans	
LEARNING AIDS AND RESOURCES TO BE USED: Textbooks	
LEARNING OBJECTIVES WITH THE LESSON: Learners will:	
	1. acknowledge the necessity to remove toxic waste products of metabolism.
BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to:	
	3.11
PRESENTATION OF THE LESSON:	
1. Monitoring of homework done:	Correction on previous given.
2. An appropriate short introduction:	Define excretion.
3. Presentation of subject content and learning tasks:	Define deamination and describe formation of urea, breakdown of alcohol, drugs & hormones in the liver. Identify positions of ureter, urethra & bladder.
4. Consolidation:	urethra & bladder
5. ASSESSMENT / HOMEWORK / TASK / EXERCISES	
	No work given
OPPORTUNITIES TO DEVELOP LEARNERS' ENGLISH READING AND WRITING SKILLS IN THE SUBJECT:	
Reading activities:	Read in English
Writing activities:	Copy notes in English

Appendix B: Lesson Study Approach (LSA) lesson plan template

Activity, Learner, Experiment, Improvisation/ Plan, Do, See, Improve (ALEI-PDSI)

LESSON PLAN TEMPLATE

Name of a teacher:

Subject:

Date:

Class:

Duration:

Topic:

Sub-topic:

Lesson objectives:

Rationale:

Pre-requisite knowledge:

Teaching / learning resources/ materials:

Lesson development/presentation:

Stage/Time	Teaching/Learning activities	Learning point/s	Remarks/Reflection
Introduction:			
Development:			

Conclusion/ Consolidation			
Evaluation/ Assessment:			

Reading and writing skills:

Learner support/Inclusive:

Appendix C: ALEI-PDSI lesson observation template

Activity Learner Experiment Improvisation: Plan Do See Improve (ALEI-PDSI) Checklist

Please evaluate each of the following aspects of the lesson on the scale 0-4

(0 – not at all, 1 – a little, 2 – fairly adequately, 3 – adequately, 4 – a great deal)

Plan	Aspect	0	1	2	3	4
P1	The work plan took into account learners' backgrounds, such as learning difficulties, their needs/ interests/ misconceptions, growth of experimental skills and previous experience in relation to the topic.					
P2	The work plan was appropriate and realistic in the light of the lesson content and learners' abilities/ skills/ interests.					
P3	Teacher prepared appropriate and adequate materials for learners 'use.					

Do (teach)	Introduction	0	1	2	3	4
D1	Introduction incorporated previous knowledge/ skills/ everyday experience and linked them to the new topic.					
D2	Introduction was clear on what the teacher wanted the learners to learn.					
D3	Introduction was stimulating enough to arouse the interest and curiosity of the learners.					
	Development	0	1	2	3	4
D4	The lesson encouraged learners to express their prior experiences and explain their ideas related to the content.					
D5	The lesson encouraged learners to give their own hypotheses/ predictions and helped to discuss how they differed from those held by others and to verify them through experiments, facts, etc.					

D6	The lesson encouraged learners to give their own observations/ results in the experiment and to discuss how they differed from others.					
D7	The lesson facilitated process skills such as observing, measuring, identifying variables, planning experiments, etc.					
D8	Teacher dealt with learners 'questions, misconceptions and reinforced learning at each step.					
D9	The lesson encouraged active participation of learners as much as possible in the main teaching steps.					
	Conclusion	0	1	2	3	4
D10	The lesson encouraged learners to draw conclusions.					
D11	The teacher summarised the lesson and gave follow-up activities.					
D12	The lesson assisted to view the content in relation to what they come across in the society.					
D13	Teacher checked the accuracy correctness and appropriateness of the content through question-and-answer techniques.					
	Class management	0	1	2	3	4
D14	The teacher organised and conducted lesson taking into account the individual differences in students capability.					
	Instructional materials/ media	0	1	2	3	4
D15	The teacher made effective use of the teaching/ learning materials and media.					

See (evaluate)	Aspect	0	1	2	3	4
S1	The teacher supervised class work.					

S2	The teacher was attentive to the needs of learners – low and high academic ability.					
S3	The teacher kept eye contact on learners to monitor their feelings.					
S4	The teacher invited questions from learners.					
S5	The teacher asked questions to check quality of understanding.					

Improve	Aspect	0	1	2	3	4
IM 1	Teacher rephrased question or instructional statements as necessary.					
IM 2	Teacher interjected rightly and called to attention inattentive learners.					
IM 3	Teacher gave further guidance to learners on lesson activity /ies.					
IM 4	Teacher made appropriate adjustment in the conduct of lesson.					

ALEI	Aspect	0	1	2	3	4
Activity	The lesson was activity-focused					
Learner involvement	The lesson was learner centred					
Experiment effectiveness	The experiment(s) helped to achieve the objective(s) of the lesson					
Improvisation	Improvisation was practised during the lesson					

Appendix D: Request permission from the director



Private Bag X1290,
Potchefstroom
South Africa 2520

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Web: <http://www.nwu.ac.za>

Date

To: The Director of Education
Directorate of Education: Oshikoto Region
P/Bag 2028, Ondangwa
Namibia

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY IN A SCHOOL IN YOUR REGION

I hereby request your permission for a research study to be conducted at a particular school in the Oshikoto Region.

Information about this research study can be found below:

TITLE OF THE RESEARCH STUDY: A Lesson Study Approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development

ETHICS REFERENCE NUMBER: NWU-01113-20-A2

PRINCIPAL INVESTIGATOR/SUPERVISOR: Dr. LO de Sousa

ADDRESS: Private Bag X1290, Building C6 – office 105, Potchefstroom, 2520
luiza.desousa@nwu.ac.za

CONTACT NUMBER: 0182994727/0834686726

POST GRADUATE STUDENT: Ms. Alina Hambelela Angula

Ms Alina Hambelela Angula is a PhD student working under my supervision at the North-West University (NWU) in Potchefstroom, South Africa. She wishes to conduct a **research study** in one of the schools in your region. The research study under the above mentioned title forms part of a **doctoral research study in the Faculty of Education, North West University**. The research study will involve only teachers who are teaching Biology at Grade 10 to 12 learners. Please take some time to read the information presented here, which will explain the details of this study that is **entirely voluntary** and the teachers are free to decline participation.

This study has been approved by the **North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-01113-20-S2)** and will be conducted according to the ethical guidelines and principles of Ethics in Health Research: Principles, Processes and Structures (DoH, 2015) and other international ethical guidelines applicable to this study.

Permission to conduct the research will also be requested from the school principal upon your approval.

What is this research study all about?

- The study plans to investigate how the Lesson Study Approach is integrated by the Grade 10 – 12 Biology teachers to enhance teaching praxis to foster Education for Sustainable development.
- The objectives of the study are to:
 - Investigate how Grade 10-12 Biology teachers integrate the Lesson Study Approach in their teaching praxis.
 - Determine factors that hinder or facilitate the teaching praxis of Grade 10-12 Biology teachers who make use of the Lesson Study Approach.
 - Design a Namibian Lesson Study Approach framework for the Grade 10–12 Biology teachers to enhance teaching praxis and that will foster ESD.
- This study will be conducted at the school in a venue to be agreed with by the participants and will be conducted by an experienced researcher trained in the Lesson Study approach. **Four** participants, two males and two females will be invited to participate in this study and to attend three meetings and one workshop.

Why will the teachers be invited to participate?

- Teachers will be invited to participate in this research because they are Grade 10-12 Biology teachers and have the knowledge and understanding about the Lesson Study Approach and collaborative learning.
- They use the Lesson Study Approach in their teaching and learning.
- In addition, these teachers will be able to effectively communicate orally or in writing and be willing to take part in the study and co-operate with the researcher.

What will be expected of the participants (teachers)?

- Participants will be expected to attend a three-hour planning workshop which will take place at a suitable venue at the school.
- They will then be asked if the researcher could observe them during their initial planning in their lesson design stage according to the guidelines of the Lesson Study approach.
- Participants will be asked if they would allow the researcher to observe one of their lesson presentations.
- Two of the teachers will be asked to volunteer to conduct two lesson presentations.
- After the lesson presentations, teachers will be expected to give feedback about their engagement with the learning materials that they developed and implemented. This feedback session will be conducted after each lesson presentation and will take approximately an hour.
- During the aforesaid meeting the researcher will engage in a discussion with the participants so as to gain their feedback based on their experiences of presenting their subject and understanding the needs of learners in the classroom environment.
- The teachers will also be asked to take part in a focus-group interview with the researcher. The interview will take less than two hours.

Will the participants/teachers gain anything from taking part in this research?

- The teachers will gain insight into the Lesson Study Approach which may enrich their teaching and learning.
- Together with their colleagues, teachers will plan and present lessons that are well-planned and utilize the expert advice from colleagues in the same field of study which will result in enriched teaching activities.

Are there risks involved in teachers taking part in this research and what will be done to prevent them?

- There will be minimal risks for teachers participating in this study.

- There are more gains for participants in participating in this study than there are risks.

How will we protect the teacher's confidentiality and who will see the data?

- Anonymity of the data will be protected by using pseudonyms right from the onset. The teachers' identities will be protected by not availing their personal details to anyone else.
- Their identities will be kept confidential by the researcher even when research articles are published.
- Only the researcher and supervisor will have access to the data. Data will be kept safe by locking hard copies in locked cupboards in the researcher's office and electronic data will be saved on password protected computers.

What will happen with the data?

- The data forthcoming from this study will **only** be used for the purposes of this study and for other academic purposes such as academic articles published in scientific journals.

How will the participants know about the results of this research?

- The results of this study will be shared with them during a final workshop and, on request a summarised report will be emailed to them.

Will participants be paid to take part in this study and are there any costs for them?

- Participants will not be paid to take part in the research study because there will be no costs for them by participating in the research.
- Refreshments will be served to participants during workshops and other meetings.

Is there anything else that you should know or do?

- You can contact me as the supervisor of this study, or Ms Alina H, Angula at Email: alinayanakambale@gmail.com/ 264 81 2946 300 if you have any further questions or have any problems.
- You can also contact the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee via Mrs Villera le Roux at 018 299 4707 or villera.leroux@nwu.ac.za if you have any concerns that were not answered about the research or if you have complaints about the research.

Thank you very much for considering this request. Will you please communicate the outcome of this request to me via email. My e-mail address is: luiza.desousa@nwu.ac.za

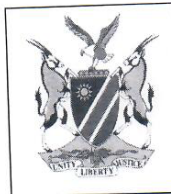
Yours sincerely

A handwritten signature in black ink, appearing to read 'Luiza', is written over a horizontal line.

Dr LO de Sousa

Principal Investigator/ Supervisor

Appendix E: Approval letter from the director



REPUBLIC OF NAMIBIA

**OSHIKOTO REGIONAL COUNCIL
DIRECTORATE OF EDUCATION,
ARTS AND CULTURE**



Tel (065) 281900
Fax (065) 240315
Enq: Ms H Tende

Private Bag 2028
ONDANGWA
07 April 2021

Ref: 12/3/10/1

Ms Alina Hambelela Angula
Email: alinayanakambale@gmail.com
Cell: 0812946300

Dear Ms Angula

**RE: PERMISSION TO CONDUCT A STUDY AT [REDACTED] SS,
OSHIKOTO REGIO**

The Office of the Director acknowledges receipt of your letter seeking for permission to conduct a research study to investigate how the lesson study approach is integrated by the Grade 10-12 Biology teachers to enhance teaching praxis to foster Education for Sustainable Development, using [REDACTED] SS in Onathingwe circuit as the study site.

Kindly be informed that permission has been granted to carry out the research in Oshikoto Region, please be guided by the following:

- You have to consult the school principal well in advance to ensure a proper co-ordination of other school activities.
- The research should not interfere with the normal teaching and learning process at the school.
- Participation in the research should be on a voluntary basis.
- The information to be collected should be treated as confidential and only for research purposes.
- And, be advised to adhere to the COVID-19 protocols and measures.

Thank you for showing interest to do the research in the Oshikoto Region. It is our sincere hope that the information you would gather will be useful towards the completion of your qualification.

Sincerely yours


Director
2021-04-08
PRIVATE BAG 2028
ONDANGWA
DIRECTOR OF EDUCATION, ARTS AND CULTURE
OSHIKOTO REGION

Appendix F: Request permission from the principal



Private Bag X1290, Potchefstroom
South Africa 2520
Tel: +2718 299-1111/2222
Fax: +2718 299-4910
Web: <http://www.nwu.ac.za>

Date 14 April 2021

To: **The School Principal**
[REDACTED] SS in Onathing Circuit
Oshikoto Region
Namibia

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY IN YOUR SCHOOL

I hereby request your permission for a research study to be conducted at your school.

Information about this research study can be found below:

TITLE OF THE RESEARCH STUDY: A Lesson Study Approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development

ETHICS REFERENCE NUMBER: NWU-01113-20-A2

PRINCIPAL INVESTIGATOR/SUPERVISOR: Dr. LO de Sousa

ADDRESS: Private Bag X1290, Building C6 – office 105, Potchefstroom, 2520
luiza.desousa@nwu.ac.za

CONTACT NUMBER: 0182994727/0834686726

POST GRADUATE STUDENT: Ms. Alina Hambelela Angula

Ms Alina Hambelela Angula is a PhD student working under my supervision at the North-West University (NWU) in Potchefstroom, South Africa. She wishes to conduct a **research study** in your school. The research study under the above-mentioned title forms part of a **doctoral research study in the Faculty of Education, North West University**. The research study will involve only teachers who are teaching Biology at Grade 10 to 12 learners. Please take some time to read the information presented here, which will explain the details of this study that is **entirely voluntary**, and the teachers are free to decline participation.

This study has been approved by the **North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-01113-20-S2)** and will be conducted according to the ethical guidelines and principles of Ethics in Health Research: Principles, Processes and Structures (DoH, 2015) and other international ethical guidelines applicable to this study.

Page 1 of 4

Permission to conduct the research was also requested from the Director of Education for the Oshikoto Region.

What is this research study all about?

- The study plans to investigate how the Lesson Study Approach is integrated by the Grade 10 – 12 Biology teachers to enhance teaching praxis to foster Education for Sustainable development.
- The objectives of the study are to:
 - Investigate how Grade 10-12 Biology teachers integrate the Lesson Study Approach in their teaching praxis.
 - Determine factors that hinder or facilitate the teaching praxis of Grade 10-12 Biology teachers who make use of the Lesson Study approach.
 - Design a Namibian Lesson Study approach framework for the Grade 10–12 Biology teachers to enhance teaching praxis and that will foster ESD.
- This study will be conducted at your school in a venue to be agreed with by the participants and will be conducted by an experienced researcher trained in the Lesson Study Approach. **Four** participants, two males and two females will be invited to participate in this study and to attend three meetings and one workshop.

Why will the teachers be invited to participate?

- Teachers will be invited to participate in this research because they are Grade 10-12 Biology teachers and have the knowledge and understanding about the Lesson Study Approach and collaborative learning.
- They use the Lesson Study Approach in their teaching and learning.
- In addition, these teachers will be able to effectively communicate orally or in writing and be willing to take part in the study and co-operate with the researcher.

What will be expected of the participants (teachers)?

- Participants will be expected to attend a three-hour planning workshop which will take place at a suitable venue at the school.
- They will then be asked if the researcher could observe them during their initial planning in their lesson design stage according to the guidelines of the Lesson Study Approach.
- Participants will be asked if they would allow the researcher to observe one of their lesson presentations.
- Two of the teachers will be asked to volunteer to conduct two lesson presentations.
- After the lesson presentations, teachers will be expected to give feedback about their engagement with the learning materials that they developed and implemented. This feedback session will be conducted after each lesson presentation and will take approximately an hour.
- During the aforesaid meeting the researcher will engage in a discussion with the participants so as to gain their feedback based on their experiences of presenting their subject and understanding the needs of learners in the classroom environment.
- The teachers will also be asked to take part in a focus-group interview with the researcher. The interview will take less than two hours.

Will the participants/teachers gain anything from taking part in this research?

- The teachers will gain insight into the Lesson Study Approach which may enrich their teaching and learning.
- Together with their colleagues, teachers will plan and present lessons that are well-planned and utilize the expert advice from colleagues in the same field of study which will result in enriched teaching activities.

Are there risks involved in teachers taking part in this research and what will be done to prevent them?

- There will be minimal risks for teachers participating in this study.
- There are more gains for participants in participating in this study than there are risks.

How will we protect the teacher's confidentiality and who will see the data?

- Anonymity of the data will be protected by using pseudonyms right from the onset. The teachers' identities will be protected by not availing their personal details to anyone else.
- Their identities will be kept confidential by the researcher even when research articles are published.
- Only the researcher and supervisor will have access to the data. Data will be kept safe by locking hard copies in locked cupboards in the researcher's office and electronic data will be saved on password protected computers.

What will happen with the data?

- The data forthcoming from this study will **only** be used for the purposes of this study and for other academic purposes such as academic articles published in scientific journals.

How will the participants know about the results of this research?

- The results of this study will be shared with them during a final workshop and, on request a summarized report will be emailed to them.

Will participants be paid to take part in this study and are there any costs for them?

- Participants will not be paid to take part in the research study because there will be no costs for them by participating in the research.
- Refreshments will be served to participants during workshops and other meetings.

Is there anything else that you should know or do?

- You can contact me as the supervisor of this study, or Ms Alina H, Angula at Email: alinayanakambale@gmail.com/ 264 81 2946 300 if you have any further questions or have any problems.
- You can also contact the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee via Mrs Villera le Roux at 018 299 4707 or villera.leroux@nwu.ac.za if you have any concerns that were not answered about the research or if you have complaints about the research.

Thank you very much for considering this request. Will you please communicate the outcome of this request to me via e-mail. My e-mail address is: luiza.desousa@nwu.ac.za

Yours sincerely

A handwritten signature in black ink, appearing to read 'Luiza de Sousa', written over a horizontal line.

Dr LO de Sousa
Principal Investigator/ Supervisor

Appendix G: Request permission from the schoolboard Chairperson



Private Bag X1290, Potchefstroom
South Africa 2520
Tel: +2718 299-1111/2222
Fax: +2718 299-4910
Web: <http://www.nwu.ac.za>

Date 14 April 2021

To: **The Chairperson of the school board of members**
[REDACTED] SS in Onathing Circuit
Oshikoto Region
Namibia

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY IN YOUR SCHOOL

I hereby request your permission for a research study to be conducted at your school.

Information about this research study can be found below:

TITLE OF THE RESEARCH STUDY: A Lesson Study Approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development

ETHICS REFERENCE NUMBER: NWU-01113-20-A2

PRINCIPAL INVESTIGATOR/SUPERVISOR: Dr. LO de Sousa

ADDRESS: Private Bag X1290, Building C6 – office 105, Potchefstroom, 2520
luiza.desousa@nwu.ac.za

CONTACT NUMBER: 0182994727/0834686726

POST GRADUATE STUDENT: Ms. Alina Hambelela Angula

Ms Alina Hambelela Angula is a PhD student working under my supervision at the North-West University (NWU) in Potchefstroom, South Africa. She wishes to conduct a **research study** in your school. The research study under the above-mentioned title forms part of a **doctoral research study in the Faculty of Education, North West University**. The research study will involve only teachers who are teaching Biology at Grade 10 to 12 learners. Please take some time to read the information presented here, which will explain the details of this study that is **entirely voluntary**, and the teachers are free to decline participation.

This study has been approved by the **North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-01113-20-S2)** and will be conducted according to the ethical guidelines and principles of Ethics in Health Research: Principles, Processes and Structures (DoH, 2015) and other international ethical guidelines applicable to this study.

Page 1 of 4

Permission to conduct the research was also requested from the Director of Education for the Oshikoto Region.

What is this research study all about?

- The study plans to investigate how the Lesson Study Approach is integrated by the Grade 10 – 12 Biology teachers to enhance teaching praxis to foster Education for Sustainable development.
- The objectives of the study are to:
 - Investigate how Grade 10-12 Biology teachers integrate the Lesson Study Approach in their teaching praxis.
 - Determine factors that hinder or facilitate the teaching praxis of Grade 10-12 Biology teachers who make use of the Lesson Study approach.
 - Design a Namibian Lesson Study approach framework for the Grade 10–12 Biology teachers to enhance teaching praxis and that will foster ESD.
- This study will be conducted at your school in a venue to be agreed with by the participants and will be conducted by an experienced researcher trained in the Lesson Study Approach. Four participants, two males and two females will be invited to participate in this study and to attend three meetings and one workshop.

Why will the teachers be invited to participate?

- Teachers will be invited to participate in this research because they are Grade 10-12 Biology teachers and have the knowledge and understanding about the Lesson Study Approach and collaborative learning.
- They use the Lesson Study Approach in their teaching and learning.
- In addition, these teachers will be able to effectively communicate orally or in writing and be willing to take part in the study and co-operate with the researcher.

What will be expected of the participants (teachers)?

- Participants will be expected to attend a three-hour planning workshop which will take place at a suitable venue at the school.
- They will then be asked if the researcher could observe them during their initial planning in their lesson design stage according to the guidelines of the Lesson Study Approach.
- Participants will be asked if they would allow the researcher to observe one of their lesson presentations.
- Two of the teachers will be asked to volunteer to conduct two lesson presentations.
- After the lesson presentations, teachers will be expected to give feedback about their engagement with the learning materials that they developed and implemented. This feedback session will be conducted after each lesson presentation and will take approximately an hour.
- During the aforesaid meeting the researcher will engage in a discussion with the participants so as to gain their feedback based on their experiences of presenting their subject and understanding the needs of learners in the classroom environment.
- The teachers will also be asked to take part in a focus-group interview with the researcher. The interview will take less than two hours.

Will the participants/teachers gain anything from taking part in this research?

- The teachers will gain insight into the Lesson Study Approach which may enrich their teaching and learning.
- Together with their colleagues, teachers will plan and present lessons that are well-planned and utilize the expert advice from colleagues in the same field of study which will result in enriched teaching activities.

Are there risks involved in teachers taking part in this research and what will be done to prevent them?

- There will be minimal risks for teachers participating in this study.
- There are more gains for participants in participating in this study than there are risks.

How will we protect the teacher's confidentiality and who will see the data?

- Anonymity of the data will be protected by using pseudonyms right from the onset. The teachers' identities will be protected by not availing their personal details to anyone else.
- Their identities will be kept confidential by the researcher even when research articles are published.
- Only the researcher and supervisor will have access to the data. Data will be kept safe by locking hard copies in locked cupboards in the researcher's office and electronic data will be saved on password protected computers.

What will happen with the data?

- The data forthcoming from this study will **only** be used for the purposes of this study and for other academic purposes such as academic articles published in scientific journals.

How will the participants know about the results of this research?

- The results of this study will be shared with them during a final workshop and, on request a summarized report will be emailed to them.

Will participants be paid to take part in this study and are there any costs for them?

- Participants will not be paid to take part in the research study because there will be no costs for them by participating in the research.
- Refreshments will be served to participants during workshops and other meetings.

Is there anything else that you should know or do?

- You can contact me as the supervisor of this study, or Ms Alina H, Angula at Email: alinayanakambale@gmail.com/ 264 81 2946 300 if you have any further questions or have any problems.
- You can also contact the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee via Mrs Villera le Roux at 018 299 4707 or villera.leroux@nwu.ac.za if you have any concerns that were not answered about the research or if you have complaints about the research.

Thank you very much for considering this request. Will you please communicate the outcome of this request to me via e-mail. My e-mail address is: luiza.desousa@nwu.ac.za

Yours sincerely

A handwritten signature in black ink, appearing to read 'Luiza', with a horizontal line underneath it.

Dr LO de Sousa
Principal Investigator/ Supervisor

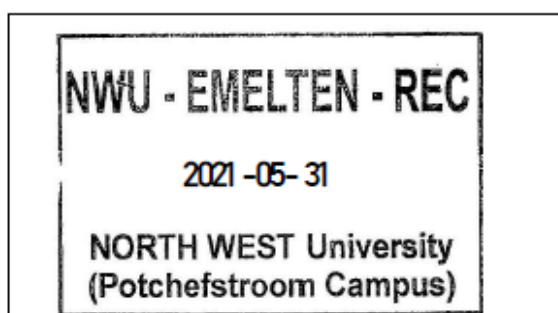
Appendix H: Informed consent letter for teachers



Private Bag X1290, Potchefstroom
South Africa 2520
Tel: +2718 299-1111/2222
Fax: +2718 299-4910
Web: <http://www.nwu.ac.za>

Date 28 May 2021

The Faculty of Health Sciences Ethics Office of the North-West University is acknowledged for the use of their document with minor adjustments made by the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-EMELTEN-REC).



INFORMED CONSENT DOCUMENTATION FOR TEACHERS REGARDING THEIR INVOLVEMENT IN AN ACTION RESEARCH STUDY

TITLE OF THE RESEARCH STUDY: A Lesson Study Approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development

ETHICS REFERENCE NUMBERS: NWU-01113-20-A2

PRINCIPAL INVESTIGATOR: Dr LO de Sousa

ADDRESS: Private Bag X1290, Building C6 – office 105, Potchefstroom, 2520
luiza.desousa@nwu.ac.za

CONTACT NUMBER: 0182994727/0834686726

POST GRADUATE STUDENT: Ms Alina Hambelela Angula (33465770)

We hereby request your permission to take part in this research study. Please take some time to read the information presented here, which will explain the details of this research study. Please ask the researcher or person explaining the research to you any questions about any part of this study that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research is about and how you might be involved. You are free to deny the request to take part. If you agree not to take part, you will not in any way whatsoever be negatively affected.

This study has been approved by the **North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-01113-20-A2)** and will be conducted according to the ethical guidelines and principles of Ethics in Health Research: Principles, Processes and Structures (DoH, 2015) and other international ethical guidelines applicable to this study. It might be necessary for the research ethics committee members or other relevant people to inspect the research records.

What is this research study all about?

- The study plans to investigate how the Lesson Study Approach is used by Grade 10 – 12 Biology teachers when they present their lessons to learners.

Why have you been invited to participate?

- You have been invited to be part of this research because you are one of the Grade 10-12 Biology teachers and you have the knowledge and understanding about the Lesson Study approach and collaborative learning.
- You have met the criteria of this research study because you use Lesson Study approach in your teaching and learning.
- In addition, you are a person that should be able to effectively communicate orally or in writing and be willing to take part in the study and co-operate with the researcher

What will be expected of you?

- Participants will be expected to attend a three-hour planning workshop which will take place in the school hall or in one of the classrooms.
- Participants will then be asked if the researcher can observe them during their initial planning in their lesson design stage according to the Lesson Study approach.
- Participants will be asked if the researcher can observe their lesson during the lesson presentation.
- Two of the teachers (participants) will be asked to volunteer to present two lesson each.
- Every teacher is expected to use one or a double lesson depending on the nature of the topic to be presented. One lesson takes forty-five minutes and a double lesson will take ninety minutes.
- After the lesson presentation, teachers are expected to give feedback as they are engaging with the learning materials that they develop and implemented. The discussion meeting will be done after every lesson presentation and will take an hour.
- In the aforesaid meeting the researcher will engage in a discussion with the participants so as to gain feedback based on their experiences of presenting their subject and understanding the needs of learners in the classroom environment.
- The teachers will be asked to take part in the focus-group interview with the researcher. The interview will take less than two hours.

Will you gain anything from taking part in this research?

- You will gain insight into the Lesson Study approach that may enrich your teaching and learning. Together with your colleagues you will plan for and present a lesson that is well-planned for, containing expert advice from colleagues in the same field of interest offering suggestions for enriched learning activities. There will be no direct gains for you in the study.

Are there risks involved in you taking part in this research and what will be done to prevent them?

- There will be no risks to you by involving yourself in this study.
- There will be no harm to any participants in this study, but the study rather benefits them in one way or the other.
- There are more gains for you in joining this study than there are risks.

How will we protect your confidentiality and who will see your data?

- Anonymity of your data will be protected by the use of pseudonyms from the onset. Your privacy will be respected by not availing your contact details to anyone else. Your results will be kept confidential by the researcher even when articles are published. The final analysis and recommendations will be made available to you at the final workshop for discussion. Only the researchers will be able to look at your data. Data will be kept safe by locking hard copies in locked cupboards in the researcher's office and for electronic data it will be password protected. As soon as data has been transcribed it will be deleted from the recorders. Data will be stored for five years in an electronic format.

What will happen with the data or samples?

- The data of this study will only be used for this study.

How will you know about the results of this research?

- We will give you the results of this research when we have a final workshop and, on your request a report can be emailed to you.

Will you be paid to take part in this study and are there any costs for you?

- You will not be paid to take part in the research study because you are taking part in the study that benefits you in terms of teaching and learning approach. You are using your normal space and time for this activity.
- You had no travel expenses and do not need to be refunded for traveling.
- Refreshments will be served when there is a workshop and discussion meetings.
- There will thus be no costs involved for you, if you do take part in this study.

Is there anything else that you should know or do?

- You can contact Ms Alina H, Angula at Email: alinavanakambale@gmail.com/ 264 81 2946 300 if you have any further questions or have any problems.
- You can also contact the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee via Mrs Villera le Roux at 018 299 4707 or villera.leroux@nwu.ac.za if you have any concerns that were not answered about the research or if you have complaints about the research.
- You will receive a copy of this information and consent form for your own purposes.

Declaration by participant

By signing below, I agree to take part in the research study titled: **A Lesson Study approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development**

I declare that:

- I have read this information as it was explained to me by a trusted person in a language with which I am fluent and comfortable.
- The research was clearly explained to me.
- I have had a chance to ask questions to both the person getting the consent from me, as well as the researcher and all my questions have been answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be handled in a negative way if I do so.
- I may be asked to leave the study before it has finished, if the researcher feels it is in the best interest, or if I do not follow the study plan, as agreed to.

Signed at (*place*) on (*date*) 20....

.....
Signature of participant

Declaration by person obtaining consent

I (*name*) declare that:

- I clearly and in detail explained the information in this document to
.....
- I did/did not use an interpreter.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above.
- I gave him/her time to discuss it with others if he/she wished to do so.

Signed at (*place*) on (*date*) 20....

.....
Signature of person obtaining consent

Declaration by researcher

I (*name*) declare that:

- I explained the information in this document to the participant
.....
- I did/did not use an interpreter.
- I was available should he/she want to ask any further questions.
- I encouraged him/her to ask questions and took adequate time to answer them.
- The informed consent was obtained by an independent person.
- I am satisfied that he/she adequately understands all aspects of the research, as described above.
- I am satisfied that he/she had time to discuss it with others if he/she wished to do so.

Signed at (*place*) on (*date*) 20....

.....
Signature of researcher

Appendix I: Informed consent letter for parents



Private Bag X1290,
Potchefstroom
South Africa 2520

Tel: +2718 299-1111/2222

Fax: +2718 299-4910

Web: <http://www.nwu.ac.za>

Date 14 April 2021

The Faculty of Health Sciences Ethics Office of the North-West University is acknowledged for the use of their document with minor adjustments made by the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-EMELTEN-REC).



INFORMED CONSENT DOCUMENTATION FOR PARENTS/GUARDIANS OF LEARNERS WHO WILL BE PRESENT IN THE CLASSROOM WHEN THEIR TEACHERS' LESSONS ARE OBSERVED BY A RESEARCHER

TITLE OF THE RESEARCH STUDY: A Lesson Study Approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development

ETHICS REFERENCE NUMBERS: NWU-01113-20-A2

PRINCIPAL INVESTIGATOR: Dr LO de Sousa

ADDRESS: Private Bag X1290, Building C6 – office 105, Potchefstroom, 2520
luiza.desousa@nwu.ac.za

CONTACT NUMBER: 0182994727/0834686726

POST GRADUATE STUDENT: Ms Alina Hambelela Angula (33465770)

We hereby request your permission for your child to be present in the classroom when his/her Biology teacher's lesson will be observed by a researcher. Please take some time to read the information presented here, which will explain the details of this research study. Please ask the researcher or person explaining the research to you any questions about any part of this study that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research is about and how you might be involved. You are free not to give permission that your child is present when his/her Biology teacher's lesson is observed by the researcher. If you do not give permission, this will not affect your child negatively in any way whatsoever.

This study has been approved by the **North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-01113-20-S2)** and will be conducted according to the ethical guidelines and principles of Ethics in Health Research: Principles, Processes and Structures (DoH, 2015) and other international ethical guidelines applicable to this study. It might be necessary for the research ethics committee members or other relevant people to inspect the research records.

What is this research study all about?

- The study plan to investigate how the Lesson Study Approach is used by Grade 10 – 12 Biology teachers when they present their lessons to learners.

Why should your child be present in the classroom when his/her teacher's Biology lessons are observed?

- We will appreciate it if your child could be present in the classroom, because in order to observe the teacher's lesson the interaction with learners is an important aspect to observe.

What will be expected of the learner?

- Learners will be expected to participate fully during the lesson presentation as they normally would when there is no observer in the classroom.
- Nothing else is expected of your child. Your child's written work will not be checked by the observer and your child's school marks will not be affected in any way because of the presence of the observer in the classroom.

Will your child gain anything from taking part in this research?

- There are no direct gains for your child, because the focus is on the teacher's instruction and not on the learners' progress.

Are there risks involved for your child being present in the class when his/her teacher's Biology lessons are observed by the researcher?

- There will be no risks for your child by being present in the classroom when his/her teacher's Biology lessons are observed.

How will we conduct the observations of lessons?

- The researcher and three Biology teachers involved in this research study will only observe the lesson.
- They will sit at the back of the classroom and they will in no way engage with the learners.
- No photos of the learners will be taken.
- The observers will only make notes in their journals.

Will your child be paid to be present in the classroom when his/her Biology teacher's lessons are observed?

- Learners will not be paid because there will not be any costs involved for them by being present in the classroom when his/her teacher's Biology lessons are observed.

Is there anything else that you should know or do?

- You can contact Ms Alina H, Angula at Email: alinayanakambale@gmail.com/ 264 81 2946 300 if you have any further questions or have any problems.
- You can also contact the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee via Mrs Villera le Roux at 018 299 4707 or villera.leroux@nwu.ac.za if you have any concerns that were not answered about the research or if you have complaints about the research.
- You will receive a copy of this information and consent form for your own purposes.

Declaration by parent/guardian

By signing below, I agree to allow my child to be present in the classroom when his/her **Biology teacher's lessons are observed**.

I declare that:

- I have read this information and permission form and understand what is expected of my child in the research.
- The research was clearly explained to me.
- I have had a chance to ask questions to both the person getting the consent from me, as well as the researcher and all my questions have been answered.
- I understand that taking part in this study is **voluntary** and my child has not been pressurised to take part.
- I may choose to exclude my child from the study at any time and he/she will not be penalised or prejudiced in any way.

Signed at (*place*)..... on (*date*)..... 20....

.....

Signature of parent

Declaration by person obtaining consent

I (*name*) declare that:

- I clearly and in detail explained the information in this document to

.....

- I did/did not use an interpreter.

- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above.
- I gave him/her time to discuss it with others if he/she wished to do so.

Signed at (*place*)..... on (*date*) 20....

Signature of person obtaining consent

Declaration by researcher

I (*name*) declare that:

- I had the information in this document to be explained by (the teacher) who I trained for this purpose.
- I did/did not use an interpreter.
- I encouraged him/her to ask questions and took adequate time to answer them.
- The informed consent was obtained by an independent person.
- I am satisfied that he/she adequately understands all aspects of the research, as described above.
- I am satisfied that he/she had time to discuss it with others if he/she wished to do so.

Signed at (*place*)..... on (*date*)..... 20....

Signature of researcher

Appendix J: Informed consent letter for learners



Private Bag X1290,
Potchefstroom
South Africa 2520

Tel: +2718 299-1111/2222

Fax: +2718 299-4910

Web: <http://www.nwu.ac.za>

Date 14 April 2021

The Faculty of Health Sciences Ethics Office of the North-West University is acknowledged for the use of their document with minor adjustments made by the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-EMELTEN-REC).



INFORMED CONSENT DOCUMENTATION FOR LEARNERS WHO WILL BE PRESENT IN THE CLASSROOM WHEN THEIR TEACHERS' LESSONS ARE OBSERVED BY A RESEARCHER

TITLE OF THE RESEARCH STUDY: A Lesson Study Approach for Grade 10-12 Biology teachers: A framework to foster teaching praxis in education for sustainable development

ETHICS REFERENCE NUMBERS: NWU-01113-20-A2

PRINCIPAL INVESTIGATOR: Dr LO de Sousa

ADDRESS: Private Bag X1290, Building C6 – office 105, Potchefstroom, 2520
luiza.desousa@nwu.ac.za

CONTACT NUMBER: 0182994727/0834686726

POST GRADUATE STUDENT: Ms Alina Hambelela Angula (33465770)

We hereby request your permission to be present in the classroom when your Biology teacher's lesson will be observed by a researcher. Please take some time to read the information presented here, which will explain the details of this research study. Please ask the researcher or person explaining the research to you any questions about any part of this study that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research is about and how you might be involved. You are free to deny the request not to be present when your Biology teacher's lesson is observed by the researcher. If you agree not to be present, you will not in any way whatsoever be negatively affected.

This study has been approved by the **North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-01113-20-S2)** and will be conducted according to the ethical guidelines and principles of Ethics in Health Research: Principles, Processes and Structures (DoH, 2015) and other international ethical guidelines applicable to this study. It might be necessary for the research ethics committee members or other relevant people to inspect the research records.

What is this research study all about?

- The study plans to investigate how the Lesson Study Approach is used by Grade 10 – 12 Biology teachers when they present their lessons to learners.

Why should you be present in the classroom when your teacher's Biology lessons are observed?

- We will appreciate it if you could be present in the classroom, because in order to observe the teacher's lesson the interaction with you as a learner is an important aspect to observe.

What will be expected of you?

- You will be expected to participate fully during the lesson presentation as you normally would when there is no observer in the classroom.
- Nothing else is expected of you. Your written work will not be checked by the observer and your school marks will not be affected in any way because of the presence of the observer in the classroom.

Will you gain anything from taking part in this research?

- There are no direct gains for you, because the focus is on the teacher's instruction and not on your progress.

Are there risks involved for you being present in the class when your teacher's Biology lessons are observed by the researcher?

- There will be no risks for you by being present in the classroom when your teacher's Biology lessons are observed.

How will we conduct the observations of lessons?

- The researcher and three Biology teachers involved in this research study will only observe the lesson.
- They will sit at the back of the classroom and they will in no way engage with you.
- No photos of any learners will be taken.
- The observers will only make notes in their journals.

Will you be paid to be present in the classroom when your Biology teacher's lessons are observed?

- You will not be paid because there will not be any costs involved by you being present in the classroom when your teacher's Biology lessons are observed.

Is there anything else that you should know or do?

- You can contact Ms Alina H, Angula at Email: alinayanakambale@gmail.com/ 264 81 2946 300 if you have any further questions or have any problems.
- You can also contact the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee via Mrs Villera le Roux at 018 299 4707 or villera.leroux@nwu.ac.za if you have any concerns that were not answered about the research or if you have complaints about the research.
- You will receive a copy of this information and consent form for your own purposes.

Declaration by learner

By signing below, I agree **to be present in the classroom when my Biology teacher's lessons are observed.**

I declare that:

- I have read this information and permission form and understand what is expected of me in the research.
- The research was clearly explained to me.
- I have had a chance to ask questions to both the person getting the consent from me, as well as the researcher and all my questions have been answered.
- I understand that taking part in this study is **voluntary** and I am not being pressurised to take part.
- I may choose to exclude myself from the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*)..... on (*date*) 20....

.....

Signature of learner

Declaration by person obtaining consent

I (*name*) declare that:

- I clearly and in detail explained the information in this document to
.....
- I did/did not use an interpreter.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above.
- I gave him/her time to discuss it with others if he/she wished to do so.

Signed at (*place*)..... on (*date*) 20....

.....

Signature of person obtaining consent

Declaration by researcher

I (*name*) declare that:

- I had the information in this document to be explained by (the teacher) who I trained for this purpose.
- I did/did not use an interpreter.
- I encouraged him/her to ask questions and took adequate time to answer them.
- The informed consent was obtained by an independent person.
- I am satisfied that he/she adequately understands all aspects of the research, as described above.
- I am satisfied that he/she had time to discuss it with others if he/she wished to do so.

Signed at (*place*)..... on (*date*)..... 20....

.....

Signature of researcher

Appendix K: Ethics approval letter for this study



Private Bag X1290, Potchefstroom
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**North-West University Education, Management
and Economic Sciences, Law, Theology,
Engineering and Natural Sciences Research
Ethics Office (NWU-EMELTEN-REC)**

Tel: +2718 299 4707
Email: lukas.meyer@nwu.ac.za

18 August 2020

Dear Dr de Sousa

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-EMELTEN-REC) on 17 August 2020, the NWU-EMELTEN-REC hereby approves your study as indicated below. This implies that the NWU-EMELTEN-REC grants its permission that, provided the general and specific conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: A Lesson Study approach for Grade 10-12 Biology teachers: A framework for Namibian schools to foster teaching praxis in education for sustainable development																															
Principal Investigator/Study Supervisor/Researcher: Dr de Sousa																															
Student: Ms Alina Hambelele Angula																															
Ethics number:	<table border="1"><tr><td>N</td><td>W</td><td>U</td><td>-</td><td>0</td><td>1</td><td>1</td><td>1</td><td>3</td><td>-</td><td>2</td><td>0</td><td>-</td><td>A</td><td>2</td></tr><tr><td colspan="3">Institution</td><td colspan="5">Study Number</td><td colspan="2">Year</td><td colspan="5">Status</td></tr></table>	N	W	U	-	0	1	1	1	3	-	2	0	-	A	2	Institution			Study Number					Year		Status				
N	W	U	-	0	1	1	1	3	-	2	0	-	A	2																	
Institution			Study Number					Year		Status																					
Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation																															
Application Type: Single study	Risk: <table border="1"><tr><td>Adults: Minimal</td></tr><tr><td>Children: Minimal</td></tr></table>	Adults: Minimal	Children: Minimal																												
Adults: Minimal																															
Children: Minimal																															
Commencement date: 14/08/2020																															
Expiry date: 13/08/2021																															
Approval of the study is provided for a year, after which continuation of the study is dependent on the receipt and review of a twelve-monthly monitoring report and the concomitant issuing of a letter of continuation.																															

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- The principal investigator/study supervisor/researcher must report in the prescribed format to the NWU-EMELTEN-REC:
 - twelve-monthly on the monitoring of the study, whereby a letter of continuation will be provided annually, and upon completion of the study; and
 - without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.
- The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the principal investigator/study supervisor/researcher must apply for approval of these amendments at the NWU-EMELTEN-REC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.

- *Annually a number of studies may be randomly selected for active monitoring.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-EMELTEN-REC reserves the right to:*
 - *request access to any information or data at any time during the course or after completion of the study;*
 - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
 - *withdraw or postpone approval if:*
 - *any unethical principles or practices of the study are revealed or suspected;*
 - *it becomes apparent that any relevant information was withheld from the NWU-EMELTEN-REC or that information has been false or misrepresented;*
 - *submission of the twelve-monthly monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and/or*
 - *new institutional rules, national legislation or international conventions deem it necessary.*
- *NWU-EMELTEN-REC can be contacted for further information via Ethics-EMELTEN-apply@nwu.ac.za or 018 299 4707*


Specific conditions:

1. The commencement and execution of the study are subject to COVID-19 restrictions and regulations and strict adherence to the prevailing COVID-19 research procedures and protocols.

The NWU-EMELTEN-REC would like to remain at your service and wishes you well with your study.

Please do not hesitate to contact the NWU-EMELTEN-REC for any further enquiries or requests for assistance.

Yours sincerely,



Prof Lukas Meyer
Chairperson NWU-EMELTEN-REC

Current details:(23239522) G:\My Drive\9. Research and Postgraduate Education\9.1.5.4 Templates\9.1.5.4.2_NWU-HREC_EAL.docm
20 August 2019

File Reference: 9.1.5.4.2

Appendix L: Language editor letter

Nikki Watkins

Editing/proofreading services

Cell: 072 060 2354

E-mail: nikki.watkins.pe@gmail.com

25 November 2022

To whom it may concern

This letter serves to inform you that I have done language editing and proofreading on the doctoral thesis

A Lesson Study Approach for Grade 10–11 Biology teachers: A framework to foster teaching praxis in education for sustainable development

by

Alina Hambelela Angula (33465770)



Professional
EDITORS
Guild

Nikki Watkins
Associate Member

Membership number: WAT003
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