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INYUVESI YAKWAZULU-NATALI

TEACHERS' UNDERSTANDING AND ENHANCEMENT OF LEARNING FOR SUSTAINABILITY IN MAURITIAN PRIMARY SCHOOLS

by

HINCHOO THREELOCKNATH SING

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SUPERVISOR: Professor D. J. HLALELE

CO-SUPERVISOR: Dr R. BHOLAH

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DECLARATION

I, Hinchoo Threelocknath Sing, Student Number 218045038, declare that:

- This thesis, except where otherwise stated, is my original work;
- It has not been submitted for any other qualification or examination at any other institution;
- It does not include any other persons' data, pictures, graphs, or other information unless specifically acknowledged as being sourced from other persons;
- Sources that have been cited, have been acknowledged in-text and in the reference list .

This thesis was mainly conducted at the School of Education, University of KwaZulu-Natal (UKZN) from 2018 under the supervision of Professor D. J. Hlalele and Doctor R. Bholah.

Student Name: **Hinchoo Threelocknath**

Signature: 

Date: **22 December 2022**

Main Supervisor: **Professor D. J. Hlalele**

Signature: 

Date: **11/01/2023**

Co- Supervisor: **Doctor R. Bholah**

Signature: 

Date: **30/12/2022**

ABSTRACT

Mauritius, a small island, is confronted by numerous environmental challenges such as pollution, biodiversity loss, and climate change. The Government developed various policies and strategies at different levels to address these issues to sustain the country's resources and to maintain the island's greenery. The education sector has entrenched Learning for Sustainability (LFS) in the National Curriculum Framework (NCF) with the vision of learners becoming responsible citizens. The current NCF which highlights the learning outcomes, acts as a guide for teachers regarding the implementation of the LFS content. Although many concepts and values pertaining to environmental and social citizenship (such as helping and sharing) are taught at school (MoEHR, 2016), the objectives are still to be realised. Many challenges which threaten children's future have arisen over the years; these are because they continue growing up in an environment that may become unsustainable. School curricula, through LFS, can intervene in this endeavour (Casinader, 2021).

The purpose of this study was to explore teachers' understanding and enhancement of LFS in primary schools using a participant-designed action research methodology, within a multiple case study design framework. The potential value of the participant-designed action research methodology's findings was to inform teachers and school administrators about teachers' understanding of LFS in the Mauritian education context. Theoretically, the research drew from two models, Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework. Burns' Model of Sustainability Pedagogy focuses on the current need to align teaching and learning strategies with contemporary socio-cultural and ecological issues by empowering and transforming learners into agents of sustainability for the future. O'Donoghue's Active Learning Framework provides opportunities for authentic decision-making that has a positive impact on local communities. Learning for Sustainability may be simply understood as a concept that describes all educational activities concerned with

developing an understanding of related concepts in sustainability. However, teachers struggled to align their understanding and practice of LFS, and thus could not efficiently enhance the quality of teaching-learning. Hence, this study aimed to intervene and potentially 'redress' the weaknesses in the schools' teaching and learning system which included observations and reflections in order to generate data from six participants.

Data generated was analysed by applying the thematic analysis approach which facilitated categorising and interpreting data into common themes which were synthesised and generalised to provide an overall representation of the case study. The findings indicated that there were various understandings of LFS among primary school teachers which significantly influenced their attempts to enhance the teaching of LFS. This was inconsistent with the various levels of knowledge about teachers' understanding and their enhancement of LFS; it should have elicited a positive change in teachers' understanding of LFS practices. Further, the study's results revealed that LFS enhances teachers' practices and experiences by exposing them to new knowledge which increases their understanding of LFS. It is recommended that this study concientises other teachers, school leaders, policymakers, and curriculum writers and designers to incisively understand LFS, address the dearth of data on the subject, and provide insights for future teachers to improve the teaching-learning of LFS by ushering in transformation and adaptation strategies to promote best practice.

Keywords: climate change, environmental citizenship, Learning for Sustainability, Mauritius, primary education, teaching-learning

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LIST OF ABBREVIATIONS

ARC	Action Research Cycle
ALF	Active Learning Framework
AR	Action Research
DESD	Decade for Education for Sustainable Development
EE	Environmental Education
EEASA	Environmental Educational Education Association of Southern Africa
EfS	Education for Sustainability
ESD	Education for Sustainable Development
GIS	Government Information Services
ICT	Information and Communication Technology
LFS	Learning for Sustainability
MGI	Mahatma Gandhi Institute
MIE	Mauritius Institute of Education
MoEHR	Ministry of Education and Human Resources
MoEHRTESR	Ministry of Education, Human Resources, Tertiary Education, and Scientific Research
MoESD	Ministry of Environment and Sustainable Development
MoETER	Ministry of Education, Tertiary Education, and Research
MoETEST	Ministry of Education, Tertiary Education, Science, and Technology
MoFED	Ministry of Finance and Economic Development
MoFEPD	Ministry of Finance Economic Planning and Development
NCF	National Curriculum Framework
NYCBE	Nine-Year Continuous Basic Education
OECD	Organisation for Economic Cooperation and Development
OUM	Open University of Mauritius
PCF	Primary Curriculum Framework
PTA	Parent-Teacher Association
RTI	Rabindranath Tagore Institute
SDG	Sustainable Development Goals
SIDS	Small Island Developing States

UKZN	University of KwaZulu-Natal
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNGA	United Nations General Assembly
UNSDG	United Nations Sustainable Development Goals
UoM	University of Mauritius
UTM	University of Technology
WRR	World Risk Report

CHAPTER ONE

BACKGROUND TO THE STUDY

1.1 INTRODUCTION

This study explored teachers' understanding of LFS and how it shaped the enhancement of LFS in Mauritian primary schools. Scholars such as Laurie et al. (2016) and Rieckmann (2018), agree that LFS is a concept that describes how sustainability should be understood by teachers, and how teachers can utilise it to enhance their understanding of LFS in their teaching practice. Since LFS provides knowledge and skills on the use of educational tools and methods of teaching-learning, an understanding of its advantages to achieve sustainability would become apparent. Accordingly, education is an invaluable instrument for sustainability to be successfully attained (Mogren et al., 2019).

The Mauritian National Curriculum Framework (NCF) designed by the Ministry of Education and Human Resources (MoEHR, 2016) identified Learning for Sustainability (LFS) as an essential teaching strategy that must be adopted to achieve a holistic, quality education. In 2010, the MoEHR in Mauritius advocated for LFS to be taught from primary to secondary school level as a foundation for curriculum design across all subjects. The NCF is therefore central to the success of LFS in Mauritius as it specifies learning objectives that learners must attain to assist teachers in implementing the LFS content. United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2021) cautions that climate change and sustainability issues are not highlighted in school curricula in more than half the number of its member countries. Hence, teachers are obliged to promote LFS's critical developmental outcomes as a priority (NCF, 2016).

It is assumed that early education positively influences a country's societal development (Painuly et al., 2020). According to Tyagi et al. (2020) and Painuly et al. (2020), a country's social, environmental, and economic progress depends on its society's development. The reports from UNESCO (2021) and the guidelines contained in the NCF (2016) advocate that teachers should focus on developing and motivating learners to promote the creation of a sustainable future. However, if making-sense of the principles and requirements of LFS is demanding for teachers, then learners cannot be adequately prepared to develop a sustainable future.

Since the new curriculum encourages teachers to prioritise both its designing and implementing as opposed to being mere traditional players (Hill et al., 2020), sustainability learning as an educational philosophy now involves innovative approaches to teaching and learning which Ben-Eliyahu (2021) maintains is a deepening of teachers' understanding of sustainability on how to adapt to life's challenging demands and everchanging global conditions.

Sustainability is explained as the model that promotes a future in which economic, environmental and societal concerns are balanced in the quest for progress and an improved lifestyle (Burns, 2013; Taylor et al., 2015). Global environmental teaching-learning for sustainability is crucial for humanity's existence (Messerli et al., 2019); hence, it should be entrenched in primary school education as today's learners are tomorrow's adults (Bourn et al., 2016). Bourn et al. (2016) add that formal education curricula should include degree qualifications in global and sustainability education.

1.2 PROBLEM STATEMENT

The Republic of Mauritius is a Small Island Developing State (SIDS) in the Indian Ocean, south east of the African continent. It has limited natural resources, and hence depends on its human capital for its economic survival. The Government's Economic Mission Statement states that it aims to make Mauritius an affluent country by 2030 (Ministry of Finance and Economic Development [MoFED], 2017). Mauritius' economy is overwhelmingly affected by external factors; for instance, it is considered globally as the 51st highest disaster risk area. Further, it is graded 13th on the list of countries most prone to natural calamities and climate change disasters (World Risk Report, 2021; Ramcharrun et al., 2021). Mauritius, with a fragile ecosystem and limited resources (Government Information Services [GIS], 2017; Ministry of Environment and Sustainable Development [MoESD], 2017), is ecologically vulnerable because of its isolated position, small size, and limited resources. The environment is an intricate system, constantly trying to maintain its equilibrium between multitudes of living and non-living entities, particularly given the impact of human beings' lack of environmental awareness. In other words, the population's activities directly affect the environmental, social, and economic well-being of the country. These numerous problems which are currently affecting Mauritius (GIS, 2017; MoESD, 2017) include waste disposal, limited land space, degradation of marine and coastal environments, loss of biodiversity, limited water availability, quality of life, poor sanitation, difficulties in accessing health care facilities, drug addiction, alcoholism, and the

general degradation of communities (MoESD, 2017). This trend can be mitigated, but citizens must play their part by adhering to LFS principles. To attain the desired outcomes for a sustainable future, in line with learning to develop environmentally friendly enterprises, people should understand the deleterious consequences of exploitative human activities on the economy, environment, and society (Burgener & Barth, 2018).

School children are exposed to environmental, economic and social information while attending primary schools (Adawiah & Esa, 2012). Many concepts and values regarding environmental and social citizenshipsuch as helping the indigent, neighbourliness, and sharing are taught at school (NCF, 2016); however, the objectives are seldom realized. Many problems have arisen over the years that could result in children being affected by an unsustainable world. The school curriculum, through LFS, can play a role in migrating towards sustainability (Casinader, 2021).

According to Bunwaree (2018), Mauritius still accommodates a multicultural society. Although the media displays much concern about the environment by emphasising the long-term effects of mankind's abuse on the planet, extreme poverty and social disparities have similar adverse effects on society and on the environment (Ben-Eliyahu, 2021; Bunwaree, 2018). An educational structure that is primed to teach sustainability plays a critical role in supporting a connected and knowledgeable society. Furthermore, the more cohesive a society is, the more social inclusion is fostered. These inclusive strategies equip society to managing conflicts through promoting respect for the environment, accepting diversity, and encouraging equality in the modern world (Ben-Eliyahu, 2021; Laurie et al., 2016).

Intercontinental migration streaming means that people have lived for centuries by assimilating cross-culturally through social immersion processes such as language or marriage. However, inherent weaknesses such as social and environmental vulnerability, coupled with a high degree of economic uncertainty, have made social unity more vulnerble than ever before since societies now have to survive the tide of rapid economic international changes exacerbated by global warming (Bourn et al., 2016). While the gap of inequality between rich and poor is ever-increasing (World Bank Report, 2017), multi-faceted forms of poverty that could 'inflame' societies (Gungadeen et al., 2021) are evident. As such, poverty, coupled with an inequitable allocation of resources and lack of employment opportunities, is a hotbed endangering stability and peace (Ternel & Greyling, 2018).

Poverty can be embodied in many ways, but it is the primary source of many social issues, often exacerbating questionable situations such as exploitation and substandard or insufficient housing (Bunwaree, 2018). In support, the Mauritius 2017- 2018 Budget Speech (MoFED) stated that children who live under these adverse conditions are the worst affected (Bunwaree, 2018). In the 2018 Annual Report, the Ombudsperson for Children exposed how poverty and displacement traumatise children. Hence, a secure and equal social system is critical to ensure stability to foster sustainable development and peace in Mauritius (Ternel & Greyling, 2018). A proper structure to build social cohesion will prepare members of a society to collaborate to address the country's weaknesses and develop resilience among all societies (Tandrayen-Ragoobur et al., 2021).

The Mauritian education system is still considered 'foreign' as it is biased towards the English and French languages. According to Belle (2017), the curriculum has not been 'Mauritianised', and consequently new generations of Mauritians who are being acculturated by the education system are in a sense 'foreigners' in their own country. This transgresses Mauritius' aspirations to become a regional knowledge centre in the Indian Ocean (and by extension, Africa), by building an 'African knowledge society'. Therefore, efforts to build sustainable social peace in Mauritius are imperative for stability. Under stable conditions, LFS will play a dominant role in promoting peace, social cohesion, and preservation of the environment (Green & Somerville, 2015).

1.3 AIM AND OBJECTIVES OF THE STUDY

1.3.1 Aim: This study aimed to explore teachers' understanding and enhancement of LFS in Mauritian primary schools.

1.3.2 Objectives: The specific research objectives were based on the aim of this study:

- to explore teachers' understanding of LFS and its implementation in Mauritian primary schools;
- To demonstrate how teachers' understanding shapes their enhancement of LFS in Mauritian primary schools; and

- To investigate why teachers' understanding of LFS in Mauritian primary schools is enhanced in the particular ways.

1.4 RESEARCH QUESTIONS

1.4.1 Main Research Question

- What are teachers' understanding and enhancement of LFS in Mauritian primary schools?

1.4.2 Subsidiary Research Questions

- How are teachers' understanding of LFS exhibited in Mauritian primary schools?

Teachers expressed their own beliefs and understanding of LFS. The planning and reflection phases collectively helped to determine their initial understanding of the LFS concept. This research question also formed the basis of the research, and therefore assisted to design the intervention phase of the action research. Moreover, the responses to this research question were considered in preparation for the next cycle of the action research.

- How does teachers' understanding of LFS shape their enhancement of LFS in Mauritian primary schools?

The data obtained from the action and observation steps of the intervention phase helped to evaluate the modifications in teachers' comprehension, and how these modifications shaped their enhancement of LFS during their teaching.

- Why do teachers enhance LFS in Mauritian primary schools the way they do?

The responses elicited from this research question included information to influence change. It also provided opportunities for teachers to transform and reflect incisively on their practice and mindsets. This can be viewed as a possible foundation for future research and exploration in the same field of interest.

1.5 RATIONALE FOR THE STUDY

This study was prompted by my apprehension rearding future generations' ability to manage the repercussions of decades of economic, environmental, and social irrational decisions perpetrated by their predecessors. According to Allen (2021) and Gajparia et al. (2021), the lack of knowledge, inaction, a school career packed with traditional programmes, an emphasis on examination, and a centralised syllabus cannot prepare future generations to be astute decision-makers to contribute positively to the society, the economy, and the environment. Therefore, an urgency exists to migrate from the basic understanding of the individual components of biotic and abiotic environments to a transformed holistic style of thinking and acting to promote the creation of sustainable environments to secure a better future for our successors (Casinader, 2021; Leal Filho et al., 2018; Moyer & Sinclair, 2020).

Since one of the primary aims of education is to develop knowledgeable, responsible and innovative citizens, this should not only pertain to environmental concerns, but also to topics of citizenship, equity, compassion, and social justice. The Republic of Mauritius through the Ministry of Education, Tertiary Education, Science, and Technology (MoETEST), is implementing various initiatives at different levels to improve LFS (MoETEST, 2016). It has been reported that there has been insufficient coverage of LFS (MoEHR, 2006); hence, various interventions have been implemented to review teacher-training programmes and school curricula as prescribed in the NCF document to mainstream LFS. There have been international, regional, and local efforts to support LFS, especially through *Maurice Ile Durable-Sustainable Mauritius* (MID). I, as the researcher, was also concerned about how effectively these core educational components for LFS are taught and learned at school.

Even though several years have elapsed following the Decade of Education for Sustainable Development (DESD) declaration, recent research reveals that globally LFS is still deficient in applying current creative teaching-learning methods (UN, 2005 – 2015). Mauritius is not excluded from this category despite the commitment to the Mauritius Declaration at the 39th Environmental Education Association for Southern Africa (EEASA) International Conference that was held in 2021 in Mauritius. Although there have been renewed commitments initiated to mobilise LFS in diverse ways in education systems (EEASA, 2021), there has been insufficient evidence that indicates the prioritisation of LFS-related content in school curricula (MoESD, 2011; Adawiah & Esa, 2012). One of the main outcomes that emerged was the theoretical engineering and re-orienting of Education for Sustainability (EfS). Additionally,

teachers have been distressed about their inability to grasp the complicated nature of sustainability and its 'convoluted' links with social, environmental and economic aspects of life (Walshe, 2017). While there is an urgency to have environment-friendly and socially-conscious citizens, this is only possible through the effective and efficient teaching-learning of LFS content.

This research aimed to identify how teachers successfully understand LFS, and how their understanding led to their enhancement of LFS in their classrooms. The outcomes of LFS could contribute vital information on how to eliminate perceived obstacles. Through exploring the phenomenon, I aimed to address gaps between teachers' understanding of LFS and its implementation. Green and Somerville (2015) established that teachers' and mentors' understanding of LFS ranged from very little to nothing. Geographically cut off from the continental mainland, Mauritius is characterised by a unique learning culture which is largely free of intrusions from other African countries and beyond. Consequently, the unique educational context and cultural background of Mauritian school teachers offer a distinct opportunity to explore teachers' understanding and enhancement of LFS.

As a researcher and teacher, I noticed that the majority of my colleagues could not apply LFS tenets in lesson-delivery. 'Green projects' in schools have successfully been implemented (e.g., Eco-schools) by some teachers. However, most of these LFS projects are based primarily on waste and resource management, which excluded LFS social and economic principles. However, LFS itself lacks holistic application in disciplines outside the Natural Sciences (Mogren et al., 2019). Literature also confirms that teachers cannot successfully apply LFS approaches because of an inadequate understanding of its meaning (Green & Somerville, 2015; Suarez-Lopez & Eugenio-Gozalbo, 2021). Research also enlightens us about teachers' obstacles and failures to bridge the disconnection between school curriculum, policy, resources, enthusiasm, and personal values regarding LFS (Dash & Mohan, 2017).

1.6 SIGNIFICANCE OF THE STUDY

This multiple case study research project aimed to explore teachers' understanding and enhancement of LFS in Mauritian primary schools by conducting a participant-designed action research intervention. The potential value of action research intervention findings is that it informs teachers and school administrators about teachers' understanding of LFS in the Mauritian education context. Aligned to the phenomenon under investigation, literature reveals

that teachers lack knowledge of what constitutes LFS, which was observed when little attention was devoted to its practice at the primary school level (Cebrian & Junyent, 2015; Garcia-Gonzalez et al., 2020; Dash & Mohan, 2017; Green & Somerville, 2015).

Enlightening teachers to understand LFS content and principles will enhance its (LFS's) importance via the aligning of teaching strategies to suit learners' characteristics, needs, experiences, and intellectual levels which could lead to (among others) the achievement of better academic performance. Teacher-trainers who are tasked with the aspect of teachers' professional development might also value the findings in terms of revising and developing their programmes to comply with sustainability best practice (Murphy et al., 2021; Lasen et al., 2017). Moreover, the findings can assist other small island nations on the subject of LFS which will empower them to adopt appropriate behavioural changes to acquire sustainability competencies that will overcome sustainability challenges (Lasen et al., 2017; Burgener & Barth, 2018). Adawiah and Esa (2012) add that primary school teachers and learners can become ambassadors to push the sustainability brand for the future (Green & Somerville, 2015; Murphy et al., 2021). Since they are the future adults of the next generation, it is crucial for young children to learn about sustainability concerns (Taylor et al., 2015; Burns et al., 2019).

1.7 REVIEW OF LITERATURE: AN OVERVIEW

Since LFS involves acquiring knowledge, values, attitudes, and skills, it is a critical agent needed to progress from a current unsustainable state to that of a sustainable one (Mughal et al., 2011; Taylor et al., 2015; Laurie et al., 2016). As such, LFS serves as a balance or monitoring mechanism between human activities and the environment. In other words, there is a synergy that exists between the physical or natural environment and the human and social environment. Despite this, Hlalele (2013, 2019) contends that there has always been a pursuit to separate the natural and the social/human environment in the realm of scientific discourse, which is consistent with that of Dyball and Newell's (2014) study, that there is tension within human ecology between those who favour an open-ended approach, and those who seek a more scientific way of proceeding.

The Sustainable Development Goals (SDGs) emphasise that incorporating environmental and social dimensions to attain economic development goals (UNESCO, 2012a; Taylor et al., 2015) acknowledges that humanity's future economic prosperity depends directly on the ecological

health of the planet (Almond et al., 2020). Accordingly, LFS serves as more than a knowledge-base connected to the environment, society, and economy; it incorporates values, skills, and attitudes to direct and motivate people to strive for sustainable livelihoods in a democratic society. Belle (2017) maintains that education in the 21st century should prepare learners to tackle sustainability issues that the world is confronted with so that they are equipped to create a better and sustainable future. In support, Laurie et al. (2016) advocate that LFS should develop and enhance learners' decision-making skills based on rigorous science, ethics, and values. Education plays a pivotal role in constructing societies based on the tenets of collective justice, equity, and sustainability and has been recognised by international agencies. In response, action plans and strategies were devised (Cebrian & Junyent, 2015; Bourn et al., 2016; Moyer & Sinclair, 2020).

Although schools in many countries are expected to teach and promote sustainability, the lack of preparedness and confidence observed in pre- and in-service teachers to conceptualise and apply the principles of sustainability is a hindrance to its implementation (Green & Somerville, 2015; Dash & Mohan, 2017; Garcia-Gonzalez et al., 2020). Since teachers' behaviours comprise their personal, practical and implied beliefs (values, knowledge systems, and hopes) as fundamental factors that influence how learners are taught sustainability, it is imperative that a thorough understanding of LFS is grasped (Alsina & Mula, 2019).

According to a regional workshop (in collaboration with UNESCO) held in Johannesburg (South Africa), the main challenge of implementing LFS in the national school system of Mauritius was the different teachers' interpretations of LFS as a concept and philosophy for the new education system (UNESCO, Regional Office for Southern Africa [ROSA], 2018). However, there are enablers for delivering LFS content successfully into the Mauritian national school system – these include political will, and a revised, compliant, and relevant sustainability education national curriculum (MoEHRTESR, 2016). The challenges to energise these enablers to promote sustainability lie in the difficulty to understand LFS content, and the reluctance of teachers (and other role-players) to work towards achieving sustainability objectives.

Taylor et al. (2015), Bourn et al. (2016), and Ben-Eliyahu (2021) assert that people worldwide recognise that the current economic climate is unsustainable. Also, public awareness, education, and training are tools humanity needs as trajectories towards sustainability. In this regard, the United Nations Sustainable Development Group (UNSDG) was launched in 2015,

various stakeholders were encouraged to promote a vision for a sustainable future through the eradication of poverty and the establishment of social cohesion and peace. Hence, teaching and learning to achieve global sustainability is of the utmost importance in education, especially in primary education as these learners will become tomorrow's adults who will protect the world from catastrophe.

In Mauritian schools, issues regarding the teaching of global sustainability and its challenges in relation to the curriculum are highlighted in the NCF. Alarmingly, in the United Kingdom (UK), a study by Bourn et al. (2016) exposes the fact that despite UK education policymakers noting the significance of global sustainability, they failed to recognise its relevance in relation to the role that education plays in creating sustainability awareness. According to Kuzmina et al. (2020), policies and approaches that emphasise whole-school LFS engagement are scarce. Tsayang and Kabita (2013) and Nkambwe and Essilfie (2012) elaborate that the holistic comprehension of LFS is inadequate, both in conceptual and practical levels for teachers and teacher-trainers in Botswana. Many teachers are motivated to apply LFS in primary schools; however, they lack the ability, knowledge, and confidence to enact it effectively (Green & Somerville, 2015; Adawiah & Esa, 2012; Garcia-Gonzalez et al., 2020; Dash & Mohan, 2017). Teachers complain that they hardly understand LFS and cannot be expected to incorporate it into the already congested and centralised curriculum (Green & Somerville, 2014; SuarezLopez & Eugenio-Gozalbo, 2021).

Identifying and understanding how teachers incorporate LFS into their teaching methods can provide invaluable perceptions on how to surmount these barriers. The present Mauritian primary school curricula already contain many important content areas. However, Suarez-Lopez and Eugenio-Gozalbo (2021) caution that adding new items would cause congestion of the curricula and an increased workload for teachers. It was noted that teachers tend to react negatively to additional work or changes, owing to their current overwhelming workload. Teachers and teacher-educators feel pressured to accommodate changes to the curriculum; for example, incorporating aspects such as citizenship education, human rights, and HIV/AIDS (Nkambwe & Essilfie, 2012; Tsayang & Kabita, 2013) - another addition to the curriculum might not create a positive impact.

However, the need to convince teachers, unions, and community members that the integration of LFS into the actual curriculum and textbooks is not an arduous task. Nkambwe and Essilfie (2012) and Tsayang and Kabita (2013) contend that although teachers and teacher-educators

are presented with teaching and learning materials on LFS, they cannot apply it effectively in lessons via innovative methods. Since teachers are generally concerned with the completion of the syllabus in an exam-oriented system, the holistic development of learners is compromised. This leads to many teachers stalling the implementation of LFS.

Additionally, the education system lacks mechanisms to guarantee and monitor the teaching and learning of sustainability-relevant content (Allen, 2021). Such mechanisms are critical to ensure that LFS activities are not taught in isolation, and that teachers are proactive in developing their transcultural capacity as part of their professional development to deal with diversity (Casinader, 2021). Also, Leal Filho et al. (2018) reflect on the possibilities for university learners as transformative agents to promote a sustainable future. Hence, education systems should transform to serve as models to foster LFS by applying strategies that reflect 21st century global innovations that include diversity among populations (Casinader, 2021).

However, there is a dearth of empirical and in-depth research that investigates pedagogical practices for teaching sustainability in education systems (Sandri, 2020; Michel, 2020). In other words, according to sustainability researchers, there is a lack of exploration regarding sustainability issues, especially concerning teachers' perceptions of LFS and how it can be enhanced in Mauritian primary schools and abroad. However, schools should urgently prepare learners for life. Accordingly, this participant-designed action research framed in a multiple case study approach, explored how teachers understand LFS, and how their understanding precipitated the enhancement of LFS in their classrooms. This study provided insight into the actual situation prevailing in Mauritian primary schools which would contribute to improving the delivery of sustainability knowledge, skills and values in classrooms such that learners are inspired to become ambassadors for global sustainability. Lastly, this study may also assist policymakers to revise and/or restructure curricula to fill in gaps and to align content to sustainability issues, while streamlining jam-packed syllabi to reduce the stress on teachers.

1.8 THEORETICAL FRAMEWORK: AN OVERVIEW

The theoretical perspectives and lenses that informed this study included Burns' Model of Sustainability Pedagogy (B 2013) and O'Donoghue's Active Learning Framework (O'Donoghue, 2001). Throughout the research processes it was essential to investigate how teachers framed their understanding of LFS, how this understanding enhanced the teaching-learning of LFS.

1.8.1 Burns' Model of Sustainability Pedagogy

Burns' Model of Sustainability Pedagogy was designed to attend to the need for an effective and practical method to teach LFS in several contexts (Burns, 2009, 2011, 2013; Burns et al., 2019). It facilitates the increasing demand to focus on how teaching and learning can be repositioned to accommodate sustainability issues. It also enlightens us on how teachers can successfully navigate major ecological, socio-cultural and economic challenges in ways that transform learners by empowering them to effect positive changes as a civic duty regarding sustainability (Burns, 2013; Burns et al., 2019).

Teachers agree that teaching LFS encourages change to circumvent sustainability challenges (Redman, 2013; UNESCO, 2014). At the swift rate that social and ecological setbacks are occurring, the demand for effective education to prepare learners to understand sustainability principles for ecological and social renewal has become imperative (Stables, 2009; Gamage et al., 2022). To understand and solve sustainability challenges, educational practice has to foster LFS as a matter of urgency (Claro & Esteves, 2021; Cebrian & Junyent, 2015; Burns et al., 2015).

Burns' Model of Sustainability Pedagogy (2011) comprises of five dimensions, each embedded in some learning theory. The model facilitates an understanding of how sustainability is being taught and enhanced at school level. The Burns' Model of Sustainability Pedagogy (2011) can also be utilised to gauge how teachers consider dominant paradigms and perceive complicated sustainability problems and practices from varied viewpoints. Since learning about sustainability is accelerated through experience, inquiry, and reflection, it moves towards problem-based learning and cooperative groupwork. This model supports pedagogy for sustainability and ecological living through transformative learning that considers LFS. It includes process-oriented learning, transferrable learning, and situated experiential learning. However, Burns (2015) admits that the best way to design sustainable and regenerative educational systems is through ecological systems themselves. Thus, the prime motivation for sustainability teaching is to produce meaningful, integral, and transformative learning through a purposeful design that includes several dimensions.

1.8.2 O'Donoghue's Active Learning Framework

Teachers who implement LFS successfully are motivated to create opportunities for learners to engage in genuine decision-making processes that can advantage their local communities (UNESCO, 2005). Taylor et al. (2019) mention the issue of teachers increasingly failing to apply LFS effectively in practice. However, Getzin (2019) asserts that learners' skills in engaging in decision-making opportunities encourage teachers to re-create meaning-making in LFS when planning and delivering lessons in classrooms. Unfortunately, direction on how teachers in the Mauritian context can develop knowledge and skills to interrogate issues related to LFS is lacking in literary discourses.

O'Donoghue's (2001) Active Learning Framework clarifies how learners can engage in independent learning. The model which suggests an action plan for learning about and countering environmental challenges (O'Donoghue, 2007; O'Donoghue et al., 2018), advocates that learners should be engaged in action-taking activities in the community to enhance their skills and attitudes to improve the state of LFS at schools. However, O'Donoghue et al. (2018) caution that no model can accurately dictate how teachers should apply LFS in their lessons.

In the schooling context, LFS has emerged with new sustainability knowledge which focuses on co-engaged action learning. The school context directs LFS to be framed as a deliberative inquiry on matters that pertain to the everyday lives of learners. Since the challenges can be largely identified in the arena of teachers' capabilities and perception of LFS, Payne and Hart (2020) recommend empowering teachers to be accountable and responsible for designing their own learning programmes by integrating LFS content.

1.9 RESEARCH APPROACH AND RESEARCH METHODS

1.9.1 Research Paradigm

A research paradigm refers to a thinking framework where there is a set of fundamental assumptions and beliefs about how the world is viewed (Schwandt, 2015). Similarly, Rehman and Alharthi (2016) define a research paradigm as a basic belief system and theoretical framework with assumptions about ontology, epistemology, methodology, and methods. In this research, an **interpretive** paradigm was adopted as I conducted the research from the viewpoint

that reality is socially constructed; therefore, no single path, method, or theory to knowledge exists (Scotland, 2012; Kamal, 2019; Lincoln et al., 2011). In other words, the interpretive paradigm depends on how reality is perceived and studied (Rehman & Alharthi, 2016).

I intended to derive in-depth constructs from the field of study by examining the phenomenon of interest (LFS) from the perspectives of a group of teachers. The interpretive perspective identifies inside viewpoints or actual meanings of social phenomena from its research participants as good social knowledge (Wahyuni, 2012). In educational research, a *paradigm* refers to the researcher's worldview or basic set of beliefs that will guide the researcher through the research process (Paragoo, 2021; Creswell & Creswell, 2018; Mertens, 2020). Similarly, Khatri (2020) describes it as the philosophical viewpoint of the researcher from which research phenomena are observed and analysed. The underlying assumptions that guide the research paradigm included ontology, epistemology, axiology and methodology (Kivunja & Kuyini, 2017; Al-Ababneh, 2020; Khatri, 2020).

1.9.2 Research Approach

This study pursued the qualitative approach which explored teachers' understanding and enhancement of LFS in Mauritian primary schools. Qualitative research attempts to interpret phenomena in terms of the lived experiences of the participants in their natural settings (Denzin & Lincoln, 2021; Brinkmann et al., 2018). It provides a more holistic view of human beliefs, perceptions and ideas in their specific social contexts. According to Creswell (2015), the aim of qualitative research is to explore and discover issues about the problem on hand because very little is known about the problem (cited in Kamal, 2019). In this participant-designed action research, incisive insights from participants were required as the phenomenon of interest related their understanding of LFS. The qualitative approach was suitable for this study as it allowed the researcher to understand how teachers interpreted and made-sense of daily occurrences regarding LFS in the 21st century.

Creswell (2015) maintains that, as opposed to quantitative methodology, qualitative research methodology depends heavily on language and interpretation to provide meaning-rich data. Therefore, the data generation method in this study involved the collaboration of the participants in a creative process of theory development (Creswell & Creswell, 2018; Kamal,

2019). In sum, learning about human behaviour is best investigated by analysing qualitative data (Denzin & Lincoln, 2018).

1.9.3 Research Design

A multiple case study design was adopted for this study to elicit responses in line with the aim and objectives of the research by answering the *how* and *why* questions on teachers' understanding and enhancement of LFS. A case study can be both qualitative and/or quantitative (Stake, 2013). In this context, a qualitative design was more suitable than a quantitative design as I aimed to gain valuable descriptive insight into teachers' understanding of LFS. Hence, a case study design was selected to study specific cases such as individuals in a school (Yin, 2018). Yin (2018) who views a case study as an examination of specific phenomena, such as a programme, an event, a person, a process, an institution or a social group, also states that a case is a contemporary phenomenon where the context is not clear, and the researcher has little control over the phenomenon and the context. Thus, a case study can be seen as an empirical inquiry that provides answers to *how* and *why* questions concerning the phenomenon of interest.

A case study is also descriptive and exploratory in nature, as it provides rich longitudinal information about individuals or particular situations (Martin et al., 2014). In this study, the general-purpose primary school teachers in one school were selected to answer particular research questions based on their experience and suitability regarding the phenomenon under investigation. The school teachers provided a holistic and in-depth wealth of information for analysing aspects of LFS. As advised by Yin (2018), the school allowed me to investigate general-purpose primary school teachers' understanding of LFS as the phenomenon of interest within its real-life context where teachers attempted to incorporate LFS tenets into their daily lessons as spelt out in the NCF. In sum, the multiple case study design provided an organised method to obtain data, analyse it, and report the results to enable me to understand a specific phenomenon extensively (Creswell & Creswell, 2018).

1.9.4 The Participants

Convenience sampling was adopted for this study which involved the selection of primary schoolteacher-participants. Convenience sampling refers to non-probability sampling which

relies on data generation from members of a population group that I had access to (Cohen et al., 2018). Mauritius is a small island, so schools are easily accessible. I aimed to discover, understand, and gain in-depth knowledge of teachers' understanding of LFS; therefore, I selected a sample from which much could be learnt. Here, specific people (teachers whom I was acquainted with) or events (classroom practice) were deliberately selected to produce rich and relevant information in line with the study's aim, objectives, and research questions (Creswell, 2015; Creswell & Baez, 2020).

There are currently 319 primary schools (Statistics Mauritius, 2020) in Mauritius - one primary school in the eastern part of the country was chosen for the study. The school chosen had a population of 891 learners with a teaching staff of forty-two [42] (Statistics Mauritius, 2020). This study involved a descriptive and exploratory inquiry that yielded thick descriptions from a small relatively small sample. The selected participants were general-purpose primary school teachers with many years of teaching experience who taught subjects such as English, French, Mathematics, Science and History/Geography. Six teachers were selected from the school to provide deep insight into the impact LFS has on the learning process. The criteria for participant-selection were based on teachers' willingness to voluntarily participate, their experience, and their interest in the outcomes of this participant-designed action research.

1.9.5 Research Methodology: Participant-designed Action Research

The purpose of this study was to explore teachers' understanding and enhancement of LFS by conducting a participant-designed action research intervention. Action research was the main tool in this research project as it provided suitable opportunities for reflective practice regarding teachers' understanding and enhancement of LFS.

1.9.5.1 Characteristics of Action Research that contributes to research methodology

Lewin (1946) contends that action research involves a study of the products of social interaction which comprises of 3 steps: planning, action, and reflection (fact-finding). It is research undertaken by a professional in the study of individuals in a common field or organisation to create change in their employment context (Greenwood & Levin, 2007). Additionally, Altrichter et al. (2021) describes action research as a skill development exercise intended for people to attain freedom through transformation. This enables them to create a better

environment (Greenwood & Levin, 2007; Hendricks, 2019; Kemmis et al., 2019; McNiff et al., 2018).

Further, Greenwood and Levin's (2007) and Lewin's (1946) processes of action research were implemented in this study as both acknowledge the effects of reflective practice and social collaboration on transformation. When the context, experience and action are continuously being developed and redefined, the aims cannot be predetermined. In acknowledging this dynamic, more flexibility and responsibility are placed on teacher-researchers than the case appears to be (McNiff et al., 2018). It was through the understandings of action research that a holistic perspective of action research was attained for this inquiry (Woods-Jaeger et al., 2021).

Additionally, Greenwood and Levin (2007) outline five central features of action research. Firstly, action research is a method of study that is context-dependent which aims at generating answers to the issues that exist within a certain context. Secondly, action research is described as a collective, self-reflective inquiry which requires participant collaboration. Thirdly, action research appreciates the diversity of experiences and skills that the participants contribute to the study as it ensures more meaningful outcomes. Fourthly, it facilitates meaning-construction through participants' capacity to act. Through reflecting on actions, participants develop new definitions (Woods et al., 2022). Fifth, the validity of action research is measured by its ability to generate a resolution to a problem (Kemmis et al., 2019) and to modify participants' perceptions in such a way that they are equipped to deal with problematic situations successfully (Messikh, 2020).

1.9.5.2 Benefits of Action Research

Messikh (2020) contends that the primary aim of action research is to upgrade one's practice and to develop one's knowledge. It can be argued that improved practice is a result emanating from the acquisition and synthesis of knowledge which is the primary aim of an action research study. In this study, teachers' understanding and enhancement of LFS were investigated through the action research methodology. The actions demonstrated by teachers confirmed the development of a theoretical understanding of LFS, in addition to acquiring practical knowledge to enhance and apply LFS in practice. Action research is not only a problem-solving approach as described by Khatun and Salahuddin (2018), but also a systemic process of improving the present situation. In support, Ness and Heimburg (2020) and Bartels et al. (2020) agree that the purpose of action research is to expand personal and professional development.

Action research is beneficial for both learners and teachers, including the adopted culture of the school (Bradbury et al., 2019). Wallen and Tormey (2019) add that the processes of action research boosts teachers' self-confidence. Also, Bradbury et al. (2019) mention that the defined values must be appropriately witnessed through concrete actions to indicate improvements in practice. Messikh (2020) states that ideally, values that are being transformed into applicable actions should be measured according to teachers' focus on a continuous process of reflective practice. This view acknowledges that personal values, perceptions of existing values, and diverse situations affect translating values into positive actions to enhance practice.

Therefore, it can be deduced that when experts conduct action research, they engage in an energetic process based on their professional, social, ethical, religious values, and self-esteem (Villacanas de Castro & Banegas, 2020). By applying the modifications in classroom teaching-learning situations, a better improvement is achieved in linewith predetermined goals (Mertler, 2019).

1.9.5.3 Structure of the Action Research Cycle (ARC)

This study adopted Lewin's (1948) model of action research which starts by investigating a concept, an idea, or a problem. This was attained through the *planning* stage where teachers' perceptions of LFS were confirmed. It also required devising a plan that would produce results and solutions pertinent to the issue under investigation which was to be accomplished as the end result of the research. Lewin's (1946) second step (*action*) involved implementing the plan that was devised. The third step of *observation* involved observing the teachers on how they acquire their understanding of LFS, and how they integrated and enhanced them in their teachings. Finally, depending on the evaluation of results, a process of *reflection* is undertaken. This could initiate a new cycle to re-plan and take further steps to improve the action.

The action research cycle followed four consecutive steps: *planning-action-observation-reflection.* Consequently, these were seen to be linear steps that had to be executed in sequence (Johnson, 2012). In addition, teachers were urged to reflect on these steps continuously while engaging in them. Each step was informed by reflective thinking which involved occurrences of reflection-in-action, reflection-on-action, and reflection-for-action.

The *planning step* is known as the 'pre-intervention phase'. Preceding the intervention, its goal was to identify what the teachers understood about LFS. The first research question relating to

teachers' understanding of LFS was in part answered by the data provided in the first step of the cycle.

The *action and observation steps* (intervention phase) consisted of a teacher-designed intervention. The purpose of this step was to observe how teachers' understanding of LFS was developed and how this enhanced their teaching practice. This was measured by observing the innovations that the teachers designed and implemented. Data was generated during each phase through instruments that were considered suitable for the intervention phase. The data that was captured provided information to answer the second research question.

The purpose of the *reflection step* **(**the post-intervention phase), was investigate teachers' understanding and enhancement of LFS after the intervention cycle. This second analysis of teachers' understanding and enhancement of LFS served to clarify whether (and how) teachers developed professionally from their initial understanding of LFS. The data generated during this refection stage assisted in the acquisition of relevant knowledge to fully answer the first and third research questions.

1.10 DATA GENERATION PROCESSES

The data generation processes were of an emergent nature (McNiff, 2016). The observation process presumed that all the teachers agreed to participate in the research. To explore teachers' understanding and enhancement of LFS in Mauritian primary schools, several data generation methods and instruments were utilised. After selecting the teachers who were presumed to be suitable and information-rich, telephonic messages and face-to-face meetings communicated invitations to voluntarily participate in the study. Various instruments were utilised in a targeted fashion (Parveen & Showkat, 2017), especially during the *planning* and *reflection* steps of the action research cycle. The instruments chosen to generate data were designed to provide answers to research questions pertaining to this study (Kabir, 2016).

Generating data can be expressed as the process of carefully extracting the required information with little interference, so that the analysis provides authentic answers to the research questions to strengthen credibility and to stand the test of logic (Creswell & Baez, 2020). Thus, the data generation methods were organised to answer the research questions. The data generation methods for the *planning* and *reflection* steps were described accordingly to confirm their purpose and relevance in answering the research questions. The qualitative semi-structured

interviews and classroom observations were audio-recorded after having obtained the consent of the teachers. Audio-recording strengthens triangulation, and allows for an authentic information-recording (transcriptions) compared to taking down notes (Kabir, 2016). The audio- recordings were subsequently transcribed into text for close analysis and member-checking. The data generation techniques for this action research are included hereunder:

1.10.1 Semi-structured Interviews

The primary source of data emanated from semi-structured interviews conducted with the six participant-teachers. Newcomers et al. (2015) and Roulston and Choi (2018) define semi-structured interviews as asking several structured questions and then prodding with open-ended questions for extra information related to the topic, even when the participants may not feel comfortable with sensitive issues (Cohen et al., 2018; Gill & Baillie, 2018). Semi-structured interviews were deemed as the most appropriate form of interviewing for the planning and reflection phases of the study as it aligned with processes of collaboration and symbiosis in teaching and learning, which were considered as essential parts of a *community of learners'* approach (Muzari et al., 2022; Young et al., 2018). Essentially, the semi-structured interview approach comprised of a series of open-ended questions on the topic under investigation (Muzari et al., 2022; Carlin & Kim, 2019).

The intention in using the semi-structured interview process for this study was to elicit incisive and extensive information on issues pertaining to the learning context involving sustainability issues. This facilitated an exploration of teachers' understanding of LFS, and how they enhanced the concept of LFS within the learning areas they taught. This led to the first and second research questions being answered.

1.10.2 Document Analysis

Document analysis was used to confirm evidence of planning lessons that included LFS in reflective journals. Teachers were requested to plan lessons with all relevant materials and teaching aids. According to Muzari et al. (2022), content analysis refers to texts, books, newspapers, official documents, music, lyrics, photographs, and artefacts (Cohen et al., 2018). Here, teachers designed and implemented a lesson where they applied their understanding of LFS. It also answered the first question wholly, but partially answered the second research question.

1.10.3 Classroom Observations

Classroom observations entailed the collection of primary data which included a focus on the processes of collecting, observing, and interpreting data (Lindorff & Sammons, 2018). Teachers implemented their formal lesson plans which revealed their understanding of LFS including how they enhanced LFS tenets in their practice. While I played the role of a non-participant observer, I recorded key actions in my observation schedule. I also wrote down post-class observation notes once each classroom observation was completed. In qualitative studies, observation notes are an innate tool of recognition and synthesis (Maharaj, 2015). In this regard, Cohen et al. (2018) explain that to enact observation as a process of data generation is the beginning of the analysis of data. Early data generation and evaluation allowed me to guide data generation practically. The process of classroom observations, therefore, fully answered the second research question.

1.10.4 Journal Reflections and Post-lesson Interviews

Teachers' reflections focused on their experiences of attempting to integrate LFS subject content in their lessons. Through reflection, teachers also reviewed their understanding of LFS. Moreover, the post-lesson interview, revealed what was done in their lessons and why it was done in a specific manner. These reflective steps answered research questions one and two. During the final round of post-lesson interviews, teachers reflected on how they enhanced LFS and why they decided to use the enhancements in the ways they did. This data generation method only transpired in the reflection phase; it and answered the first and third research questions in full.

1.11 DATA ANALYSIS

In qualitative studies, researchers try to generate data through direct interaction with the phenomenon being studied. This involves arriving at conclusions drawn from raw data (Wahyuni, 2012; Azungah, 2018). However, raw data has to be organised first so as to be ready for analysis which involves dismantling, segmenting, and reassembling data to form meaningful themes and patterns in order to draw inferences which enabled me to make-sense of the collected data (Tjora, 2018; Xu & Zammit, 2020). In support, Mohajan (2018) agrees that analysing, organizing, and interrogating data in ways that allow researchers to see patterns, identify themes, discover relationships, generate explanations, make interpretations, develop

critiques, and generate theories. Further, observation assists to uncover hidden nuances that supplement meaning and understanding of the phenomenon. Therefore, the process of data analysis leads to an interpretive philosophy that gives meaning to qualitative data (Creswell & Poth, 2018; Azungah, 2018).

Data collected from semi-structured interviews during the planning and reflection steps was interrelated because of my ethical approach in questioning and making the interviewees feel at ease during interviews. A constant comparative analysis was applied to dissect conversations after transcription to determine which themes needed further exploration. According to Dufour and Richard (2019), and Lindsay (2019), this strategy involves categorising transcriptions from each interview, and comparing them with other interviews. Accordingly, different themes emerged from the analysed data such as, among others, teachers' understanding of LFS and the values that inspired them to integrate LFS into their lessons, and teachers' opinions of the ways they had integrated LFS into their previous lessons.

Document analysis included prearranged lesson activities in the planning and reflection phases, identifying evidence of LFS tenets being integrated into classroom tasks, and any other themes originating from the data (Scharp & Sanders, 2019). Data generated from classroom observations were closely related, due to their natural context (Lindorff & Sammons, 2018). During classroom observations which were conducted during the action step, behaviours and interactivity, together with what was presented to the learners were analysed according to their relevance to LFS. An observation schedule was followed as a data generation instrument (Lindorff & Sammons, 2018). The final analysis of the reflective journals were centred on teachers' understandings, successes, confusions and any other aspect that the data revealed to support evidence concerning themes identified in the cycle (Durmuş, 2020). All data generated through this instrument was interconnected because of its explanatory, descriptive and documentory nature.

Since qualitative data analysis is a process that seeks to reduce and make-sense of vast amounts of information (Creswell & Creswell, 2018; Azungah, 2018), the specified research questions were answered using evidence from the interviews, observations, document analysis and reflective journals. Also, the data obtained through individual interviews were indexed using pre-defined themes, as well as new themes that were added as required. The themes were then grouped into common but salient themes that could answer the research questions (Yin, 2018;

Akinyode & Khan, 2018). *Thematic analysis* was adopted to identify the continuous messages that pervaded the situation (Xu & Zammit, 2020).

1.12 ETHICAL CONSIDERATIONS

This action research was conducted with the participants only after obtaining permission from the University of KwaZulu Natal (UKZN) Ethics Committee, and the Mauritian Ministry of Education, Tertiary Education, Science and Technology (MoETEST). It was clearly stated in the consent letter that participation was voluntary and that the participant may withdraw from the research process at any time without being penalised in any way. Many institutions have predetermined ethical guidelines for research studies including not causing harm, obtaining permission, confidentiality, privacy, research integrity, and using peer connections (Gul et al., 2021). I also ensured that the identities and information of all participants would be protected by using pseudonyms such that all their information that they provided remained confidential and stored in a password-protected electronic file, while hardcopies would be stored in a lock-up safe only to be accessed by the researcher and the supervisors (Clough & Nutbrown, 2012). In this study, it was essential to consider the interests and feelings of the participants. According to the UKZN protocol, the information will be kept for five years after which it will be deleted or destroyed.

1.13 TRUSTWORTHINESS

In contrast to quantitative researchers, who use statistical methods for establishing the validity and reliability of research findings (Denzin & Lincoln, 2018), qualitative researchers apply methodological strategies to ensure the *trustworthiness* of the findings. These include declaring personal biases which could impact the findings, recognising sampling biases, and continuously critically reflecting on the methods used to ensure the relevance, depth of data generation, high quality of analysis processes, and authenticity of results (Rose & Johnson, 2020). Conscientious and truthful record-keeping, a meticulous audit trail, and ensuring consistent and transparent interpretation of data is of paramount significance. The comparison of similarities and differences between participants ensures that different perspectives are depicted through lived-experiences and thick descriptions of participants to support findings (Stahl & King, 2020).

In sum, participants in this study were general-purpose teachers from one selected school. The observation process allowed for the generation of data from classroom activities at different stages in a natural setting. Different methods to generate information were employed to produce a more extensive set of findings. Triangulation was also strengthened through independent peers who had an interest in the findings. Peers were requested to analyse the data to determine whether they drew similar conclusions regarding the themes and contents (Muzari et al., 2022). This process validated the findings. Lastly, trustworthiness was also achieved by devoting sufficient time in the field with the participants who provided rich descriptions so that readers could make-meaning of the research (Lube & Berg, 2017; Stahl & King, 2020).

1.14 LIMITATIONS OF THE STUDY

Literature confirms that LFS involves the very existence of society at large; but everyone is learning at different levels and stages of life. Teachers are also learning about sustainability, and since it is a dynamic phenomenon, new issues and concepts regularly arise. Thus, teachers and other stakeholders should have a common interest about how LFS is being integrated at the school level. Changes occur all the time – they not only affect learners, but also teachers and other stakeholders. Individuals understand LFS from their own perspective; however, in the school context, not only the student learns, but also education officials, parents, siblings, teachers, NGOs, and school communities. The officials could be representatives from the MoETEST and curriculum writers from the Mauritius Institute of Education (MIE) who are mandated by the MoETEST. The NGOs involved in the social aspects are represented by private companies linked to the school to assist indigent children with school materials, food, and clothing. Environmental clubs and their affiliatives could also help the school by organising campaigns to promote awareness regarding environmental cleaning and the planting of indigenous trees. Society is also represented by the local community such as village and town councils and senior citizens' clubs who could assist in LFS conscientisation. However, this study was limited to me as the researcher (one component of the stakeholders) and the teachers who were directly linked to the school. The focus was solely on what teachers learnt, understood, and how they enhanced LFS in terms of integrating sustainability themes into their lessons. For practical and financial reasons, only six participants from one primary school were involved in the study.

1.15 LOCATION OF THE STUDY

This participant-designed action research case study was conducted in Mauritius which is a small island found in the middle of the Indian Ocean with a population of about 1.3 million. Cut off from the mainland, its learning culture is as unique as its people. Figure 1.1 below indicates the exact location of the research site (school).

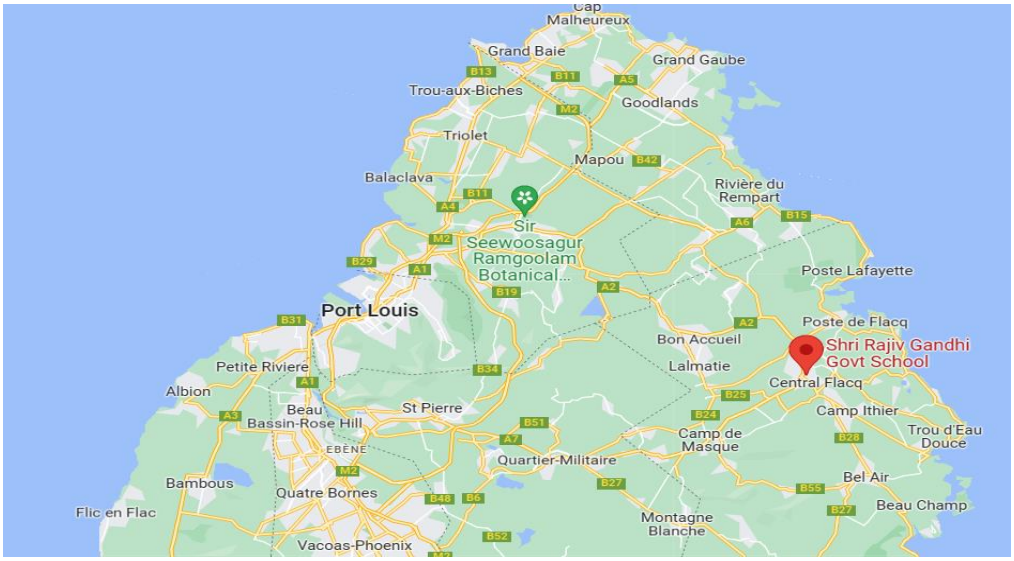

Figure 1.1: Location of the research site (Google Maps, 2022)

This study focused on primary school teachers (educators) from one primary school in Mauritian education system. Data was generated from primary school teachers who were the research participants. The name of the primary school was not divulged, and the participants were assigned pseudonyms/codes for confidentiality purposes. Geographically, the school is in a region where mixed-ability learners are enrolled, in the village of Central Flacq in the District of Flacq (Figure 1.1). The school is situated between houses, supermarkets, shops, restaurants, bookshops, banks, a police station, and colleges. Within the school premises, there are the school buildings, the library, staff rooms, a pre-primary section, the administrative office, the kitchen, a storeroom, an ICT room, Asian Language classrooms (including separate Tamil, Urdu, and Telegu rooms), and two ablution blocks. The school also has a green area, comprising of a football playground, a children's corner, and a few trees.

1.16 LAYOUT OF THE CHAPTERS

Chapter One provided a detailed statement of the problem, rationale and significance of the study, aim and objectives of the study, research questions, and the research methods used. Ethical issues and limitations were also addressed.

The conceptual and theoretical framework of the study was presented in **Chapter Two**. It commenced with an overview of the two theoretical frameworks which underpinned this study which led to the creation of meanings to reach credible findings. The investigation of these two conceptual frameworks provided a clear picture of the necessity to address LFS's shortcomomgs as the phenomenon under investigation.

Chapter Three reviewed the literature on the education system in Mauritius, specifically LFS in the Mauritian curriculum, to address the gapin research, and the significance of sustainability to the study. It also dealt with the understanding of LFS concepts and its approaches to learning. This was followed by an in-depth analysis of LFS, specifically the situation regarding the environment, economy, poverty, social cohesion, and peace in Mauritius.

Chapter Four described the literature that supported the methodological processes of the study. It focused on participant-designed action research as a methodology, the selection of participants, the action research process and its cyclical steps.

Chapter Five presented the data generated during cycle one of the action research. It discussed and analysed participants' initial understanding of LFS and how they intended to enhance their presentation of LFS content in their lessons by better understanding the intricacies of LFS.

Chapter Six addressed the gap identified during cycle one and focused on how this can be circumvented during the second cycle of the action research. The relevant themes that supported, but also criticised certain aspects of literature, were examined. Also, new perceptions revealed in the responses of participants were provided, in addition to the interpretation of results which were in line with current literature.

Chapter Seven dealt with the reflection phase of the action research. A concise analysis and interpretation of the reflections from participants' perspectives through post-lesson interviews and reflective journals were provided.

Chapter Eight included answers to the three research questions that guided this action research to attain the outcomes which drew realistic and valid conclusions. It also suggested a model for

LFS to promote change that would enhance sustainability teaching and learning. It concluded by outlining the limitations and suggesting recommendations for further research.

1.17 CONCLUSION

This chapter introduced the study, provided the problem statement, delineated the aim and objectives, listed the research questions, reviewed the literature and theoretical framework as an overview, described data generation and analysis, explained ethical considerations, dealt with trustworthiness principles, structured the layout of chapters, and presented the conclusion to the chapter. The next chapter (2) provided the theoretical framework of the study.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 INTRODUCTION

The first chapter provided an outline for the rationale, purpose, research aims and objectives, research questions, methodology and significance of the study. It also outlined the review of the literature and the theoretical framework adopted in the study. To achieve the objectives of the study, a participant-designed action research methodology was utilised to explore teachers' understanding and enhancement of LFS. In this chapter (2), the theoretical framework that relates to the study and justification of these theories are presented. Theoretical perspectives and lenses that inform this study include Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework. Further, the application of these theories in this study is explained in this chapter. The theoretical implications and understanding of LFS, as well as their modifications in teacher learning, especially when involved in action research, are also explored. The discussion scrutinised how the two learning theories were suitable to explore teachers' understanding and enhancement of LFS, in terms of effective skills that are used during teaching. As previously stated, the research framework was appropriate as it was based on the collaborative construction of knowledge by myself and the teachers through various interactions in which action, learning and research occurred simultaneously by adopting action research as a methodology.

2.2 OPERATIONAL CONCEPTS

Operational concepts that are clarified in this section include learning, active learning and learning for sustainability (LFS). Research studies usually have terms that must be precisely and carefully defined to obviate misunderstandings and ambiguities. Operational concepts represent the construct of the concepts or theoretical definitions. The following are the main operational concepts that needed to be clarified:

2.2.1 Learning

Sedrakyan et al. (2020) describe learning as a process through which behaviour or knowledge is either obtained or changed through experience, studying, or training. According to Fong and

Slotta (2018), learning can enable learners to create knowledge through interacting with peers, teachers, parents, peers, communities, and the environment. Social learning processes are needed to contribute to societal change and transformation, hence it has the utmost importance in education (Burgener & Barth, 2018; UNESCO, 2015a). Learning can also mean gaining knowledge and skills by being taught, and by studying. Barth (2014) contends that learning not only occurs among learners, but also by changing educational practices and societal transformation. Learning serves a pivotal role in managing sustainability initiatives as frequently indicated in current literature. It is crucial for sustainability transformations to occur as it may lead to a wider awareness towards sustainability issues and LFS (Vinke-de Kruijf et al., 2019; Beers & Van Mierlo, 2017; Halbe, 2016; Pahl-Wostl, 2019).

In the Memletics Learning Styles Model proposed by Whiteley (2006), five steps are considered necessary for learning: identifying what is to be learnt *(locate)*, investigating to make-sense of it *(explore)*, making the required mental adjustments to absorb new experiences into an existing framework of knowledge *(arrange)*, adopting various methods and practices to fortify understanding *(reinforce)*, and lastly determining the process and efficacy of the styles and methods acquired *(enquire)*. These steps demonstrate that learning involves a process of attaining precise understanding. Since different learners have different ways of understanding (Nor et al., 2019), this model is appropriate to investigate diverse sense-making techniques.

This process acknowledges that learners already have some connection to the new concept which enables them to construct new meanings that enhances existing knowledge and understanding. Learning in this manner can be facilitated by using the knowledge of related experiences and guidance mechanisms. In this way, learners can identify with the learning experience through specifically selected actions. During these activities, knowledge-construction is enhanced through the understanding of how to tackle these sometimes intricate issues.

Open learning environments pursue situated learning, thus facilitating the development of content knowledge as well as pedagogical content knowledge (Burgener & Barth, 2018). Learning makes it possible for people to integrate all forms of knowledge with their lived-experiences. This method leads learners in the direction of inquiry-based practices and reflective knowledge acquisition in a professional setting (Alsina & Mula, 2019). In this context, Van Mierlo et al. (2020) assert that inquiry-based learning and reflective learning allow for the understanding and development of self-values and abilities that enhance teachers'

strategies to transform practice to promote sustainability concerns. This form of best practice is more relevant to teachers who have gained knowledge and skills from daily experiences in different contexts such that prior knowledge, coupled with astute understanding, are utilised to engender innovative changes that promote LFS enhancement.

Laurillard (2020) proposes an interaction model to ascertain what the existing interactions are between learners and teachers. In this model, the learning process is defined as an outcome of constant communication between teacher and learner although they understand and view the world differently. Both the teacher and learner are aware that there is higher-order thinking (metacognition) involved throughout the process. Metacognition is defined as having explicit knowledge of learning strategies and one's own learning process (Lai, 2011). Through metacognition, learners can successfully grasp new concepts on a daily basis. In other words, it is the ability to employ comprehension strategies by monitoring and controlling one's own thinking and learning (Ramdani et al., 2020).

Further, the understanding of metacognition is not restricted to knowledge only, nor its use, but is also applied to the explicit knowledge gained form one's learning process. Metacognition is a process of knowledge-acquisition that researchers gained from learner-centred education which is exhibited by looking at different behaviours that learners have internalised by building on prior knowledge (Zhiri, 2019). Therefore, learning is a way of understanding and viewing the world which provides individuals with the knowledge and abilities necessary for maintaining their learning in different circumstances. Similar to Laurillard (2020), I perceive that LFS is a mode of educating and teaching practical daily standards of living that enable sustainability which requires learners to be open-minded, inquiring, reuse-friendly, renew oriented, and able to rebuild to manage complex and challenging circumstances that need learning and re-learning.

2.2.2 Active Learning

Richardson (2015) describes active learning as a process where all learners are engaged in related activities that encourage them to understand content through observations and reflections to deepen their content understanding (Rodriguez et al., 2018). Innovative teaching strategies such as active learning pedagogy are constructed and employed as a new and promising landscape in education to enhance lessons creatively (Zamora-Polo et al., 2019). This active learning strategy requires a high level of learners' motivation in conjunction with

sound teaching practice that should lead to the enhancement of sustainability teaching and solving sustainability challenges. Similarly, Buil-Fabrega et al. (2019) maintain that active learning requires higher-order thinking skills such as conceptualising, analysing, synthesising and evaluating. It must be noted that active learning is a learner-centred method of instruction where learners are the focus of attention (Zohrabi et al., 2012). O'Donoghue (2007) states that active learning appeared at a period when concern for local enquiry, problem-solving and action learning was deemed as essential pedagogical processes.

According to research by Buil-Fabrega et al. (2019), active learning based on the flipped classroom method makes learners more committed to LFS. In support, Leal Filho et al. (2018) observed that in higher education institutions active teaching-learning is a key driver for the development of sustainable societies. However, Nguyen et al. (2021) argue that no research has yet been conducted that systematically analyses approaches to facilitate the implementation of active learning, and address learners' emotional and behavioural responses. Their (Nguyen et al., 2021) research revealed that most active learning activities involved in-class problem-solving that resulted in positive emotional and behavioural outcomes for learners which led to conducting a systematic literature review which included identifying eight approaches to aid in active learning. The strategies from the study conducted by Nguyen et al. (2021) complement O'Donoghue's Framework to promote sustainability pedagogy and LFS.

A criticism regarding active learning is offered by Van Rensburg (2015) who states that it (active learning) is very often associated with activity-based learning. This argument has its foundations in Piaget's reflections that learners develop new understandings through the active manipulation of objects. Learners are more engaged in activities than they would be in passive learning. Thus, teachers are encouraged to create learning situations that promote collaboration, discussion, and problem-solving (Calavia et al., 2021; Rosen et al., 2020). Importantly, active learning migrated from passive learning to teacher-centred methodologies, and then to learner-centred approaches which encouraged learners to learn on their own bombarded without being bombarded with knowledge from teachers. This means that learners gather new knowledge in a learning ecology in what Muijs and Reynolds (2017) describe as an active process where learners are encouraged to create their own meaning from prior knowledge rather than accepting a determined bank of knowledge from others. Hedden et al. (2017) claim that active learning is most suitable for teaching sustainability in higher education as it acts as a practicum-

based education which utilises an active learning approach to teach learners how to learn in an effort to motivate them to become lifelong learners.

Hodges (2020) claims that active learning promotes education in such a way that it enables learners to remember subject content that they have learnt. Also, they acquire new knowledge, skills and values through interactions with peers, parents, teachers and the community. Edwards et al. (2014) concur that the most enduring learning is acquired through experience and interaction with the social, intellectual, and physical environment. In 2018, learner-centred teaching and learning approaches in pre-service teacher education were promoted in Ethiopia to engender reforming the primary school curriculum which aimed at improving instructional approaches to teaching, reading, and writing (Dejene et al., 2018). Active learning is instituted as an alternative to the lecture approach as it (active learning) promotes diverse teaching-learning methods to ensure the integration of sustainability concepts and content in higher education – this is a possible framework to offer a coherent and actionable method of learning (Lombardi & Shipley, 2021).

Komatsu et al. (2021) disagree with UNESCO, the Organisation for Economic Cooperation and Development (OECD) and the World Bank who view the learner-centred approach as a panacea for sustainability integration without supporting evidence. Komatsu et al. (2021) also declare that this assumption is alarming as it does not prove that the learner-centred approach is effective in dealing with social and environmental problems, adding that encouraging the learner-centred approach may potentially be a hurdle to sustainability pedagogy. Bower and Hedberg's (2010) agree and elaborate that learner-centred appraoches promote learners' self-centredness and makes them oblivious to long-term possibilities; for example, global-scale sustainability. Active learning was adopted in this study in line with O'Donoghue's Active Learning Framework in an effort to prepare learners and teachers with innovative teaching and learning strategies to transform attitudes and behaviours towards LFS to ensure a sustainable future.

2.2.3 Learning for Sustainability

The LFS principles foster inclusive, value-based, and action-centered narratives. Therefore, it should include everyone (teachers, learners, and communities) in the learning process (Burns et al., 2019; Christie & Higgins, 2020) and should be planned by applying an open-ended learning approach involving everyone as it values engagement as a continuous process of

curiosity, exploration and community development. When learners are quizzed about global sustainability, they offer spontaneous responses such as climate change, water pollution, marine degradation, the state of schools, widespread social injustice, and globalised and industrial food systems (UNESCO, 2018). Sustainability, according to Burns et al. (2019), is a complex concept involving ecological, economic, and socio-cultural dimensions (Purvis et al., 2019). Although modern day learners are well-informed about global sustainability issues, they are more troubled at the state of everyone's livelihood and chances of survival in an ever-evolving world.

Although sustainability education critically dissects and evaluates information about various issues to find sustainable solutions, learners become easily disinterested if they are not taught participatory and problem-solving skills to become change agents. Since sustainability is rooted in deep ethical and spiritual teachings (Stead & Stead, 2014), teachers need to implement strategic approaches to teach sustainability in a way that transforms individuals to adhere to and practise sustainability principles (Rezapouraghdam et al., 2019). Similarly, Murphy et al. (2021) highlight that educational experiences through transformative teaching allow learners to develop necessary attitudes, skills and knowledge that contribute to solving sustainability problems. Some researchers assert that this demands a complete transformation of teachers' classroom practice such that learners deepen their understanding to tackle sustainability issues through effective interventions (Olmos-Gomez et al., 2019).

Moreover, teachers must understand LFS to successfully design and implement lessons that enhances learners' decision-making skills, participation in cooperative leadership, and producing systemic solutions to meet rising local and global sustainability challenges (Chambers, 2018). Hence, priority must be given to transformative sustainability learning that equips learners with creative strategies of knowing and being human (O'Riordan & Voisey, 2013). Potter-Nelson and O'Neil (2019) assert that we need education that prepares people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics. While conducting a study in Scotland, it was observed that there was a direct shift in practices of LFS and discourses regarding school gardening (Donald et al., 2019). Donald et al. (2019) state that school gardens offer an opportunity to focus on food education and healthy eating for the global sustainability of food systems which combines the philosophy of cognition and outdoor learning studies (Affifi, 2017; Gray & Sosu, 2020).

Traditionally, ecological principles were mostly ignored in schools which did not prepare learners to lead successful lives (Aguirreazkuenaga, 2019). Significantly, teaching sustainability requires relying less on information transmission and more on transformational learning that incorporates local community contexts. Because of their complex nature, teacher-centred and transmissive models of education are not sufficient for teaching sustainability issues. To realise the goal of transformation, education needs to migrate towards reflective learning, problem-solving, self-discovery learning, and collaborative groupwork. These approaches focus on learning through inquiry, experience and reflection (Suarez-Lopez & Eugenio-Gozalbo, 2021). Hence, for sustainability teaching to positively impact learners' lives, a shift in educational culture towards systemic, connective and ecological ways of learning is vital.

A survey conducted on a pre-service teacher course by Merritt et al. (2018) concluded that there was a need for an early intervention to integrate sustainability topics into school curricula. Merritt et al. (2018) elaborate that modelling classroom behaviours promoted sustainability more than implementing sustainability subject content into the curriculum. Furthermore, system thinking which looks at connected wholes rather than discrete parts has not been used as a method for developing an understanding of sustainability issues in teacher-education programmes (Palmberg et al., 2017; Yli-Panula et al., 2017), but it can also form part of the educational method since it emanates from results of life experiences.

Athough everyone has an idea of what sustainability education should encompass, barriers such as time-constraints and alignment with curricula in pre-service teacher courses prevent its effective implementation. In addition, there are limited studies that have explored how to deliver sustainability pedagogy that is systemic, connective and ecological at the primary school level (Merritt et al., 2018). In a study conducted in Australia by Larsen et al. (2017), it was found that teachers perceived LFS as highly relevant for their learners and reported that the main barrier to implementing aspects of LFS was a packed curriculum which prioritised literacy and numeracy disciplines. The findings from Larsen et al. (2017) also revealed that professional learning was required for teachers to imbibe the philosophy of sustainability pedagogy to promote learners' sense of civic responsibility towards sustainability issues.

However, LFS at the primary school level has proven to be too conceptual and restrictive. Suarez-Lopez and Eugenio-Gozalbo (2021) confirm this in their findings when they point out that there is a limited presence of sustainability in the curricula exacerbated by an inconsistent

conception of sustainability. Literature lacked evidence on how sustainability pedagogy is designed and executed, and whether learners are capable of taking action and confronting sustainability issues and challenges (Suarez-Lopez & Eugenio-Gozalbo, 2021). Dash and Mohan's (2017) findings concur that there is an inappropriate understanding of sustainability concepts among teachers in Mysore, India. However, it is imperative that primary school learners be armed with the values, knowledge and skills to implement sustainability at a local level. There is therefore a need for sustainability pedagogy and LFS which should be widely and effectively implemented in various school settings such that experiential activities and outside the classrooms activities become a norm (Agirreazkuenaga, 2019).

2.3 THEORETICAL LENS

According to Adom et al. (2018), a theoretical lens or framework is defined as a blueprint that is often borrowed by the researcher to build his/her own research inquiry. The researcher, thus, is guided by the theoretical framework. It can also be regarded as a lens that a researcher uses to focus on different aspects of the research subject (Ocholla & Le Roux, 2011; Mthembu & Ocholla, 2018; Ng'ong'Ocholla, 2022). Additionally, it provides guidance on how to build and support the research as it defines philosophical, epistemological, methodological, and analytical approaches to the study. Groenewald (2021) explains that a theoretical framework presents important viewpoints, directions, and guidance to the study in that it connects the researcher to existing knowledge. A research study may be framed by utilising more than one theory - this study was underpinned by Burns' Model of Sustainability Pedagogy (Burns, 2011) and O'Donogue's Active Learning Framework (O'Donoghue's, 2001) which pertained to teachers' understanding and enhancement of LFS.

2.3.1 Theories Framing the Study

The theoretical lenses that informed this study included Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework (c.f. 1.6). The two theories were merged for this action research project as they were appropriate to effectively analyse the collected data. Additionally, observing how teachers constructed their understandings during the research processes provided insight into LFS challenges and how to circumvent them for enhancement purposes. Thus, teachers' understanding and enhancement of LFS referred to what they had constructed concerning the meaning-making of LFS.

Burns' Model of Sustainability Pedagogy (Burns, 2009, 2011) was the first theory that the study drew on. It expanded on trends towards transformational learning while providing a holistic approach to developing (or re-developing) sustainability lessons grounded in ecological principles (Burgener & Barth, 2018). Therefore, the purpose of sustainability pedagogy is to construct significant, integral, and transformative learning by intentionally applying learning processes incorporating multiple dimensions (Burns, 2016b).

The second theory that this study drew on was O'Donoghue's Active Learning Framework (O'Donoghue, 2001) which assisted in presenting an overview of how educators involved learners in self-learning. This model also assisted in unearthing strategies for learning about and reacting to sustainability issues (O'Donoghue, 2007). Nguyen et al. (2021) articulate that learning involves an active process where learners create knowledge and grasp understandings by actively applying their personal experiences. This viewpoint is supported by O'Donoghue (2001) who sees this model as supporting open-ended processes of active learning, while suggesting that teachers may consider any single dimension as a starting point, and thereafter apply relevant methods within different dimensions to create a multi-skilled and multi-perspective approach to environmental issues.

Since sustainability pedagogy has the potential to be transformative and meaningful when learning is designed thematically, it focuses on interrelated methods to co-create content (Larsen et al., 2017; Leal Filho et al., 2018). Learning can also be designed when critical questions dissect dominant norms, incorporate diverse perspectives, and utilise active, participatory, experiential and relational processes (Suarez-Lopez & Eugenio-Gozalbo, 2021; Agirreazkuenaga, 2019). Learning can be based on specific context-real ecosystems and communities where learners survive, learn, and assist (Burns, 2009).

The above two theories thus provided opportunities for transformative and active learning (Lombardi & Shipley, 2021). They acted as agents to transform the attitudes and values of learners to eventually create communities that work collaboratively contribute to creating sustainable systems (O'Donoghue, 2001; Burns, 2016a; Dash & Mohan, 2017).

2.3.2 Burns' Model of Sustainability Pedagogy

Burns' Model of Sustainability Pedagogy serves as a practical and flexible model to teach sustainability (Burns, 2016b) in various settings including the non-formal education sector, through co-curricular and learner-leadership programmes, and academic courses. This model recognises that ecological and environmental systems are the best guides to uplift regenerative educational systems (Burns, 2009, 2011). Burns (2009) also maintains that this model considers best practice and relevant effective theories for teaching sustainability qualitatively while adhering to the central goal of providing opportunities for transformative learning (cited in Leal Filho et al., 2018). These opportunities inspire learners to eradicate negative norms and values, and initiate integrity via authentic, ethical, and practical modifications in their lives (Green & Somerville, 2015; Sipone et al., 2019). Emanating from Burns' Model of Sustainability Pedagogy are five different themes (Figure 2.1) which are deeply embedded in learning theory (Burns, 2009, 2015; Burns et al., 2018):

- *Content* - Thematic, multidisciplinary, and co-created
- *Perspectives* - Diverse and critically questions dominant paradigms and practices
- *Process* - Participatory, experiential, and relational
- *Context* - Place-based learning theory
- *Design* - Transformational learning

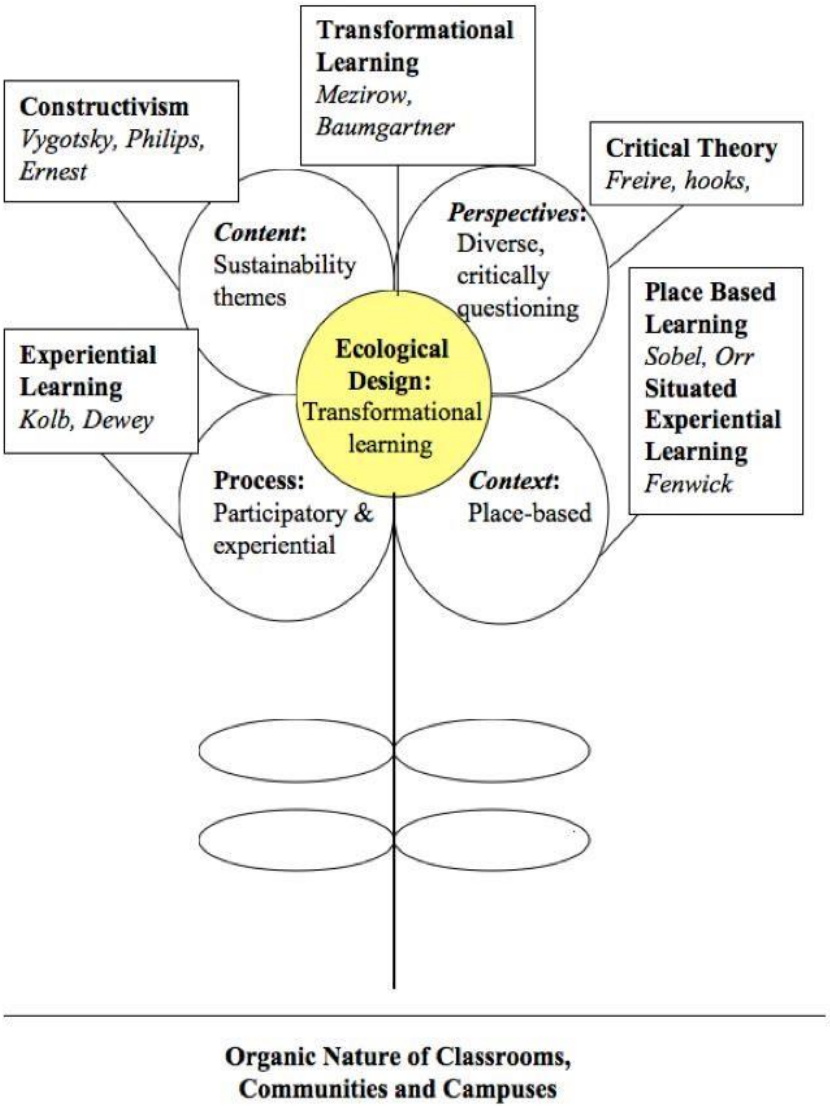

Figure 2.1*:* Burns' Model of Sustainability Pedagogy (Burns, 2009, p. 7)

Burns developed the model (Burns, 2013, 2018) to address the demand for a practical approach to teaching LFS effectively. It dealt with the growing need to focus on how teaching and learning can be restructured and redirected towards sustainability. Teachers can create active discourse around prevalent socio-cultural and ecological issues in ways that stimulate learners to feel empowered. This will transform them into future adults who instil changes based on a sense of civic duty towards sustainability issues (Burns, 2018, Burns et al., 2019). As social and ecological problems accelerate, the desire for sustainability education to prepare learners to understand complex challenging issues so that they can participate in global regeneration processes becomes imperative (BenEliyahu, 2021; Gamage et al., 2022). Accordingly, the

practice of LFS must be developed and embodied in educational practices so that the interrelated and inextricable issues that we face today can be understood and successfully confronted (Claro & Esteves, 2021; Cebrian & Junyent, 2015; Burns et al., 2015).

Most sustainability curricula focus only on content. There is a lack of transformational methodologies that incorporate pedagogical processes as a condition for recognising sustainability programmes and for assessing their rigour (Green & Somerville, 2015; Suarez-Lopez & Eugenio-Gozalbo, 2021). Green and Somerville (2015), and Suarez-Lopez and Eugenio-Gozalbo (2021) also report that co-curricular programmes are rather experiential in theory and practice and that a sustainability co-curriculum in line best practice and guiding theories is still emerging (Spalding et al., 2014). If learners are to become capable of effecting holistic sustainable change by using transformational values and culture to design creative solutions, then the educational systems in which they take root should aim at enhancing teaching and learning processes to advance LFS (Sipone et al., 2019). Burns' Model of Sustainability Pedagogy provides a transformative learning theory and ecological design principles that create opportunities for meaningful learning experiences that can develop the personal, intellectual, and socio-cultural skills necessary to create resilient and regenerative systems (Burns, 2009, 2016a; Burns, 2018).

As an ecological teaching framework, Burns' Model of Sustainability Pedagogy combines content that is theme-based and multidisciplinary with diverse viewpoints while critically challenging dominant paradigms and practices - a process that is participatory and experiential in a context that is place-based (Burns, 2009). This model expands the width of theory and practice of LFS so that teachers have an ecologically grounded framework for creating lessons and programmes for transformation (Burns, 2009, 2013).

This model has many goals for learners (Burns, 2009):

- First, it extends learners' systemic comprehension of multifaceted sustainability issues *(Content)*.
- Second, it provides learners with possibilities to think critically about important practices, paradigms, power relationships, and complex environmental and social issues from a wide variety of viewpoints *(Perspectives)*.
- Third, learners' civil duty and intentions to work towards LFS through active participation and experience are enhanced *(Process)*.

- Fourth, learners' understanding of and linking this with the environment and the location in which they survive is augmented *(Context)*.
- Fifth, the model utilises an ecological course design process that integrates the first four dimensions to produce transformative learning experiences *(Design)*.

These five sustainability goals are presented in detail in the next section with a detailed explanation of how each goal is directed towards promoting transformational learning.

The main purpose of Burns' Model of Sustainability Pedagogy is to encourage a transformative style of LFS (Leal Filho et al., 2018). Mezirow (2018) describes transformational learning as a way through which we transform our taken-for-granted frames of reference to make them more inclusive, discernible, open, emotionally capable of change, and reflective so that they may generate beliefs and options that prove truer or justified to guide action. Another feature of transformational learning includes an awareness of how oppressive social structures are, sense-making from a holistic and situational perspective, and a spiritual facet of soul-based learning (Leal Filho et al., 2018; Baumgartner, 2019).

2.3.3 Dimensions of the Burns' Model of Sustainability Pedagogy

The dimensions of the Burns' Model of Sustainability Pedagogy include content, perspectives, process, context, and design that teachers can consider when planning their lessons; but they must show an inter-connectedness between the dimensions that are rooted in ecological principles of sustainability.

2.3.3.1 Content

In the Burns' Model of Sustainability Pedagogy, the dimension of content is used to expand learners' understanding of intricate sustainability problems. As such, LFS needs to be approached from a multidimensional perspective in order to incorporate systemic relationships intothe biological and cultural components of life (Burns, 2011). Since LFS requires the recognition of relationships, dynamics, and patterns, learners need to be a part of a holistic unfragmented understanding of relevant concerns. The goals of Burns' Model of Sustainability Pedagogy can be attained by organising lesson content centring on a theme concerning contemporary sustainability issues. This approach is essential for imparting multidisciplinary LFS. Hence, LFS content may be integrated into any lesson by focusing on a sustainability theme that is relevant to the subject.

In this model, however, content is only one component of the five dimensions. Hence, conveying information about LFS, or attaching sustainability contents to other subjects, allows learners to become au fait with sustainability concepts via the interconnectness of other dimensions such as the processes, perspectives, design of the lesson, and the context. Content is inseparable from the other parts of a lesson, particular sustainability contents which consider perspectives, values, issues, skills, and beliefs.

Additionally, successfully re-orienting a lesson to integrate and accommodate LFS content requires a teacher to commence with learners' prior knowledge about LFS, after which assistance can be provided to learners to construct notions of sustainability problems. To learn new content related to complex sustainability problems, learners need to connect newly acquired knowledge to previous knowledge, and thus construct new meanings within the relevant socio-cultural environment. In this manner, LFS content is built and delivered with other learners in mind. This, in turn, challenges learners' current field of vision which stimulates them to ponder on the many perspectives of LFS issues.

2.3.3.2 Perspectives

The second dimension of Burns' Model of Sustainability Pedagogy entails preparing learners with opportunities to discern governing paradigms, practices and power relationships, while considering multifaceted ecological and social problems from various perspectives. When including LFS content in a lesson, diverse viewpoints need to be incorporated to show that there are several ways to perceive a sustainability concern. Cortese et al. (2020) contend that it is crucial for learners to reflect on the inherent causes of unsustainable practices, while comprehending the invisible social, economic, physical, and ecological effects. According to Bowers (2016), sustainability concerns are mainly cultural, and learners can decipher these aspects by questioning and examining dominant attitudes and behaviours. Questioning and critiquing cultural assumptions, economic disparities, and power relationships that reveal harmful and unsustainable practices, is an essential component that must be interrogated in LFS discourse.

To critique assumptions and power relationships is crucial for learners as they are introduced to processes that consider several diverse viewpoints. Since sustainability issues are complex and difficult to understand from one perspective, many viewpoints are required to process the information because no right answer exists. Dresner and Blatner (cited in Hennessey, 2021)

point out that problems have several solutions, and the criteria for evaluating possible solutions should consider learners' participation and contribution in a cycle of problem definition, re-definition, and using several situations. This allows learners to make-sense of diverse stakeholder perspectives, positions, and possible solutions. Cortese et al. (2020) suggest that discussing a number of previously marginalised viewpoints including multicultural, intergenerational, ecological, and local perspectives are vital to understanding LFS problems. Consequently, these perspectives can also be integrated in lessons to elicit learners' under-represented opinions of LFS.

2.3.3.3 Process

The third dimension of Burns' Model of Sustainability Pedagogy aims to enhance learners' sense of civic duty by engendering sustainability awareness by inspiring them to actively participate and gain real-world experiences. In other words, this dimension promotes experiential learning as well as the direct participation of learners. By implementing content about thematic sustainability, and by confronting generally accepted assumptions and power structures, sustainability pedagogy inherently aims to facilitate change which requires engagement with oneself, others, and places. A sustainability paradigm views change as seeking out new ways for humans to co-exist in harmony with our environment. A transformational learning process is required for this change to occur (Leal Filho et al., 2018). Furthermore, sustainability pedagogy emphasises active, experiential, and participatory learning (Burns, 2011; Colomer et al., 2020; Cortese et al., 2020) which empowers learners to develop requisite capacity to counteract LFS challenges (Burns, 2011). Such empowerment and capacity-building can be evident in learners' willingness to perform their civic duties to achieve sustainability outcomes.

Additionally, to promote LFS effectively, learners should be permitted to engage in issues, actively participate, and transform their surroundings (Mezirow, 2018). Since there are many ways to teach learners participatory and experiential learning such as problem-based learning, service learning, project-based learning, and case studies, these allow learners to interconnect with the content of the topic being taught. For example, Gibson and Sandifer (2020) assert that service learning becomes an effective route to build a sustainable democracy based on active citizen involvement. Participation in the sustainability process gives learners an opportunity to participate in sustainable practices in their immediate surroundings (Cortese et al., 2020; Cortese, 2005). The emphasis on *active participation* for change denotes that pedagogy for

sustainability has to be conceptualised in its context. The process of experiential-participatory learning is a key facet of the model because it equips learners (especially in primary schools), with values and social skills gained through active engagement.

2.3.3.4 Context

The fourth dimension of the Burns' Model of Sustainability Pedagogy entails learners' understanding of and connection with the place where they reside. Contextual factors lay the foundation for questioning critically, includes content that integrates themes on sustainability, and fosters the comprehension of a wide range of perspectives through active learning which is an invaluable aspect of the model. For positive engagement to materialise, sound sustainability pedagogy has to be firmly and contextually entrenched. Hence, the context of sustainability is critical. According to Cortese et al. (2020), the goal of sustainability in education is to work towards enhancing healthy, socially vibrant, economically secure, and environmentally sustainable places. In other words, place-based learning implies the necessity of context (Burns, 2009; 2011).

Additionally, Khadka et al. (2021) state that place-based learning focuses on how the community infrastructure, local environment, cultural traditions, and watersheds are all interrelated and influence each other. Sunassee et al. (2021) postulate that this integration of place into education is important for several reasons: first, learners have to combine intellect and experience so that they can directly observe, investigate and experiment which is crucial for holistic development; second, it decreases over-specialisation and opposes dividing subjects into discipline categories as it centres on comprehending interrelatedness. Moreover, Gruenewald and Smith (2014) stipulate that places are laboratories of diversity and complexity which mixes social functions and natural processes.

Sunassee et al. (2021) advise that an added advantage can be found in re-educating learners in the art of appreciating where they are, learning to be a citizen of the place they are from, and having a natural relationship with their surroundings. Place-based education helps learners to understand and value where they belong by actively connecting them to their community. In addition, this dimension provides a lense through which crucial relationships in local places can be questioned and explored (Khadka et al., 2021; Sobel, 2014; Sunassee et al., 2021). By combining diverse perspectives, sustainability content, and an active learning process in one

specific place, learning in context promotes comprehension and sense-making to integrate transformative sustainability learning into classroom lessons (Casinader, 2021).

2.3.3.5 Design

The fifth dimension of Burns' Model of Sustainability Pedagogy involves connecting the other four dimensions and generating transformative learning experiences through an ecological course design process (Burns, 2009). The purpose of an ecological course design is to create a learning experience that will transform learners' values and attitudes to change unsustainable structures and unsustainable cultures. It intends to empower and change learners through thematic learning that questions dominant models and integrates diverse perspectives through a participatory, and specific context (Burns, 2011). The design constitutes the intentional and purposeful merging of these dimensions into a lesson to enhance LFS teaching and learning. Hemenway (2015, p. 15) states that the ecological design comprises of five basic steps: "observation, visioning, planning, development, and implementation". When embedded into LFS, ecological principles guide us on how to create resilient cultural and social systems that promote sustainability (Nelson & Shilling, 2018).

These above five dimensions can be applied to understand how sustainability is being taught and enhanced at the school level. Also, it has the potential to disclose how teachers think about important paradigms and practices to interpret sustainability issues from diverse perspectives. These dimensions' primary objective is to foster transformative learning through ecological design because it recognises the need to migrate to more sustainable ways of thinking and teaching regarding LFS to emphasise the responsibility of humans to preserve their environment (Orr, 2019). Therefore, responsibility must be rooted in problem-orientated, practical and place-based learning. The Burns' Model of Sustainability Pedagogy is geared towards problem-based collaborative learning as it focuses on learning about sustainability through inquiry, experience, and reflection (Gal & Gan, 2020).

At a basic level, sustainability can be described as stabilising the "disruptive relationships between human culture and the living world" (Folke et al., 2021, p. 847). Consequently, LFS also aims at a deeply ethical and spiritual comprehension of existing sustainably within the limits of biotic systems, thus emphasising our relationship with our planet and with individuals (Capra & Luisi, 2014; Nelson & Shilling, 2018; Peterson, 2022).

2.3.4 Relevance of the Burns' Model of Sustainability Pedagogy to this Study

Teachers are increasingly cognisant (Adawiah & Esa, 2012) of the importance of teaching sustainability issues in primary schools (Burgener & Barth, 2018; Olmos-Gomez et al., 2019). Hence, this research aimed to explore how teachers' understanding informed their enhancement of LFS in Mauritian primary schools. Thus, school teachers can be empowered by developing appropriate behavioural change skills and acquiring sustainability competencies to teach learners about contemporary sustainability challenges that the globe is facing. In so doing, primary school teachers and learners can become ambassadors for sustainability in the future. As tomorrow's adults, it is vital that children are taught about how to live sustainably (Taylor et al., 015).

One of the greatest lessons of sustainability learning is understanding that our assumptions and perspectives must be broadened (unsustainable thinking), and that we must adapt our beliefs to guide sustainable action. This implies that because of the increasing demand to focus on how learning and teaching can be redirected toward sustainability (Vaughter et al., 2016; Silo & Ketlhoilwe, 2020), teachers should urgently address socio-cultural and environmental issues to empower learners to consider action-based sustainability as a civic duty which leads to transformation (Olmos-Gomez et al., 2019). Hence, individual transformation can act as a catalyst for community transformation.

The Burns' Model of Sustainability Pedagogy functions as a curriculum design tool that empowers and motivates learners to solve complicated issues to effect changes that renew and sustain places and societies (Burns, 2009; Leal Filho et al., 2018). Also, this model, with some amendments, can serve as a powerful tool for planning lessons so that learners can benefit from the transformational and invaluable benefits of an integrated curriculum.

2.3.5 O'Donoghue's Active Learning Framework

The principles that underpin LFS provide opportunities for the "development of critical and reflective thinkers with specialist knowledge" of a context to address problems concerning sustainability issues (Fuertes-Camacho et al., 2019, p. 767). Educators delivering LFS lessons must provide opportunities for learners to engage in genuine decision-making processes that relate to their local environment (UNESCO, 2005; Grindheim et al., 2019). Sonetti et al. (2020) criticise teachers for being unable to apply their understanding of LFS in practice. However,

Qablan (2018), who has a different perspective, argues that this is not a barrier but an opportunity for teachers to make LFS relevant to the local context.

Currently, there is no research to guide teachers within the Mauritian context so that they can develop their skills and knowledge to engage with the multifaceted problems regarding LFS. An approach is suggested in O'Donoghue's Active Learning Framework (2001, p. 8). This model (see Figure 2.2) provides an overview of how the Active Learning Framework (ALF) is structured to guide educators on how to involve learners in independent individual learning (O'Donoghue, 2007; O'Donoghue et al., 2018).

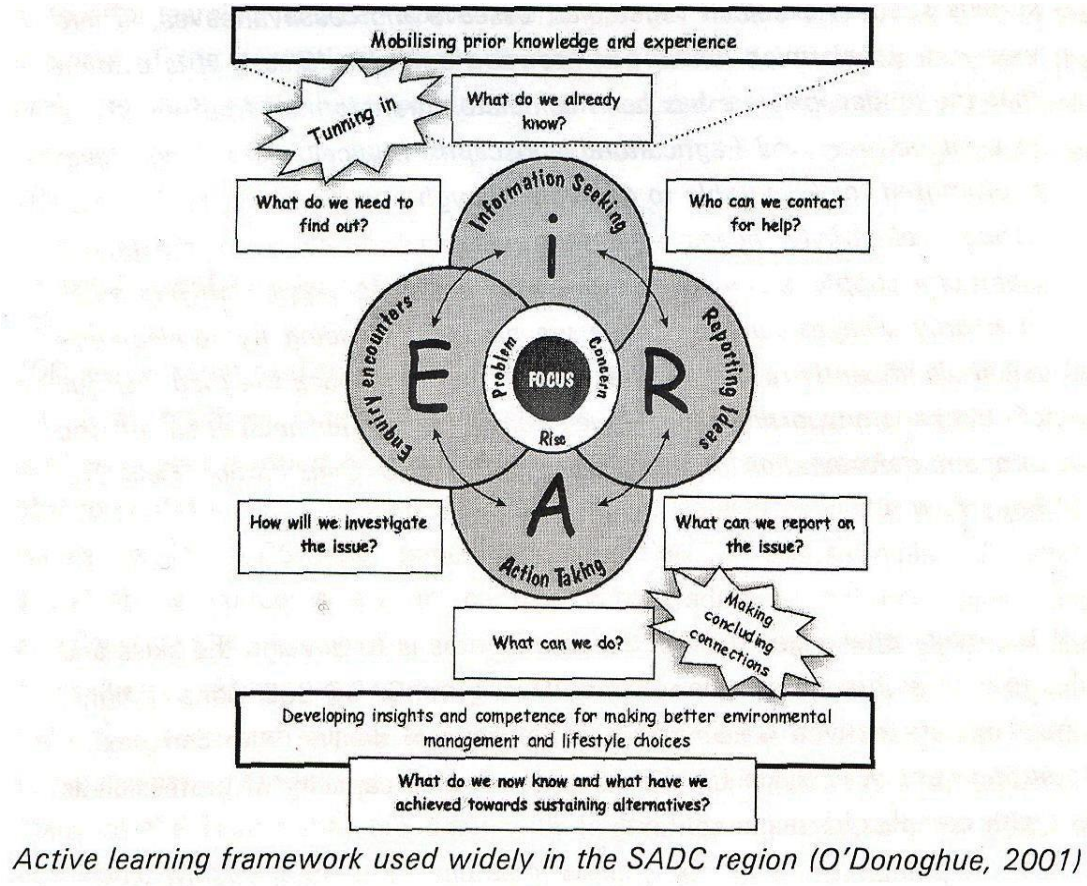

Figure 2.2*:* O'Donoghue's Active Learning Framework (O'Donoghue, 2001, p. 8)

O'Donoghue's Active Learning Framework was developed and piloted by the Environmental Education community in South Africa through South Africa's National Environmental Education Programme (Lotz-Sisitka & Raven, 2001; O'Donoghue et al., 2020). This model provides an action plan for learning about and responding to sustainability problems

(O'Donoghue, 2017). It guides learners so that they can engage in action-taking activities to develop their skills and attitudes in favour of LFS. As a model that suitably explains how teachers can execute LFS in practice does not exist, it is left to trial and error. Fildes et al. (2021) suggest that educators should be afforded the responsibility and freedom to plan and deliver their own lessons in their classrooms (Payne & Hart, 2020). However, teachers' capabilities remain a challenge (Pesanayi et al., 2019) such that they need support to transfer their learning to become LFS-oriented. The dimensions of O'Donoghue's Active Learning Framework advise how to address and understand a sustainability issue (Lombardi & Shipley, 2021) while suggesting activities that support problem identification in the local environment so that learners can obtain ideas on how to respond to challenging issues.

This framework for active learning facilitates the understanding of LFS while encouraging learner-centred classroom lessons (O'Donoghue et al., 2019). O'Donoghue and Russo's (cited in Kassier, 2022, p. 26) study, it was found that "in 1999-2001, as the environment was identified as a concern within all learning areas in South Africa, an open process framework was abstracted as a tool for planning environmental learning and using materials in a more learner-centred school curriculum". O'Donoghue and Russo (cited in Li & Krasny, 2019) attest that as a guide for designing environmental learning, this framework rapidly gained favour in planning professional development activities.

O'Donoghue's Active Learning Framework emphasises a sustainability focus (risk, concern or problem) by providing four varieties of activities that can facilitate sustainability learning programmes. These programmes were explained in the context of teachers' understanding of LFS. Such programmes also expand on the framework's dimensions and how to implement them. Since it was created to be an open-ended process such that learning and teaching can commence with any dimension, this framework does not need to be used linearly (O'Donoghue, 2001; 2007).

2.3.6 Learning activities of O'Donoghue's Active Learning Framework

The activities that can structure sustainability learning programmes include the focus area, information seeking, enquiry encounters, action-taking, and reporting. This section elaborates on the five learning programmes to demonstrate how they provide theoretical foundations for this study.

2.3.6.1 Focus area

The centre of the framework focuses on a particular sustainability problem known as the tuning-in process which is where the active learning process starts - it gauges what the learners already know and understand about the specific area of focus. In Wals's (2007) related work, he calls it the orientation and exploration process where key actors and key issues are identified so that learners can address them in a way that connects with their background and experience on the topic, thus increasing their motivation and sense of purpose. During this process, the learners are allowed to deliberate and take note of what they already know about the focus area, and what they think is important to select for their content knowledge (O'Donoghue, 2007; Adawiah & Esa, 2012). From this deviation point, teachers can orient the lesson with applicable mediation mechanisms to address gaps in their comprehension of local context, extra content knowledge, sustainable actions, and alternatives which provide the basis for further exploration (Murphy et al., 2021).

2.3.6.2 Information-seeking activities

During information-seeking activities, teachers discover what is already known about the sustainability focus (by teachers themselves and their learners). They ascertain what else they need to know and how to find it by using information resources to glean 'expert' knowledge pertaining to sustainability topics (Schudel, 2012, 2021). Amongst other possibilities, varieties of information may include foundational sustainability knowledge of ecological principles and systems, scientific information about an issue or practice, a technological design to support a particular practice, or information on an ethical standpoint on a particular issue (Schudel, 2021). During class activities, learners may be asked questions to elicit suggestions to find the required information for the area of focus. During this process, both teachers and learners familiarise themselves thoroughly with the sustainability problem by utilising genuine materials to help them understand the subject being studied (O'Donoghue et al., 2020).

2.3.6.3 Enquiry encounters

During enquiry encounters, teachers further dissect the focus by establishing (using surveys, interviews, observations, audits, and field studies) how the sustainability issue is being experienced by conducting investigations in local surroundings (O'Donoghue, 2001).

O'Donoghue et al. (2018) propose that sustainability learning should be formed as a deliberative inquiry that focus on matters concerning the everyday lives of learners and

teachers. By possessing the necessary information obtained through enquiry, teachers and learners can provide feedback about what they discovered about the problem. This enables teachers to monitor, analyse, and evaluate the situation, resource, or activity, and thereafter plan to take appropriate action during their lessons (Schudel, 2021). This dimension allows for learning through examining sustainability problems. To augment this learning experience, O'Donoghue et al. (2020) also propose a reflexive inquiry which involves an enlargement of existing learning progressions in school subject curricula with a more learner-led action learning.

2.3.6.4 Action-taking

During the action-taking process, teachers "act to make a conscious and informed response to an issue raised during their classes and find out ways of doing things differently when their understandings are established" (O'Donoghue et al., 2007, p. 437). Schudel et al. (2008) explain that it is not necessary for the action to be a practical activity, as it can also involve planning for action in the class. The question that should have been asked is "What can we do?" (O'Donoghue, 2007). This question recalls the teachers' and learners' background knowledge to create better insights and contributions (Schudel, 2012). While conducting lessons, teachers should inquire from learners about what they think can be done about a particular challenge before prompting them with clues to evoke new ideas before the action process – but this also depends on the resources that will trigger innovative ideas.

Additionally, this dimension allows for LFS such that ideas that are shared in class are deliberated upon to decide on what the best possible solution to the problem would be (Schudel, 2021; Li & Krasny, 2019). This develops teachers' and learners' action competence as they learn by doing something meaningful. The action competence approach points to democratic, participatory, and action-oriented teaching-learning. Moreover, the action competence approach assists the participants to develop their ability, motivation, and desire to play an active role in finding practical and realistic solutions to problems connected to sustainability. Lastly, Lysgaard and Bengtsson (2022) assert that temporality and spatiality in sustainability is no longer suitable in the face of dire global, regional, and local ecological crises.

2.3.6.5 Reporting

While teachers and learners reflect on the other dimensions of the framework, this dimension promotes critical reflection (O'Donoghue, 2001, p. 10) on the question of "What do we now

know and what have we achieved towards sustainability alternatives?" This can prompt conversations between learners and teachers to provide supporting evidence for their ideas. In this scenario, participants are encouraged to share what they can report on the problem, and provide practical solutions to address it. This process also encourages the development of problem-solving skills which can be applied to elicit the best possible solution (Yli-Panula et al., 2019).

Further, this process can lead to reporting back on the information-seeking exercise which may include a question based on the sustainability focus, or their responses (action) to the issue - this can stimulate further exploration concerning the issue. Once all the dimensions of the active learning framework have been implemented, the learners and the teacher can reflect on the whole active learning experience which involves posing questions pertaining to evaluation, reflection, further information-seeking, inquiry, and action. Examples of questions include "What do we now know, or what have we achieved, or how effective have we been?" (O'Donoghue, 2001, p. 10).

Active learning processes promoted by O'Donoghue's Active Learning Framework encourage the acquisition of content knowledge which should be relevant to learners' own contexts (O'Donoghue, 2001). They further suggest that teachers can take any one of the dimensions as a starting point and improvise using their own methods within the different dimensions of the framework to create a multi-skilled and multi-perspective approach to sustainability risks and concerns.

Another aspect of this framework is the complex socio-ecological nature of sustainability issues which require teachers to deal with uncertainty, poorly defined situations, and conflicting norms, values, interests, and reality constructions (Tassone et al., 2022; Wals & Jickling, 2009; Lotz-Sisitka & Raven, 2001; McGrath et al., 2020; Lotz-Sisitka & Schudel, 2007). Lastly, the context-specific application of educational solutions for sustainability is also addressed by Janse van Rensburg and Mhoney (2000) who caution that one specific context's solutions cannot be applied universally.

2.3.7 Relevance of O'Donoghue's Active Learning Framework to this Study

The O'Donoghue's Active Learning Framework which was adopted as one of the frameworks for this study, is based on the premise that teachers not only understand what learners should know and be assessed on, but also how they acquire knowledge and skills to understand the

issues at hand. This process in teaching-learning is mentioned in literature which directs us to the point that we need to think carefully; not only about 'the what' (foci and outcomes), but also about 'the how' (processes) of environmental learning (Rickinson 2006; O'Donoghue et al., 2021). O'Donoghue's (2001) framework for active learning depicts an interactive search for information about issues in local settings that would assist in reporting and being proactive to improve the environment. It provides opportunities for learners to get involved in decision-making processes that affect their local communities. Lastly, O'Donoghue (2007) confirms that he developed this model to explain how environmental learning processes can be incorporated in lesson-planning.

2.4 RELATIONSHIP BETWEEN THE RESEARCHER AND THE RESEARCHED

Thurairajah (2019, p. 132) states that "the relationship between the researcher and the researched has always been of great concern in methodology literature". There is a direct relationship between the researcher and the participants, but traditionally an inherent power imbalance between them exists (Raheim et al., 2016). Qualitative traditions have a common epistemological ground where the researcher minimises the distance and separateness of the researcher-participant relationship as research should be based on the transparency of relevant information dissemination, dialogues, and discussions by facilitating the sharing of ideas (Kambouri-Danos & Pieridou, 2020). The cordial relationship between myself (the researcher) and the participants assisted in gaining insight into teachers' understanding and their enhancement of LFS by creating an open dialogue and transparency. This resulted in a meaningful relationship (Thurairajah, 2019; Kambouri-Danos & Pieridou, 2020; Ariss et al., 2019) where relevant strategies were discussed and elaborated upon, especially during the planning and implementation of the lessons. In sum, a collaborative relationship was established between the researcher and the researched during the whole process of this action research (Nguyen et al., 2021).

2.5 ROLE OF THE RESEARCHER

My main role as a researcher was to gain ethical clearance and the gatekeeper's permission to conduct the study (Spacey et al., 2021). The necessary permission was obtained from the MoETEST and the Headmaster of the chosen primary school where the study was conducted (Fobosi & Fobosi, 2019). The participants (teachers) were invited through WhatsApp

messages, telephone calls, face-to-face contact, and written notes. Signed consent was obtained from each individual who partcipated in the study. The participant-selection process was unbiased as set criteria for selection was pursued. Furthermore, they were all free to share their experiences without any prejudice. My role as the researcher was that of an objective viewer and observer; hence, I could ask clarifying questions, listen, reflect, and probe for elaboration during semi-structured interviews. In this regard, I attempted to create a scenario by utilising ideas and theories from a variety of sources.

Further, new knowledge was constructed after analysing the generated data during the classroom observations and the different interviews conducted during the participant-designed action research processes. My task was to dissect participants' responses, make-sense of them, analyse the collected data, discuss the data, and present recommendations. I acted as a facilitator who explained the aim and purpose (and finer details) of the study to the participants, and what was expected of them. I had to provide answers to *what* and *why* questions. Their answers became the background for the fieldwork involving analysis and reporting. During the analysis process, the first part was coding which was conducted by me through rigorous scrutiny of the data (Corbin & Strauss, 2014; Chamberlain-Salaun et al., 2013). The coding involved the naming and categorising of the data. For both the coding and analysis of data, I used my prior knowledge and experiences to make-sense of the material (McCracken & Coleman, 2020). Lastly, but importantly, Holmes (2020) mentions that the researcher should be trustworthy, honest, transparent, cordial, patient, and a team-player.

2.6 THEORETICAL INTEGRATION

Boss et al. (cited in Handel, 2018) articulate that theorising is the process of systematically formulating and organising ideas to understand a particular phenomenon. Similarly, Johnson and Christensen (2012) state that theories explain how and why something functions in the way it does. Tellings (2001) also suggests that theories provide the researcher with a structured set of lenses to observe, study or analyse elements or parts of the world. The benefit of integrating theories in educational research is that it presents a rich, multi-dimensional understanding of diverse complicated issues (Van der Klis & Tellings, 2020).

Tellings (2001) elaborates that theoretical integration includes reduction, synthesis, vertical addition, and horizontal addition. I regard Burns's Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework as being closely related and similar in that they

espouse similar objectives in addressing the challenge of exploring teachers' understanding and enhancement of LFS in primary schools using an action research intervention. Therefore, in terms of Tellings' (2001) explanations of the different forms of theoretical integration, I affirm that similarities in both theories framing this research can be integrated through reduction.

A benefit of Burns' Model of Sustainability Pedagogy is that it can be easily incorporated into most activities as it addresses the need to focus on how teaching and learning are enacted and repositioned towards sustainability. As such, teachers can effectively address the increasing socio-cultural and environmental problems in our society. This endeavour should transform teachers and learners by empowering them to manage sustainability responsibilities (Mogren et al., 2018). Additionally, O'Donoghue's Active Learning Framework favours the notion that learners can be allowed to engage in action-taking activities to develop their skills and attitudes towards sustainable futures, and thereby promote LFS (O'Donoghue et al., 2018). The ALF clearly indicates what has to be done to address and understand sustainability problems by providing opporunities to encourage learner-centred methodologies (O'Donoghue et al., 2019).

Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework were of great value in terms of empowering and transforming learners to address sustainability issues in our society. This was made possible by using a participant-designed action research intervention which informs teachers and school administrators about their understandings of LFS in the Mauritian education context. Thus, in this study, both theories complement each other to enhance teachers' understanding of LFS so that they become capacitated to solve sustainability-related issues. Moreover, by teachers developing a proper understanding of LFS, it leads to positive changes, and the use of adaptation strategies to enhance teachers' practices.

2.7 CONCLUSION

This chapter provided an overview of the operational concepts which included learning, active learning, and LFS. The key characteristics of the concepts were discussed in line with different philosophies propounded by various scholars. Further, the theoretical framework was discussed, and the two theories which formed part of the action research were explained and integrated through reduction. The Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework were presented as the two theories that underpinned the theoretical framework of this study. This chapter also highlighted how Burns' Model of Sustainability

Pedagogy and O'Donoghue's Active Learning Framework can be used to critically analyse teachers' understanding and enhancement of LFS. The relevance of both theories and their integration were also explained and justified. The following chapter (3) focused on the review of literature in line with the aim and objectives of the study.

CHAPTER THREE

REVIEW OF LITERATURE

3.1 INTRODUCTION

The primary aim of this research was to explore teachers' understanding and enhancement of LFS in Mauritian primary schools through action research processes. While chapter two explained the operational concepts and the theories framing this participant-designed action research and provided insight into the overarching theoretical and conceptual underpinnings of this study, this chapter (3) provided a broader and deep understanding of the literature on LFS by discussing the various positions on sustainability. This involved establishing how LFS developed, the relationship between sustainability education and LFS, and prominent worldwide conventions that prompted the development of LFS into disciplined education schemes. The conceptions and approaches of learning, understanding, enhancement, and the status of LFS in Mauritius were also described. This chapter, as a whole, generates a review of an issue that demands serious intervention via action research recommendations and strategies.

3.2 SUSTAINABLITY EDUCATION

In the 1990s, sustainability education was seen as a combination of environmental and developmental education, but it has subsequently evolved into an approach aimed at environmental learning (Maruyama et al., 2020). In 1992, during the Earth Summit held in Rio de Janeiro, sustainability education and Education for Sustainable Development (ESD) emerged (Manteaw, 2020). The resolutions that emanated from this summit have since been recognised as a decisive means to gauge individuals' awareness and acumen pertaining to sustainability. It provided a foundation for what has since become known as ESD as "Education, including formal education, public awareness and training that should be recognized as a process by which human beings and societies can reach their fullest potential" (ESD-Earth Summit, 1992). The ESD movement encompasses all activities that are oriented towards sustainable development. It links various education traditions and different foci such as global learning, consumer education, and environmental education [EE] (Schreiber & Siege, 2016). It is advocated that educating the public about sustainability is crucial for fostering Sustainable Development (SD) and improving their ability to handle environmental and

developmental issues (UNCED, 1992). Basic education, which teaches fundamental environmental and developmental matters, is currently considered insufficient to prepare learners for a sustainable robust future.

Considering the urgency of solving sustainability challenges, the first worldwide convention which was dedicated exclusively to the environment, was hosted in 1972 in Stockholm (Baste & Watson, 2022). The United Nations General Assembly (UNGA) recommended the formation of the World Commission on Environment and Development (WCED) in 1983, which later became the Brundtland Commission. The concepts of sustainability and Sustainable Development (SD) are difficult to define because of their constant evolution. In 1987, the WCED used the resolutions of the Stockholm Summit as a basis to outline SD as development that meets the needs of the present without compromising the ability of the future generations to meet their own needs (WCED, 1987).

In support, the 1992 United Nations Conference on Environment and Development (UNCED) via Agenda 21, confirmed that SD entails the utilisation of resources in a manner that does not jeopardise the well-being of our population, and does not endanger the expectations of the rising younger generations' demands (UNCED, 1992). Purvis et al. (2019) assert that literature is blurry concerning the definition of sustainability, while Hadjichambis and Paraskeva-Hadjichambi (2020) agree that the statement by WCED (1987) reflects recognised patterns, and sends a message of doubt to future generations. Furthermore, Menon and Suresh (2020) assert that the artefacts of sustainability include the economic, social, and environmental wellbeing of the planet. The wellbeing of these three areas is inextricable. This implies that to ensure healthy and flourishing societies, resources, clean air, a healthy environment, and safe drinking water are required (Borowski & Patuk, 2021).

Further, without education, sustainability cannot be achieved (Kioupi & Voulvoulis, 2019; Messerli et al., 2019). Mughal et al. (2011) state that sustainability education is a critical agent of transformation for changing lifestyles, attitude, and behaviour. Agenda 21 states that education is critical for promoting sustainability and improving the capacity of people to address sustainability issues. Unfortunately with low education levels, economies are restricted to agriculture and resource extraction; hence, a basic education level hinders development options as planning for a sustainable future requires higher education levels which are necessary to secure jobs. Lastly, the relationship between education and sustainability is complex, but sustainability education is critical to improve the quality of life as it raises the

economic status of families, improves living conditions, lowers infant mortality, and improves the educational attainment of the next generation (Leal Filho et al., 2019).

3.3 LEARNING FOR SUSTAINABILITY

Since LFS is the process of developing the knowledge, skills, values, and attitudes, it acts as a critical agent to move us from a precarious state to a state of sustainability (Gayford, 2003, 2009; Mughal et al., 2011; Agbedahin, 2019; Ben-Eliyahu, 2021). Ahmed et al. (2020) affirm that LFS includes a synergy between the natural and social environment to uplift the human condition. However, as previously mentioned, Hlalele (2013; 2019) contends that there has always been, at least in the realm of scientific discourse, an attempt to dissociate between the natural and the social/human environment.

The Millennium Development Goals [MDGs] (UN, 2002) emphasise that integrating environmental and social dimensions in sync with economic development aims, is critical because our future economy (and survival) largely depends on the earth's ecological wellbeing. The role of education in building societies based on values of equity, social justice and sustainability has been recognised by international agencies that have developed strategies and action plans to combat possible environmental disasters (Cebrian & Junyent, 2015; Cebrian et al., 2020). Even though schools in so many countries are expected to teach sustainability, pre-service and in-service teachers' lack of confidence and unpreparedness to conceptualise and practice sustainability are identified as major barriers to its implementation (Evans et al., 2012; Green & Somerville, 2015; Manasia et al., 2019). Teacher-practice is influenced by inherent traits of individual teachers such as values, knowledge systems, and hopes which are key determinants of how learners engage with subject content.

According to Taylor et al. (2015) and Holmberg and Sandbrook (2019), people around the world see that current economic development trends are not sustainable, and that to bring society towards sustainability goals, public awareness, education, and training are crucial. Nkambwe and Essilfie (2012) and Tsayang and Kabita (2013) demonstrate that there is still a limited understanding of what LFS means, both in conceptual and practical terms for teachers and teacher trainers in Botswana. Teachers are ready to implement LFS in primary schools but are somehow lacking the confidence, skills and knowledge to do so (Green & Somerville, 2015). Dash and Mohan (2017) also point out that teachers report that they do not understand

the concept and thus cannot integrate LFS into an already overcrowded and centralised curriculum (Lasen et al., 2017).

Identifying and understanding how teachers successfully integrate LFS into their teaching practice can offer important insights into how these perceived problems can be overcome. The present primary school curricula already contain many significant content areas, and adding new aspects would mean an overloading of curricula and more work for teachers. Teachers usually respond negatively to changes or any additional work, given their already burdensome workload. Teachers and teacher-educators feel pressured to accommodate many changes in the curriculum; for example, to integrate issues about HIV and AIDS, human rights, and citizenship education, among others (Nkambwe & Essilfie, 2012; Tsayang & Kabita, 2013). Hence, another addition to the curriculum might not create the intended positive impact.

There is, however, a need to convince teachers and their respective unions that integration of LFS into the actual curriculum and textbooks is not an additional task. Nkambwe and Essilfie (2012) and Tsayang and Kabita (2013) argue that although teachers and teacher-educators may be provided with teaching and learning materials on LFS, they may not use a range of modern teaching and learning practices. They are usually more concerned with the completion of the syllabus at the expense of the overall development of the learners, mainly because of the exam-oriented system of education in Mauritius. Some educators are not eager to implement new concepts and ideas in schools which is exacerbated by the lack of monitoring to ensure that the teaching of LFS-related content is implemented; such a mechanism is necessary so that LFS activities are not ececuted in isolation.

The Scottish Government's Action Plans for the UN DESD (2005-14) set out plans of action for all sectors of education (UNESCO, 2005) as LFS is a priority for the Scottish Government and Scotland's education professionals. In schools, SD education, global citizenship, outdoor learning, and health and wellbeing are already integrated into the curriculum. Accordingly, LFS weaves into and builds upon these sustainability themes. The Scottish Government has accepted the LFS report's recommendations that all learners should be entitled to LFS education, and every practitioner, school and education leader should demonstrate LFS in their practice. Furthermore, it has also urged every school to have a whole-school approach to LFS to guarantee that it is robust, demonstrable, evaluated, and supported by leadership at all levels such that infrastructure including school buildings, grounds, and policies are in place to support

LFS. It has also recommended that a strategic national approach to supporting LFS should be established.

Since LFS is an international priority, it is essential for everyone's well-being to adopt a sustainability mindset (UNESCO, 2012). Therefore, LFS has to be embedded in the school system to support teachers in actively embracing and promoting principles and practices of sustainability in all aspects of their work. We live in a turbulent, interdependent, and rapidly evolving world, with a complex range of environmental, social, cultural, political, and economic challenges that could jeopardise our future - locally, nationally, and globally. We currently consume natural resources and generate carbon emissions at an uncontrolled rate – at this level, earth will become unsustainable. As a result of the overuse of resources across the world, ecosystems are exploited and damaged: conflict is common - a product of widespread socio-economic inequality and political injustice. Since LFS is learning to live within the environmental limits of our planet, it promotes a just, equitable, and peaceful society which is essential for the wellbeing of all.

3.4 PEDAGOGICAL DISCOURSE ON LEARNING FOR SUSTAINABILITY

The LFS approach represents a pedagogy where individuals learn about how their environment functions, and how they can take care of it in a renewable manner (Anyolo, 2015; Christie & Higgins, 2020). There are diverging explanations of LFS; for instance, Nevin (2008) explains sustainability education and LFS's holistic quality because it encompasses the development of knowledge, understanding, skills, and actions required to sustain our planet by creating awareness to ensure conservation and environmental protection.

Scott (2020) defines LFS as a learning process to increase our capacity to live more sustainably. Hamm and Muttagi (1998) also focus on building capacity to live, and our capacity to learn. Much attention has been focused on the effects of pollution, the exponential growth of the human population, the deterioration of the planet's natural resources (forests, wildlife, fishing grounds, soil etc.) through global warming, deterioration of the ozone layer, biological diversity, and the dumping of hazardous wastes (Sverdrup, 2019; Almond et al., 2020). All individuals occupy a certain space and use a number of resources, but checks that prevent exploitation of the environment should be instituted (Wilkinson, 2022).

According to Leal Filho et al. (2021), there is no precise definition for sustainability education as the cincept is intricate, challenging, and dynamically evolving. Hence, LFS and sustainability education requires an advanced orientation via education and learning opportunities for everyone (UNESCO, 2009).

The role of education relevant to this study represents a significant change to earlier understandings of sustainability education mainly because of its much broader focus on basic education and links to social concerns such as human rights, peace, and gender inequality. It also signifies a shift in approaches to teaching and learning about environmental and development issues by migrating away from transmission modes; for example, presenting information about environmental disasters and hoping this would stimulate behavioural and social change.

Bourn et al. (2016) consider LFS's concern with social issues in line with the more recent emergence of terms such as *global citizenship* and *the global dimension*. While the addition of *sustainability* to international agendas highlighted a shift in thinking about the process of development, the increasing use of the term *global* communicated an awareness to the new social, cultural, and economic systems of the world (Nousheen et al., 2020).

Additionally, sustainability education is well-known to all, but it requires a 'refresh' in primary schools to align it to the Mauritian context as LFS is a new concept which is not fully understood by all teachers (UNESCO-ROSA, 2018). Education is central to sustainability issues, therefore a need to shift the emphasis from sustainability education to LFS in the primary education system in Mauritius, is imperative. Because education and sustainability are inextricably linked, LFS facilitates the implementing of programmes that are locally relevant and culturally appropriate.

Further, there remains the universal challenge to raise education standards without creating an evergrowing demand for resources and consumer goods with the accompanying emission of pollutants. This challenge can be solved through re-orienting curricula to address the need for more sustainable production and consumption patterns. As such, every nation has to re-examine curricula at all levels. Green and Somerville (2015) maintain that basic education is the key to a nation's ability to develop and achieve sustainability targets because ducation can improve agricultural productivity, enhance the status of women, reduce population growth rates, enhance environmental protection, and raise the standard of living of a population.

3.5 HISTORICAL REVIEW OF LEARNING FOR SUSTAINABILITY (LFS)

In its introduction, the Paris Agreement welcomed the adoption of the United Nations General Assembly (UNGA) resolution A/RES/70/1 titled "Transforming our world: the 2030 Agenda for SD" adopted on 25th September 2015 (UNESCO, 2015a) which focused on the 17 SDGs. Some SDGs of the 2030 Agenda were geared to end poverty in all its forms everywhere, end hunger, achieve food security, improve nutrition, promote sustainable agriculture, ensure healthy lives, foster the well-being for all individuals, ensure inclusive and equitable education, create lifelong learning opportunities for all, and achieve gender equality to empower all women and girls. Since education is a goal in itself, and a means for attaining all other SDGs, it is an essential trajectory to attain all SDGs. Irina Bokova, the Director General UNESCO (UNESCO, 2014, p. 3) states:

> [A] fundamental change is needed in the way we think about education's role in global development, because it has a catalytic impact on the wellbeing of individuals and the future of our planet. Education has the responsibility to be in gear with 21st century challenges and aspirations and foster the right types of values and skills that will lead to sustainable and inclusive growth and peaceful living together.

Early civilisations disregarded sustainability as communities were mainly concerned about social and economic development (UN, 2002). These activities had to be adapted to accommodate sustainability and LFS. The United Nations Conference on the Human Environment in Stockholm in 1972 recommended a shared outlook and sound principles to guide the world to improve society and preserve the environment. After the UNCED conference, several other follow-up UN symposiums were held. Consequently, the UNGA declared the United Nations Decade of Education for Sustainable Development (UN DESD) from 2005 to 2014, emphasising that sustainability education is crucial in attaining SD (UN, 2002).

Subsequently in 2015, new global Sustainable Development Goals (SDGs) known as Agenda 2030 were decided upon to end poverty and combat hunger, to guarantee a just sustainability education, and advance learning opportunities for everyone, among other goals (UNESCO, 2015b). To this effect, pedagogy through sustainability education and LFS represents the key principle of schemes to encourage these goals and beliefs. However, a change in pedagogy is

required: a pedagogy that avails cardinal changes recommended by sustainability forums (UNESCO, 2005). This implies that the concern for sustainability education and LFS necessitates urgent international discourse to guide how education may be used in accomplishing change to lead a sustainable existence in future life.

In 2015, the UN SDGs inferred that there is still much to be done to achieve inclusive and equitable quality education for all. These UN objectives emphasised that by 2030 all learners should be fully versed on how to promote sustainability through LFS and sustainable lifestyles, including the promotion of peace, gender equality, human rights, non-violence, global citizenship, appreciation for diversity, and cultural contributions to sustainability (UNESCO, 2015b).

The LFS journey is more than being a knowledge-base related to the environment, economy, and society as it addresses learning skills, perspectives, and values that guide and motivate people to seek sustainable livelihoods, participate meaningfully in a democratic society, and live peacefully (Cebrian & Junyent, 2015; Cebrian et al. 2020). This involves studying local and global issues.

Reid (2019) therefore advocates that curricula should also focus on basic employment skills to promote sustainability initiatives. Further, standardised and high-level testing need to be limited in school curricula because the need for sustainability education becomes greater, as the effects of social and environmental degradation become dangerously apparent. Thus, sustainability education and LFS are tools for a sustainable future (Heng et al., 2022). As education is central to sustainability endeavours, it means that education and sustainability are intertwined (Taylor et al., 2015; Korotkova & Zakirova, 2021). As such, LFS facilitates implementing programmes that are locally relevant and culturally appropriate, and which considers the local environmental, and economic and societal conditions (Heng et al., 2022).

However, the challenge is to raise education levels without creating an undue demand for resources and consumer goods which cause pollution. This challenge can be met through revising curricula to address the need for more sustainable production and consumption patterns (Mogren et al., 2018; Buil-Fabrega et al., 2019; Casinader, 2021; Murphy et al., 2021). Therefore, every nation, at all levels of the education system, must re-assess and restructure its curricula based on research that shows that basic education is the key to a nation's ability to develop and achieve sustainability targets (Murphy et al., 2021). The benefits of such a plan

are that sustainability education can control population growth rates, improve agricultural productivity, enhance the status of women, improve environmental protection, and raise the standard of living of the population.

Murphy et al. (2021) advocate that LFS must be taught by developing learners' skills in decision-making on the basis of sound scientific knowledge, values, and ethics. As LFS involves studying local and global issues, it must be aligned to formal curricula to address sustainability topics. Agirreazkuenaga (2019) supports the fact that experiential learning, activities outside the classroom, and a positive perspectives on LFS are factors that contribute to the success of the programmes. In this regard, Sustainable Development Goals (SDGs) which are still largely unknown to many teachers around the world, should be advertised in all sectors of community life.

With the launch of the UN SDGs in 2015, countries and stakeholders are encouraged to support a vision for a sustainable future based on the eradication of poverty and peace. The global LFS programme is now imperative for primary education to prepare tomorrow's adults (Allen, 2021). Therefore, all schools should include lesson topics about global and sustainability issues within their curriculum (Gray et al., 2019; Ben-Eliyahu, 2021). However, Bourn et al. (2016) reveal that whilst education policymakers across the United Kingdom (UK) may have observed the occurrence of these global challenges, they have not seen it in a wider picture in line with the purpose and role of education. Although LFS is regarded as an approach to education that has broader societal relevance, in the UK this has been misconstrued, and veer towards addressing problems such as global terrorism to prevent radicalisation, and to promote British fundamentalism.

Olmos-Gomez et al. (2019) and Allen (2021) concur that education, globalisation, and sustainability challenges that children face in a globalised world during uncertain times include predictive environmental threats to the planet. Hence, the importance of children learning about globalisation and sustainability issues via research education to combat challenges in the future (Olmos-Gomez et al., 2019; Allen, 2021). However, merely promoting learning about these themes is not adequate (Burns et al., 2019); we must also consider how children learn about such topics, what influences their views and behaviours, and how a more critical and engaged approach towards learning can be promoted and sustained for both teachers and learners.

According to Buckingham and De Block (2013), mass media and the use of social media advantage today's children to have greater access to information about the wider world than previous generations. Some children also travel abroad and observe other cultures and their ways of living. Ben-Eliyahu (2021) states that there is considerable evidence of children's awareness about issues like climate change and the need to recycle materials (Ginsburg & Audley, 2020). However, Ginsburg and Audley (2020), Spiteri et al. (2022), and Collado and Evans (2019) state that an awareness of environmental issues is not only acquired from direct engagement with the environment itself, but also from a more passive and indirect understanding of these issues; however, it is worrying that direct interaction with the natural environment appears to be increasingly disappearing from children's lives as such experiences are essential in developing children's knowledge and understanding of the world.

3.6 INTERNATIONAL TRENDS AND INITIATIVES REGARDING LEARNING FOR SUSTAINABILITY (LFS)

To grasp how and why these different terms such as EE, ESD and LFS have emerged, it is important to note that there have been numerous initiatives in education promoting in-depth learning about global, international, and development themes. At international level, these initiatives demonstrate increasing interest and support for learning. Since 2000, they have included the following:

- UN Decade on Education for Sustainable Development, 2005-2014;
- UN Programme for Human Rights Education, 2005;
- UNESCO Guidelines on Intercultural Education, 2006;
- UN Secretary-General's Global Education First Initiative, 2012 (global citizenship education is one of its three pillars);
- UN Sustainable Development Goals in 2015; and
- OECD announced that global competencies will feature in the PISA report for the first time in 2018.

The above initiatives demonstrate a demand for LFS because education elicits changes in knowledge, skills, values, and attitudes for a sustainable society. These ongoing initiatives aim to empower current and future generations to meet their needs through an integrated approach involving the environmental, social, and economic dimensions of SD. Accordingly, LFS caters

for this need through education to address the challenges in environmental, social, and economic issues that the planet is facing. Through LFS, learners are empowered with the necessary skills, knowledge, values, and attitudes to contribute to the sustainability of the planet. Furthermore, LFS and ESD are explicitly mentioned in Target 4.7 of SDG4, which aims to ensure that all learners acquire the basic knowledge and skills needed to promote sustainability (UNESCO, 2017). There are also the five priority Action Areas of the Global Action Programme of the 2030 SD Agenda that are currently being upgraded and monitored.

In 2002, the declaration of the United Nations Decade of Education for SD (DESD) 2005-2014 advocated a push mechanism for the integration of sustainability education in all sectors of education across the world. The DESD envisioned a society where everyone could exploit educational opportunities to learn the values, behaviour, and lifestyles essential for a sustainable future. Hence, the role of education has become important. According to Mughal et al. (2011) and Nawaz et al. (2019), the recent trend in the depletion of natural resources, energy, water, and food led to crises that challenged the role of education. Silo and Ketlhoilwe (2020), Burns (2013), and Tikly (2019) agree that if a nation hopes to achieve the sustainable development goals, basic education must be repositioned to integrate LFS in all stages of education (pre-primary, primary, secondary, and tertiary). However, Allen (2021) and Weiss et al. (2021) caution that incorporating sustainability into the curriculum is a complex process with no one-size-fits-all formula for success.

There is an increasing concern about the environment in all parts of the world. Environmental problems, such as global warming, decreasing resources, destruction of forest ecosystems, climate change, ozone depletion, famine, diseases, and pollution have troubled nations over the past few decades. Moreover, and alarmingly, the rapid depletion of natural resources is threatening the continued existence of humankind (Agirreazkuenaga, 2019). People around the world acknowledge that current economic development trends are not sustainable, and that public awareness, education, and training are critical to move society towards sustainability such that LFS beomes a major player. (Olmos-Gomez et al., 2019; Allen, 2021).

3.7 LEARNING FOR SUSTAINABILTY (LFS) IN MAURITIUS

This research was conducted in Mauritius. Prior to its independence from Britain, Mauritius was reliant on agriculture as the principal source of income. Gradually, the Mauritian economy evolved to incorporate the manufacturing, textile, tourism, and the service-sector. Mauritius

now has ICT-related services including outsourcing businesses, artificial intelligence, and the knowledge industry; and is gearing towards yet another new economic diversification sector - namely, the blue economy (Ocean Economy). Mauritians still experience the influences of the past French and British colonialism in its education system, predominantly evident in private schools, colleges, and universities. French and English languages are also taught in public institutions in Mauritius. Mauritian education is largely based on British system, as English remains the medium of instruction in Mauritian institutions.

During the past decades, Mauritius has invested in competent and efficient human capital in the education sector. The MoETEST is responsible for administrating the educational system in the primary, secondary, technical, and tertiary phases. The mission for the Ministry is to create and enable a conducive environment for the higher education system that prepares learners with cutting-edge knowledge, innovative skills, and sound competencies in a dynamic work environment (MoEHRTESR, 2017) which will meet the challenges and demands for the future (GIS, 2018). The primary schools in Mauritius which enrol learners from 5 to 11 years of age, are divided into two sections: lower primary (Grade 1 to Grade 3), and upper primary (Grade 4 to Grade 6). This study was conducted in both sections; that is, classroom observations were conducted in participants' classes from Grade 1 to Grade 6.

The education system in Mauritius has remained unchanged, resulting in it being out of touch with the new social, cultural, educational, technological, economic, and environmental needs of the country (Think Mauritius, 2019). Many learners leave school with poor skills in basic literacy and numeracy, inadequate communication skills, deficient operational skills, poor work ethics and a sense of values which very often turn them into social misfits. For societal progression, education in Mauritius must empower individuals with education and the knowledge to live useful productive lives. The task of revising the system of education for the 21st Century cannot be entrusted to a small group of the population, but to all role-players. Hence, LFS, coupled with pedagogical changes, needs to provide analytical and problem-solving skills, technology-enabled learning, a strong sense of responsibility to the community and the environment, as well as creativity and innovation (Ferguson et al., 2019).

Since Mauritius has limited natural resources and must bank on its human capital for its economic survival, the population of Mauritius is the country's most precious resource, thus we must equip every learner, irrespective of their capability and aptitude, to contribute to the sustainable development of our country. The Government's Economic Mission Statement is to

change Mauritius into a high-income country by 2030 (MoFED, 2017). This vision for 2030 remains key to transform Mauritius into a sustainable, innovative, and inclusive economy through modern infrastructure, global connectivity, and technological advances (UNDP, 2019). However, Mauritius is confronted with overwhelming external factors, including being a high disaster risk and natural calamity island (WRR, 2017). Moreover, as a small island with a fragile ecosystem and limited resources (GIS, 2017; MoESD, 2017), it is ecologically vulnerable due to its isolation, small size, and few natural resources.

Additionally, one of the main purposes of education is to produce informed and astute individuals with a sense of civic duty which must extend beyond the natural environment to include elements of equity, citizenship, social justice, and compassion. To achieve this, people must not only participate in environmentally-friendly endeavours, but also understand the constraints of economic, societal, and environmental factors. Many teachers who execute LFS in primary schools lack the confidence, skills, and knowledge to deliver effective lessons (Green & Somerville, 2015; Suarez-Lopez & Eugenio-Gozalbo, 2021). Recent research has shown that there is limited content of LFS in the curricula, and this is exacerbated by inconsistent conceptions of sustainability which lack social and economic dimensions (Suarez-Lopez & Eugenio-Gozalbo, 2021). According to Green and Somerville (2015), teachers report that they do not have a good understanding of the concepts of LFS and therefore cannot integrate LFS into an already overcrowded curriculum. Important insights into how these perceived problems can be overcome have suggested integrating LFS and sustainability skills into teachers-training programmes (Green & Somerville, 2015; Suarez-Lopez & Eugenio-Gozalbo, 2021).

3.7.1 Situation Regarding the Environment

As an intricate system, with multitudes of living and non-living entities occupying the earth, our environment needs equilibrium, especially considering the negligent actions of human beings. Since our activities directly affect our environmental, social, and economic wellbeing, problems that emanate from exploitative processes currently affecting Mauritius are numerous. These include waste disposal, pressure on limited land space, degradation of marine environments, loss of biodiversity, water quality, poverty, poor sanitation and access to health care, drug addiction, alcoholism, and general deterioration of society (MoESD, 2011). For instance, Jeffery (2020) observed that coral bleaching resulted in a loss of biodiversity,

degradation of marine and land ecosystems, and had a negative impact on fisheries and tourism. Moreover, freshwater and soil salination had a negative impact on domestic water supplies and agriculture, which meant that limited agricultural land and marine resources were under severe bombardment. This trend probably cannot be stopped, but it may be slowed down, and it is the citizens of the country who can play a part in this through proper LFS provision.

I am concerned about the future generations and their capacity to deal with the real and adverse consequences of decades of environmentally, socially, and economically injudicious decisions made by our predecessors. There is a need to shift from a basic understanding of individual components of our biotic and abiotic environment based on educational packaged programmes and exam-oriented curriculum, to a transformed way of thinking of sustainably living. School children are exposed to environmental and societal information when they enrol at pre-primary schools. Many concepts and values regarding environmental and social citizenship such as helping needy people, caring for each other, and sharing are taught at school, but sustainability objectives are seldom met. Therefore, school curricula need to be revamped to accommodate new fields like domestic water supply and the energy crisis, and the inclusion of new subjects such as bio-farming, sustainable fisheries, aquaculture, apiculture, aquaponics, biotechnology, waste recycling, and ecosystem preservation. Many problems have cropped up over the years and consequently our children are growing up in an unsustainable world. Hence, school curricula, through implementing LFS, can play a major role to stimulate change.

3.7.2 Situation Regarding the Economy

Mauritius launched the 2020-2024 National Programme “Towards an inclusive, High Income and Green Mauritius, Forging Ahead Together” (GIS, 2020). This project lauds the Government of Mauritius’ vision as a source of inspiration and guidance for policymaking for the next four years. The Partnership for Action on Green Economy supports the Government in actively contributing to alleviating poverty, encouraging the acquisition of job skills, managing industrial waste, promoting competitiveness, advocating clean production, and stimulating investment. Regarding the Mauritian Government’s stand on sustainability, it has set the groundwork for a new programme comprising of four pillars: investing in clean energy, shifting to a greener and cleaner Mauritius, sustaining low-emissions, and maintaining climate-resilient development.

In addition to the above challenges, only 27% of the electrical power in Mauritius is generated by biomass, solar, wind, landfill gas, and hydro electric projects (Surroop & Raghoo, 2017). Thus, Mauritius now is facing a serious challenge to cater for the increasing demand for electrical power. To this end, renewable sources of energy appear to be the most effective way (Shea & Ramgolam, 2019). Furthermore, new tax incentives (duty-free) are provided to all Mauritians who purchase hybrid and electrical cars to decrease pollution and to limit the number of conventional cars running on fossil fuels (Budget Speech, 2022-2023). Besides the light rail metro, electrical buses are already running on Mauritian roads, and this is bound to increase over the coming years. According to Mahadew and Appadoo (2018), Mauritius has reduced the risks of climate change to boost the tourism industry, which is the economic pillar of Mauritius. Moreover, there is also the adoption of risk reduction and adaptation policy to improve beach management at coastal sites (Duvat et al., 2020).

Mauritius updates its Nationally Determined Contributions (NDC) for the 26th Conference of the Parties (COP 26). This includes increasing crises alleviation levels by applying a systemic approach to look into emission reduction possibilities to least 2050 in order to comply with the National Climate Change SDGs (Deenapanray, 2021). Doorga's (2022), studies of changes in temperature and rainfall over time were conducted in Mauritius, which revealed a spatial distribution of changing climate patterns. Further, adaptation measures were proposed to conserve indigeonous island fauna and flora as advocated in science-based policies to improve the sustainability of freshwater supplies.

Furthermore, Mauritius, in collaboration with the Partnership for Action on Green Economy, has commited to set up an Economic Research and Planning Bureau by the MoFEPD (GIS, 2020). This Bureau endorses the Government programme by implementing an action plan where private and public sector institutions function cohesively. This reveals that the country is serious to install sustainability at the forefront of the NDC strategy which comprises of the SDG 4 (Quality Education), SDG 9 (Industry, Innovation and infrastructure), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Change) and SDG 17 (Partnerships for the Goals).

3.7.3 Situation Regarding Society: Poverty, Social Cohesion, and Peace

As a multicultural country, the Mauritius educational system's vision of a sustainable society is important and realisable in cohesive communities, thus promoting social inclusion

strengthens the cohesiveness of a society to be armed with the required inclusive mechanisms for dealing with conflicts and to encourage respect for and acceptance of diversity. However, environmental and social fragility coupled with economic vulnerability have a direct deleterious effect on social cohesion. The growing inequality and diminishing of the middle class (World Bank, 2017) give rise to new forms of poverty. This, coupled with the absence of an equitable allocation of resources, constitutes a major threat to peace and stability.

There are several causes and effects of poverty but the main cause is the prevalence of many social ills which lead to the intensification of poverty such as poor housing conditions and low levels of education (Budget Speech, 2017-2018; GIS, 2018). It was observed that children living in poverty are often the most affected. In her Annual Report of 2018, the Ombudsperson for Children drew our attention to how children have been traumatised because of displacement and hunger (Ombudsperson for children, Annual Report, 2018).

A stable social order is of the utmost importance for Mauritius in order to ensure peace, stability, and progress. The presence of social cohesion ensures the preparedness of the population to cooperate to confront their vulnerabilities and to build their resilience. Consequently, the current educational system is creating new generations of Mauritians who are not acquainted with their own borders (Bunwaree, 2018). The education system must be geared towards developing younger generations with the required sustainability knowledge and know-how to become effective members of the Mauritian society. Accordingly, it must prepare them with social, cultural, and national values which are important for nation-building, national cohesion and unity, inorder to capacitate children to become agents of socio-economic and cultural change.

Regarding economic and social challenges, a healthy lifestyle, sound values, and a multicultural education is the panacea which should be included in school programmes. Therefore, building a sustainable society through peace and social cohesion is urgently necessary. In this context, LFS can play an important role in fostering and strengthening social cohesion and peace in a sustainable society.

3.8 LEARNING FOR SUSTAINABILITY IN THE MAURITIAN CURRICULUM

In the African region, Mauritius has the highest school enrolment rates (97% at the primary level, and 72% at the secondary level). Free primary education is provided to all Mauritian

children since 1940, and since 2005 education is compulsory for every child from pre-school age to the age of 16. Mauritius has achieved much in the schooling sphere; it now targets quality education so that it can ensure that the nation is provided with the educational tools and human resources to confront global challenges (MoEHR, 2008). In this respect, LFS is integrated into early childhood education (ECE), primary, and secondary (lower and upper) schooling across all subject areas including the tertiary level (MoEHRTESR, 2016). The pre-primary, primary, and secondary school curricula are guided by the National Curriculum Framework (NCF) of the MoETEST in Mauritius.

The Government of Mauritius through the NCF, expect school children to have some knowledge and information about sustainability at the primary school level. The *Maurice-Ile-Durable* (MID) - Mauritius Sustainable Island - set goals to promote an education system that prioritises the holistic development of all citizens which could lead to achieving a 100% literacy rate, and be an internationally recognised knowledge-hub for SD in the region. Additionally, education has always been regarded as the key element of economic and social development; hence, the MID intends to promote education as key in securing a sustainable future for the nation. This research endeavoured to examine the targets set by the MID, and how they assisted to progress towards achieving a sustainable future for the Mauritian nation, while also identifying any shortcomings.

In addition, Mauritius is firmly committed to the Mauritius Declaration (EEASA, 2021) taken at the annual EEASA Conference where various themes in response to DESD and SDGs were linked to mainstream LFS. Moreover, the Mauritius Declaration identified diverse ways to mainstream LFS, and has committed to re-engineering LFS through the promotion and adoption of a whole-school approach to institutionalise LFS by strengthening and consolidating the collaboration between formal and informal education sectors, while re-thinking teacher-education programmes. In sum, school learners and teachers should view LFS with the utmost of importance to learn about all aspects of sustainability.

3.8.1 Pre-primary and Primary School Levels

At pre-primary and primary levels, there are concepts related to sustainability, coupled with learning competencies. Sustainability concepts are well integrated into several subjects, but mostly in Science, Social Scientific Environmental Education, and History and Geography. The syllabi of primary school institutions cater for implementing LFS into the curriculum, and

are guided by the NCF. Much is being covered through the formal and informal engagement of all the stakeholders. Learners learn about temperature, rainfall, cyclones, composting, climate change, floods, pollution, temperature, deserts, sustainable agriculture, the effects of heat/cold on organisms, access to health care, the advantages and disadvantages of renewable/non-renewable sources of energy, efficient water usage, recycling, poverty, poor sanitation, drug addiction, general degradation of social stability, among others (MoESD, 2017; MoEHRTEST, 2017). At each grade or level, different topics of LFS are being addressed with learners who have different learning capacities in a mixed-ability setting. Thus, teachers also adapt to the different learning capacities of learners. In this context, this study investigated teachers' understanding of LFS and how they enhanced LFS in their lessons.

The Nine-Year Continuous Basic Education (NYCBE) curriculum for LFS ensures that learners acquire the desired knowledge, skills, and attitudes to develop an informed and critical understanding of issues related to sustainability (NCF, 2016). Learners also develop an understanding of the interdependent nature of our society and life on our planet. Furthermore, learners need to recognise and appreciate the value of biological diversity to be inspired to maintain the wellbeing of our planet and thus develop a caring attitude for self, other people, other living creatures, and our planet. In addition, they must acknowledge, value, protect, and respect the environment by identifying causes and effects of environmental issues. This will enable them to make informed and responsible decisions about managing the environment. Learners also must appreciate the role of the individual in maintaining and sustaining natural resources by cultivating the habit of rational use of resources (e.g., water & electricity). The NYCBE curriculum for LFS emphasises the recognition of rights and responsibilities of all to thrive in a sustainable society by adopting practices for a sustainable future.

Recently LFS is considered as a strategy that offers educational institutions an opportunity to honour their commitments to address environmental problems, economic inequalities, inclusivity, and social justice. However, there still exists the necessity to discover better ways on how to understand others in society to build commitment and enthusiasm for the conceptual framework and pedagogical imperatives that promotes LFS. Evidence from Adawiah and Esa (2012) and Taylor et al. (2015) concurs that primary school teachers are generally concerned about sustainability issues. However, the lack of understanding on how to teach sustainability with its perceived constraints emanating from current curriculum demands, impede LFS from

being taught effectively in classrooms (Green & Somerville, 2015; Dash & Mohan, 2017; Suarez-Lopez & Eugenio-Gozalbo, 2021). Taylor et al. (2015) and Leal Filho et al. (2018) contend that sustainability as a tool for action will result in a viable sustainable future for successive generations.

Currently, there is a lack of data on teachers' understanding and enhancement of LFS in primary education. It is envisaged that this study will enable other teachers, school leaders, policymakers and curriculum writers to attain a proper understanding of LFS, in addition to addressing the lack of research in this area. This will lead to the enhancement of LFS by engendering positive change and introducing adaptation strategies in teaching-learning situations which will foster best practice. This requires intensive training to effect the successful implementation of LFS instructional practices (Dixon et al., 2014; Zamora-Polo et al., 2019; Suarez-Lopez & Eugenio-Gozalbo, 2021).

3.8.2 Secondary School Level

At secondary school level, Science is the foundational subject to push sustainability content and LFS. Learners learn various sustainability-related concepts such as clean air, clean energy sources, earth and space, and natural hazards (cyclones, droughts, and floods). Furthermore, LFS includes topics encompassing the earth and the environment, weather, rainfall, the water and water cycle, wind energy, bio-fuels, geothermal energy temperature, humidity, atmospheric pressure, desertification, pollution, energy (renewable/non-renewable sources of energy, fossil fuels, and solar energy for heating water, cooking, and electricity generation), effects of heat/cold on organisms, rainwater harvesting, recycling, and composting. It is evident that climate education is visible at the secondary school level. Sustainability subject content in Mauritius is delivered to some extent via the National School Curriculum.

Moreover, some parts of the sustainability content covered in the national curriculum include pollution, climate change, biodiversity, and socio-cultural issues (equality, poverty, gender and diseases such as HIV/AIDS). The extent to which LFS is integrated into the different subjects varies from subject to subject. For example, the depth of coverage of LFS progressively increases from one level to the next, from early childhood to primary to lower secondary. The NCF document which informs the integration of ESD into the national schooling system guides the teaching and learning of sustainability content (NCF, 2016). Cross-curricular themes and

issue-based approaches are used to integrate LFS into the school curricula in Mauritius. Teachers are mostly responsible for the designing and implemention of LFS strategies into their day-to-day teaching. At this juncture, it is critical to ascertain the level of teachers' understanding of LFS, and how they could utilise this to enhance their quality of classroom teaching.

3.8.3 Tertiary Level

At a tertiary level, the University of Mauritius (UoM), the University of Technology (UTM), the Open University of Mauritius (OUM), the Mahatma Gandhi Institute (MGI), the Rabindranath Tagore Institute (RTI), and the Mauritius Institute of Education (MIE) are the major higher education institutions (HEIs). Although the content of some of the programmes at UoM and UTM include modules that partially address sustainability issues, these HEIs have no current formal programmes on LFS. The UoM has been proactive in collaborating with local and international bodies regarding several sustainability-related programmes.

Fortunately, the MIE has played a crucial role in shaping the education system in Mauritius, mainly at the pre-primary, primary, and secondary levels, which uplifted the quality of teacher education, curriculum development, and research. Over the years, MIE has been instrumental in promoting LFS through formal education in the country; this was done by collaborating with MoETEST, MoESD, UoM, UTM and several NGOs, in addition to conducting several ESD-related extra-curricular activities and projects such as School Compost Project, School Foot Printing Initiative Project, Water Education Project and an Environmental Literacy Programme. These projects cemented the link between MIE and schools such that they provided opportunities for the school community (teachers, learners, and non-teaching staff) to collaborate with parents and local NGOs on sustainability-related issues. However, UNESCO (2005) states that teachers' knowledge and skills on how to plan and teach LFS are not appropriately assessed; therefore, exploring teachers' understanding of LFS is critical as teachers are responsible for integrating and directing sustainability subject content.

3.9 CONCEPTIONS AND APPROACHES TO LEARNING

Education aims at providing and demonstrating the active use of knowledge and skills. Understanding is an essential part of the learning process. Literature describes various ways in which the learning environment and teaching methods affect the quality of learning (Gonzalez-Gomez et al., 2022; Cheng et al., 2019). Learners gain knowledge and necessary skills in

schools so that they can use them in their professional and daily lives which require understanding. Understanding phenomena entails dissecting a topic by applying a variety of thought-provoking methods such as gathering evidence, discovery, generalising, analogising, problem-solving, and creating new knowledge. In short, learning requires understanding to realise the long-term benefits of education.

According to Shah et al. (2022), literature has considered ways of improving teaching and assessment through the deep approach to learning because it promotes conceptual understanding. Shah et al. (2022) who deduce that there is a lack of knowledge on sustainability among teachers which hinders the teaching-learning of LFS in classrooms (UNESCO-Regional office for Southern Africa-ROSA, 2018), recommend the deep approach. Moreover, Kuzich (2019) agrees that teachers are not well-acquainted with LFS issues. Although teachers display a appreciation for LFS, they face many difficulties in the actual delivery of content knowledge (Watson, 2017). Consequently, Watson (2017) and Kuzich (2019) state that LFS should be taught beyond classrooms and whiteboards by using different teaching strategies. Kuzich (2019) highlights that UNESCO (2009) also noted limited awareness and understanding regarding sustainability. Similarly, Suarez-Lopez and Eugenio-Gozalbo (2021) found that teachers could not relate to sustainability issues confidently. Hence, teachers had restricted knowledge of LFS so they could not properly enhance LFS in their classes.

Since an approach to learning refers to the method of learning (Biggs, 1987), educational researchers such as Marton and Saljo (1997), Trigwell et al. (1999), and Cano (2005) recommend three major ways of experiencing and handling learning situations: the deep approach, the surface approach, and the achieving approach.

3.9.1 Deep Approach to Learning

The deep approach to learning results in high-quality learning outcomes gained through investing concerted efforts into actively involving learners in their learning which precipitates a deeper understanding of the subject depending on one's intensity to understand for meaning-making (Masuku et al., 2021). This requires intrinsic motivation and interest in the learning activity to focus on understanding the meaning of the learning material by relating content to daily lived-experiences (Chin & Brown, 2000). Quesada et al. (2019) found that the deep approach to learning has social and pedagogical implications, suggesting that the active

participation of learners relates to achieving competencies for effective and professional performance.

Fernandes et al. (2012) maintain that deep approaches to learning relate to learning that is motivated by a desire to understand, and is characterised by an ever-enquiring and critical mindset. In the deep approach, there is active involvement generated from a deep interest in the content which leads to the expansion of learning for gaining personal understandings and meaningful constructions (Hay et al., 2008). This usually occurs when relating ideas to previous knowledge and experiences, and by looking for patterns and underlying principles. Evidence must be verified and checked to align to conclusions. This also entails an examination of the logic and argument in order to become astute and critical in assessing the course content. In this approach to learning which focuses on the level of understanding assists in critiquing the author's conclusion and how it is justified.

3.9.2 Surface Approach to Learning

This type of learning provides extrinsic motivation through memorisation intended to reproduce aspects of the subject matter. Gibbs (2006) criticises that learners get away without studying very much, as learning is through extrinsic or instrumental motivation where the task is perceived as a demand to be met. Learners memorise facts, reproduce terms, and produce them through rote-learning. It is the reproduction of the intention to cope with course requirements by studying without critical-thinking or reflecting on either the purpose or the strategy. It implies passive engagement as learners are only motivated by a desire to learn for passing examinations or other essessments (Masuku et al., 2021). The method is unrelated to their experiences as facts and procedures are memorised routinely and characterised by a lack of understanding and reflection. It is more of a traditional method of teaching where teachers resort to lecturing while learners passively sit back and listen in class. Norton and Yonts (2022) define traditional teaching approaches as generally teacher-directed where learners are taught in a way that results in a lack critical-thinking and true understanding of the lesson (Giraldo-Garcia et al., 2015). This can impact them negatively as they will struggle to make-sense of the new ideas presented. They will feel pressurised and worry about work. This describes the main point of failing to integrate and transfer content to tacle real-life situations.

3.9.3 The Achieving Approach to Learning

In this approach, learners aim to understand and memorise simultaneously as opposed to learners who adopt a surface approach do not develop a proper understanding of the subject matter and thus rely on memorisation. During this process, understanding and memorisation are exclusively related to each other. This approach advocated by Biggs (1979) is derived from the intention to secure the highest possible scores by relying on organised studying and the awareness of processes. Also, Bralic and Divjak (2018) support the work of Biggs (1979) and confirm that a strategic or achieving approach is related to the desire to achieve the highest grades with an emphasis on learners' study skills. Learners who are motivated by the need for achievement display a stable personality and exude self-confidence. The process of developing through understanding was reinforced by memorisation to fossilise their understanding. Hence, two forms of memorising exist, rote-learning and meaningful repetition which embeds and extends understanding.

3.10 TYPES OF LEARNING

It is understood that the concept of learning, its influence, and the interactions with other people concerning LFS can transcend physical and social contexts. The learning process depends on the person and the place where learning is occurring; that is, the environment where activities are completed and the tools that are used for executing classroom tasks successfully. Therefore, there is a need to explore beyond individual competence and knowledge. There is a range of learning strategies that can be applied to all educational contexts. With so many approaches as to how people can learn, it is important to know that one has one's own learning style especially when engaging with LFS principles. These include active learning, transformational learning, social learning, experiential learning, and problem-based learning, among others. Integrative and interdisciplinary teaching and learning approaches can foster sustainability skills through problem-solving, critical-thinking, action competence, and system thinking. Burns (1995) views learning as a permanent change in behaviour including observable activity and internal processes such as thinking, attitudes and emotions. Burns (2013) includes motivation in the definition of learning and considers that learning might not manifest itself in observable behaviour, until sometime after the educational programme has been effected.

Serin (2018) criticises the fact that teacher-centred learning is very common in schools. According to him, it discourages learners from asking questions in class which inhibits critical-

thinking and problem-solving skills. Consequently, teachers have limited experience in teaching sustainability and LFS (Shah et al., 2022). Kim (2016) affirms that didactic learning and traditional approaches to learning do not serve the needs of the current generation of learners regarding sustainability.Similarly, Watson (2017) and Seatter and Ceulemans (2017) contend that traditional methods of teaching do not prepare learners for change, but for the status quo. A change in teaching practices and the implementation of innovative methodological strategies related to LFS is required. This includes learning from real-world problems, integrative thinking, foreseeing, preparing for future sustainability challenges, and participation. The following section described the different types of learning that promote LFS.

3.10.1 Holistic Learning Approach

The human learning process is based on ideas, beliefs and views of the world that humans have, which is called a paradigm (Sukhonthachit & Rattanawicha, 2022). Therefore, knowledge has several characteristics that need different learning processes in transferring it so that human beings can develop themselves holistically. Johnson (2012) describes holistic learning as a worldview that attempts to investigate the question of fragmentation and compartmentalisation of knowledge. It encourages the learner to view objects and subjects in terms of the whole, instead of discrete parts. Holistic learning involves exploring and forging connections by attempting to focus on relationships [inter-connectedness] (Albareda-Tiana et al., 2018). Sukhonthachit and Rattanawicha (2022) claim that holistic learning is designed for technology-driven teaching and learning processes. The basic feature of the holistic approach pertains to people's personality which comprises of many elements (intellect, emotions, body impulse, intuition, and imagination) that require activation if learning is to be effective. Most importantly, one cannot separate teaching and learning experiences from human experiences that educates the whole person in many dimensions of LFS. Watson (2017) favours the holistic learning approach for delivering LFS lessons as this will facilitate knowledge acquisition.

3.10.2 Experiential Learning Approach

Kolb (1976) proposes a four-stage learning process in experiential learning. This process starts at any of the stages and is continuous; that is there is no limit to the number of cycles that can be repeated in any learning situation. This approach highlights that reflection is very important to know where we stand or else we would simply continue to repeat our mistakes. There are

four ways as evidenced in research that individuals can learn: concrete experience, observation and reflection, abstract conceptualisation, and active experimentation (Morris, 2020) - but eventually one would develop one's own mode of learning more than another. Kolb's work identifies four learning styles:

- Activist - enjoys the experience itself;
- Reflector - spends much time and effort on reflection;
- Theorist - revels in connecting and extrapolating ideas from experiences; and
- Pragmatist - relishes the planning stage.

From the above learning styles, it is evident that there are strengths and weaknesses present in each of them. Learning is said to be optimised when one reflects on one's learning style so that strengths can reduce or override weaknesses to enhance the quality of learning. There is a holistic model of the learning process and a multilinear model of adult development which are conducive to learning sustainability issues that foster people to learn, grow, and develop. Through an experiential learning process, a learner acquires new information related to LFS by experiencing the concrete or tangible qualities of the world - this relies on the learner's senses converging towards concrete reality. Also, new information can be grasped through abstract conceptualisation such as critical-thinking, problem-solving, analysing, or systematic planning. Kim (2016) and Shah et al. (2022) affirm that experiential learning is a brilliant way to teach sustainability.

3.10.3 Action Learning

It is a reality that recent sustainability challenges facing our world need new approaches to teaching and learning. Jiusto et al. (2013) assert that at the community level, sustainability priorities are context-specific; hence, there are prescribed traditions for teaching sustainability. Action learning is the approach that links the world of learning with the world of action through a reflective process within small cooperative learning groups known as action learning sets (Brook & Pedler, 2020). The sets meet regularly to work on individual members' real-life issues to learn with and from each other. Hence, action learning is ideal for finding solutions to problems that do not have a prescribed answer.

Additionally, action learning can be described as an ongoing process of learning and reflection with the support of other individuals who work on real and complex issues, thus it brings innovation to a typical field of work to provide solutions to complex problems. Basically, it

involves doing (action), as any challenging task can be easily resolved through a collective (Revans, 2017). Moreover, action learning can be referred to as an educational process where one studies one's own actions and experiences to improve one's performance. For classroom-based activities, action learning can be designed to engage learners in their learning through answering questions, solving problems, discussing content, and unearthing research-based instructional strategies (Dancy et al., 2016) and promoting evidence-based instructional practice (Stains & Vickrey, 2017). In other words, it is about solving problems and getting things done. Since there is a deeper understanding of issues, a reflective reassessment of the problem and strategies to overcome it, are important. Moreover, action learning is an approach where learners work in groups to address problems and reflect on their attempts to enact changes in their practice. However, Dutta (2018) cautions that classroom discussions cannot compensate for 'real world' experiential learning (Brook & Pedler, 2020). For Seatter and Ceulemans (2017), action and transformational learning are crucial to trigger change in learners.

3.10.4 Adult Learning (Andragogy)

Andragogy is a concept that describes how adults best respond to knowledge acquisition (learning) and therefore it is a study of how adults learn through different learning styles (O'Neill, 2020). Knowles (1990) who popularised the concept of adult learning, claims that adulthood occurs when people behave in adult ways, and believe themselves to be adults, so they should be treated as adults, adding that andragogy is special in several ways. Firstly, for example, adult learners have numerous experiences in the learning environment, hence teachers may utilise this as a powerful resource. Second, adults may also have a high degree of influence on what they are to be educated about, and how they are to be educated, hence the active participation of adult learners can be encouraged in terms of designing and implementing educational programmes where they can witness applications for new learning. Third, adult learners may also have a high degree of influence on how evaluation can be conducted on their learning. Fourth, adult learners may expect their responses to be acted upon when asked for feedback on the progress of the programme they are enrolled for. Tennant and Pogson (1995) opine that adulthood is a social construction, and that the concept of a life's course varies for different individuals and different cultures; therefore, instructors and adult education educators need to have different definitive perspectives of adults and their behaviour.

3.10.5 Problem-based Learning (PBL)

The problem-learning approach (PBL) is an innovative method as it simultaneously teaches concepts and inspires lifelong learning. It presents learners with real-world issues where they are required to discover constructive solutions. In this manner, PBL acts as a teaching style that allows learners to be drivers of their own learning. This is based on reality where learning occurs as a result of participation in the process of working towards the understanding of, or the resolution of a problem (Bholah, 2017). Further, its systematic methodology where learners engage in dissecting knowledge and applying skills through an extended inquiry process that involves complex, authentic questions, and carefully designed products and tasks.

Wyness and Dalton (2018) propose that learners either individually or in groups, learn as they reproduce a poster, a report, a play, or a model in a problem-based learning setting. It utilises problems in real-life situations, usually in a collaborative undertaking. These project-based activities are enhanced when learners use different skills and are motivated because they have an interest in the end product. It is usually focused on outcome-based processes to achieve the set objectives. In a study conducted in Mauritius in 2017, the PBL approach was chosen by learners to identify any water-related problems in their institution (Bholah, 2017) and the findings showed that the PBL approach helped the teachers to plan their work very systematically to engage learners in identifying water-related problems in their school so that they eventually develop appropriate strategies to find solutions to water problems. Sustainability problems are complex, systemic, and are seldom easily remedied. Through PBL, these complex sustainability problems are tackled with a focus on finding solutions, recognising the need for teamwork, and stakeholder involvement (Mc Gibbon & Van Belle, 2015).

3.10.6 Social Learning

The social learning concept refers to a learning process involving several people who aim to improve a common problem through collaboration. Usually, it originates through dialogues and negotiations between groups. This results in a better understanding of different points of view, and thus develops into collective agreement and action. Social learning is gaining prominence as a framework for understanding the human relationship, knowledge generation, and decision-making processes to tackle various sustainability problems (Kilvington & Allen, 2010).

A social learning approach can be aggregated into five main areas of focus for awareness and developing practice in complex problem-solving situations. Firstly, social learning improves the learning of individuals, groups, and organisations. Secondly, it enables system-thinking and the integration of different information. Thirdly, social learning works with and improves the social/institutional conditions via problem-solving techniques. Fourthly, social learning allows to work-manage group participation and interaction. Finally, it monitors and evaluates which is key to driving uninterrupted improvement in learning practice.

Further, social learning can be utilised to understand and upgrade the capacity of any sustainability problem-solving and management situation because it has the potential to engage in complex, interconnected social and sustainability challenges such as climate change adaptation (Ensor & Harvey, 2015). It has varied approaches which include various cycles of knowledge-sharing, action to co-create knowledge, relationships, and practices among various participants. This encourages learning for change which goes beyond the individual learner into communities, networks or systems. Usually, it deconstructs the existing process of knowing and understanding to critically reflect on the values, beliefs and worldviews that underpin them and then co-constructs new shared meanings. These meanings can contribute to a sustainable future.

Harvey et al. (2013) point out that understanding social learning is important if an individual wishes to effectively respond to rising problems such as climate change, which transcends barriers between producers and users of research. According to Didham and Ofei-Manu (2015), sustainable lifestyles occur simultaneously at individual, collective, and societal levels. Therefore, changes that have occurred in conjunction with the narrowing of the gaps, were considered and evident in the research. The results have not only demonstrated higher levels of benefits in achieving social learning concerning sustainability actions, but also strengthened overall efficacy and longevity.

3.11 BARRIERS TO LEARNING

Past studies illustrate that learners find learning sustainability issues through different learning approaches such as action learning, problem-based learning, transformational learning, and active learning, among others. These approaches benefit the learning process by raising learners' self-efficacy (Patrick et al., 2016; Stump et al., 2014). Despite the evidence from past studies supporting innovative learning in LFS, research has demonstrated that traditional

teaching and learning methods such as lecturing, and surface learning approaches are still the dominant teaching mode in schools which act as barriers to LFS (Miedijensky & Abramovich, 2019).

According to Howell et al. (2022), barriers to learning are used to explain why learners do not experience learning success. It is usually followed by a deficit approach discourse in literature which locates the problem within the learner, rather than pointing to the faults in the system. A barrier to learning can be defined as anything that prevents someone from fully engaging in the learning process (Quarmby et al., 2019; Fernandes et al., 2019). Very often, learners' engagement with learning is affected by other factors (Hornby & Blackwell, 2018). When learners cannot fully participate in a learning activity, they cannot be truly engaged in learning. Theories of barriers have identified risk factors that could be potential external and internal barriers to LFS. Internal barriers range from individual disorders and differences, while external factors are many, ranging from a learner's neighbourhood, family, schools, and peers (Maiorescu et al., 2020). Additional barriers relevant to learning can be related to the need for leadership, incentives, knowledge, and resources for the successful implementation of sustainability. According to Raymer (2022), these barriers are divided into three groups: situational, institutional, and dispositional.

3.11.1 Situational Barriers

Situational barriers arise from personal (behaviour problems and inadequate provision for care) and family situations such as time pressures and financial constraints (Pennacchia et al., 2018; Hui et al., 2019). Since the family acts as a support base for learning to advance, the lack of support and reduced flexibility to learn, especially for women learners, are mostly cited as barriers (Pennacchia et al., 2018). Learners' situation, geographic location (community disorganisation including high levels of mobility, conflict, disruptions and violence), socio-economic status (minority and/or immigrant), and educational status are highly affected by their economic needs (Raymer, 2022). Extreme economic deprivation and chronic poverty, inequality, and a lack of resources and privileges are among the other forms of situational barriers. Situational barriers to LFS result from the lack of learners' participation and engagement with in-class and outside-class activities which lead to learners experiencing personal and behavioural problems (Winkler & Rybnikova, 2019).

3.11.2 Institutional Barriers

Institutional barriers arise from the unresponsiveness of educational institutions (Kezar & Holcombe, 2020) or the lack of flexibility regarding their provisions on offer such as inappropriate scheduling or irrelevance of content (Raymer, 2022). Negative experiences from having unprepared teachers or trainers who deliver boring lessons, can be a barrier to learning such that adults and children may develop a distaste for learning. Also, the curriculum is also considered a significant barrier to teaching-learning (Gatzweiler et al., 2022) as various curriculum aspects such as content, language of instruction, organisation of classrooms, teaching methods and processes, crowded curricula, and learning materials and equipment may obstruct the effective provision of LFS. The poor quality of institutions, and negative encounters with teachers, trainers, and peers also fall into the category of barriers (Briller et al., 2022). A lack of lesson preparation and limited class time devoted to LFS often hinder the proper implementation of LFS in schools. Also, Evans et al. (2012) notice teachers' resistance towards adopting sustainability skills in their classrooms. In sum, institutional barriers can result in the delay and ineffectiveness of implementing a holistic, interdisciplinary education for sustainability (Kang, 2019).

3.11.3 Dispositional Barriers

Dispositional barriers are related to attitudes, perceptions, and expectations of the learner. These include a lack of confidence, disinterestedness, peer influence, self-beliefs, temperament, and adjustment problems (Raymer, 2022). The lack of focus is also caused by distractions while learning, mostly by not understanding the essence of the cotent of lessons. Owens et al. (2020) recognise that learners also resist the introduction of innovative learning approaches to LFS through active learning. In adult learning, adults often think they are too old to learn, and thus suffer from low self-esteem (Shelton, 2021). This is expressed through resistance and disengagement towards new learning styles or new technology. Additionally, health conditions are highly related to a person's self-perception in the social environment. Resistance from teachers to implement and adopt whole-school sustainability approaches also hinders the proper implementation of LFS in schools (Evans et al., 2012; Kang, 2019). Moreover, many of these teachers do not incorporate LFS into their lessons because they do not have an understanding of what LFS is really about (Kayimba et al., 2014)

3.12 TEACHERS' PERCEPTIONS OF AND ENGAGEMENT WITH LFS

The purpose of this qualitative multiple case study was to gain an overview of primary school teachers' understanding and their enhancement of LFS. Primary school teachers are vital for LFS at all levels to successfully establish best practice at schools. However, research indicates that many primary school teachers are underprepared to meet the critical needs of learners in the context of LFS (Green & Somerville, 2015). UNESCO (2012) reports that DESD aimed to ensure that teaching and learning integrate the principles, values, and practices of SD. The concept of sustainability via the teaching-learning of LFS has been regarded as a tool to confront environmental challenges of the future. The successful integration of LFS into classroom lessons requires teachers who are knowledgeable about sustainability, and who can act as change agents (Gamage et al., 2022). Burns et al. (2019) state that teachers are required to have specific knowledge about sustainability issues to enhance LFS engagement.

3.12.1 Initial Teacher-preparation for Sustainable Futures

Many sustainability concerns such as deteriorating ecosystems, affect our health and the overall livelihood of people (Trischler, 2016). As such, humankind is facing a new catastrophe called the Anthropocene, which is evident through disasters emanating from global environmental degradation (Trischler, 2016). To find solutions to the challenges of sustainability, technological solutions, economic incentives, and political agreements are not enough; to establish a just and equal society for a peaceful and sustainable world, a combined attempt is needed by all citizens and societies. Hence, LFS has a critical role to play in the transmission of knowledge, competencies, and values to transform a rapidly deteriorating world.

Additionally, teachers have limited knowledge about sustainability concepts and limited experience in teaching such concepts (Shah et al., 2022). Teachers believe that LFS demands thorough prior preparation by utilising modern and creative methods of teaching. These learning processes should receive the highest importance in the curriculum as it requires partnerships (e.g. community members) which integrate sustainability with teachers' endeavours. Through this combined engagement in practising and promoting sustainability, teachers engender a synergy between their own practical implicit theories (e.g. values, knowledge systems, and hopes) and those of others role-players. Some practices such as classroom dynamics, decision-making processes, and how learners understand themselves in an ever-evolving world, inform teachers to enact LFS guidelines for teaching in the classrooms

as they are responsible for educating future generations on sustainability. A study of Greek in-service primary school teachers' perceptions about sustainability concerns revealed that learners have misunderstandings of the conceptual meaning of the term *sustainability* while the implementation rate of sustainability programmes is also relatively low. According to Dash and Mohan (2017), and Agirreazkuenaga (2019), teachers' interest in sustainability issues is just as low, and this can be attributed to the lack of knowledge and experience with applying new methodologies in teaching sustainability issues. Furthermore, Adawaiah and Esa (2012) contend that teachers' perceptions, knowledge and engagement in sustainability topics need to be evaluated as some teachers still hold misconceptions about LFS. However, teachers also claim that there is often limited integration of LFS in the curricula or that there are different and inconsistent conceptions of sustainability, especially if they (curricula) lack social and economic dimensions (Maidou et al., 2019; Evans et al., 2012; Suarez-Lopez & Eugenio-Gozalbo, 2021; Green & Somerville, 2015; Lasen et al., 2017).

In future, teachers may not be able to promote LFS if they have not acquired necessary competencies in sustainability, specifically in LFS. Possessing competencies in sustainability and LFS is important for teachers as their impact of teaching reflects outside their classrooms, and contributes to the re-construction of a society which should be geared towards a sustainable future. Not only do teachers have to be knowledgeable and provide persuasive LSF arguments, but they also need to prepare for sustainable futures by adapting their behaviours to be consistent with what they teach in their classroom lessons since sustainability competencies are vital to promote LFS teaching and learning.

3.12.2 Teacher Upgrading for Sustainable Futures

Teachers are responsible for preparing future generations to face the challenges as a result of of current unsustainable developments such as the energy crisis. Brandt et al. (2019) recommend that teachers undertake professional training to adopt pedagogies that can encourage action-oriented engagement in society as they have a crucial role in shaping the future (Valderrama-Hernandez et al., 2020; Dlouha et al., 2019). This requires the integration of different disciplines; thus, teachers need profound and extensive knowledge in sustainability issues to address them in future (Maidou et al., 2019).

Larsen et al. (2017) report that in Australia teachers perceive LFS and EFS to be immensely pertinent to their learners who should participate in society's efforts to promote lifelong

learning, but barriers such as a congested curriculum obstruct the proper implementation of LFS. Such deficiencies can be remedied through the the revision and streamlining of curricula, and the implementation of innovative approaches to teach sustainability based on effective cross-curricular, critical-thinking, and eco-centric ethics. Teachers' engagement and perceptions of LFS are decisive when it comes to incorporating LFS effectively since their perceptions contribute significantly to how they teach and engage their learners on sustainability issues (Cebrian & Junyent, 2015). Unfortunately, the knowledge and abilities that teachers possess are questionable as the lack of appropriate teacher professional development, to enhance competency and commitment to engage as change agents, is evident (Burgener & Barth, 2018).

However, Ferguson et al. (2021) conclude that teachers cannot adequately address LFS as they lack content knowledge; and in support Shah et al. (2022) agree that due to insufficient knowledge and misconceptions, teachers are unable to engage incisively and meaningfully with LFS subject matter. It is therefore imperative that primary school officials, policymakers, and curriculum writers interrogate the impediments of implementing best practice for teachers to enhance LFS in schools. Hence, inbibing a better understanding of LFS by teachers can lead to enhancing LSF while presenting lessons (Kuzich, 2019). Watson (2017) claims that traditional education has failed to recognise humanity's relationship with an ecological system of which we are part of, adding that the time has come for us to re-assess school curricula for learners to be able to cope with the demands of the 21st Century. In this regard, Pahnke et al. (2019) suggest promoting inquiry-based learning and scientific thinking in learners, while Tularam and Muchiesella (2018) propose new approaches to LFS that inculcate the right values, behaviours, and requisite skills in learners.

3.13 FACTORS AFFECTING LEARNING FOR SUSTAINABILITY (LFS)

The modern world is facing complicated and interconnected social, economic and environmental problems presently threatening the survival of the human species, which will increase in the future if neglected and left unabated (Dyball & Newel, 2014; Parry & Metzger, 2021). Humanity needs change agents to ensure a sustainable future, thus education through LFS can play a pivotal role in this transformation. Since LFS calls for an integration of key topics such as sustainable production and consumption, climate change solutions, poverty

alleviation, social stability, and end to economic and commercial disputes (Gamange et al., 2022), there must be an interplay of innovative knowledge, creative capacities, honest motives, and positive dispositions to accelerate and foster experience, action and reflection. In earlier research and literature (Aleixo et al., 2018) focus was on factors affecting LFS such as teaching, research, school improvements, and community outreach. In recent papers, greater insightful analysis through case studies (Aleixo et al., 2018) support systems that encourage sustainable entrepreneurship, collaborative research, and sustainability teaching centres (Soini et al., 2018). Such studies focus on both the factors affecting proper implementation, and the potential of the successful implementation of LFS.

Although LFS across all levels is welcomed, it fails to produce change agents for a more sustainable future (Parry & Metzger, 2021). To exacerbate matters, and according to Parry and Metzger (2021), education will not be adequate to prepare learners with the appropriate knowledge and relevant competencies to address aspects that hinder sustainability. Various researchers such as Shah et al. (2022), Watson (2017) and Kuzich (2019) concur that there is a need for a transition from traditional teacher-centred methodologies to strategies that are action-oriented, experiential, and active. As such, a complete rethinking of sustainability education is necessary. Hence, effective and innovative education for sustainability must occur considering that LFS has interdisciplinary and whole-system approaches to learning to integrate and enhance curriculum content and organisation within schools' ethos, management, infrastructure, resources, and communities (Cloud & Jackson, 2016). However, there are hindrances that affect the proper implementation of LFS which include curriculum overload, a traditional education system, the lack of astute leadership and managerial support, finance and funding constraints, poor quality of teacher-training, and social or institutional factors.

3.13.1 Curriculum

According to Parry and Metzger (2021), England's National Curriculum is very constraining regarding how the content is delivered, even though it covers the majority of topics covered in sustainability fields. There are various new topics that have been added to cater for LFS in schools. Usually textbooks used in schools follow the national curriculum, but they are also very restrictive in the manner the content is covered. Very often, learning objectives are too few and vague, and only factual content is given priority over competencies that allow learners to participate in collaborative problem-solving for sustainability (UNESCO- Regional office

for Southern Africa-ROSA, 2018). According to UNESCO-ROSA (2018), although LFS has been incorporated throughout the primary school curriculum, it is not being addressed efficiently in schools. Gatzweiler et al. (2022) adds that the curriculum can also be a significant barrier to learning considering the overwhelming amount of content that has to be taught in limited time. Moreover, learners are underprepared for a sustainable future because of the lack of necessary training, insufficient knowledge, and the absence of relevant skills. Consequently, teachers are unable to inculcate the right values and behaviours in learners for them to become the change agents of sustainability (Suarez-Lopez & Eugenio-Gozalbo, 2021).

3.13.2 Education System

Contemporary education consists of a teacher-centred (one-way) method of conveying information from teachers to learners (Parry, & Metzger, 2021). The education setting mostly favours fact-based assessment, and a curriculum that will not be enough to arm learners with competencies and knowledge needed to overcome persistent and convoluted barriers to sustainability. There is a need for a rethinking of the traditional education system such that it is replaced by pedagogies that promote techniques that are action-oriented, experiential, and reflective (Miedijensky & Abramovich, 2018). Similarly, Timm and Barth (2021) agree that the education system must be revamped to allow LFS to be enhanced in schools.

Furthermore, Taylor et al. (2019) note that LFS implementation presents opportunities as well as challenges. There are several obstacles that exist in implementing holistic, interdisciplinary education for sustainability (Kang, 2019; Borg, 2012; Taylor et al., 2019). These include a fragmented incoherent curriculum which does not provide the full coverage of sustainability at school levels which affects the enhancement of LFS teaching and learning. Moreover, sustainability-related instruction must compete for time within an already crammed curriculum. Among teachers, sustainability topics, because of their non-disciplinary nature, are often very difficult to include when lesson-planning and delivering lessons in classrooms (Parry & Metzger, 2021). Additionally, Evans et al. (2012) and Kang (2019) report on barriers to LFS which include lack of funding, restricted access to effective instructional materials, and school staff members' resistance to adopting sustainability whole-school approaches. Also, teachers expressed opinions that LFS would be more effective if it is integrated across the all curricula spectrums (Parry & Metzger, 2021). Consequently, this requires considerable economic and social investment, as well as a scientific understanding of how to combat sustainability

challenges. Lastly, behavioural change is not always guaranteed by acquiring more information to become change agents, but also the active collaboration of all stakeholders is imperative to ensure a better future.

3.13.3 Need for Leadership and Managerial Support

There is consensus that leadership, resources, incentives, and knowledge are needed for the fruitful application and integration of sustainability subject content into the education system (Fernandez-Sanchez et al., 2014). When there is an absence of support from the school administration for LFS integration process, the entire implemention of the discipline of sustainability in the education system is jeopardised (Kadji et al, 2012). Additionally, and according to Lee et al. (2013), a serious problem is that we do not always provide the concrete operational level required for educational institutions as coordination for the implementation of LFS is missing most of the time. Lastly, Miedijensky and Abramovich (2018) call for an improvement in managerial support in schools for the proper development and provision of LFS.

3.13.4 Finance and Funding

Finance and the availability of resources act as major factors affecting LFS in educational institutions (UNESCO- ROSA, 2018; Evans et al., 2012; Kang, 2019). The main impediments emanate from the lack of funding, disinterestedness, and the absence of support from the administration of schools and universities. Also, finance can act as a barrier, especially when implementing projects related to LFS.

3.13.5 Teacher-training

The training of teachers also presents difficulties for content and sustainability pedagogy. It was noted that issues in teacher-training act as a major drawback in the successful implementation of LFS such that sustainability plans are stifled in educational institutions (Kang, 2019; Borg, 2012; Taylor et al., 2019). Furthermore, Agbedahin and Lotz-Sisitka (2019) suggest mainstreaming LFS for better acquisition of knowledge and skills. Similarly, Togo and Lotz-Sisitka (2013) found that mainstreaming LFS a viable option for imparting sustainability skills to learners. A framework, with the consensus of the school departments, is required for this transition, but must entail a bottom-up strategy with adequate administrative support for

the successful implementation of LFS. Current curricula contain teaching strategies that are often unadaptable, but many strategies are missing such as the creation of discussion groups, debates, PBL, role-play, simulation, critical case study reading, and modelling for good practice (UNESCO, 2011). Moreover, Waltner et al. (2020) notice the lack of content knowledge hindering the proper teaching of LFS in their research, and advise that teachers should be trained to address this. Similarly, Miedijensky and Abramovich (2018) request adequate teacher-training for all teachers (pre- and in-service) to enhance sustainability teaching and learning.

3.13.6 Social/Institutional Factors

Adams et al. (2018), in a recent survey, identified the aspect of technological improvement to address the limited success of LFS. Further, there is a growing awareness of the social and cultural factors hindering the success of LFS. Moreover, and according to Wang et al. (2019), social and institutional changes are essential to execute a more effective plan to enhance LFS. Wang et al. (2019) add that the role of educational institutions in supporting partnerships between research, the community, and business is also essential for the successful implementation of LFS.

3.14 ADDRESSING THE GAP, AND SIGNIFICANCE OF THE STUDY

The Government of Mauritius, through the MoETEST, is currently implementing various initiatives at different levels to enhance LFS in the education sector to fill the gap regarding LFS's insufficient coverage (MoEHR, NCF, 2016). Various steps have been taken to review teacher-training programmes and school curricula as laid down in the NCF of the MoETEST to mainstream LFS. There have also been regional, international and local support, especially through *Maurice Ile Durable* (MID), to promote LFS on the island. According to a regional workshop in Johannesburg (RSA) in collaboration with UNESCO, the main challenge of working with sustainability in terms of implementation into the National School System in Mauritius, is the divergent understandings of LFS as a concept and a philosophy for the new education system (UNESCO-Regional office for Southern Africa-ROSA, 2018).

However, there are enablers for working with LFS in terms of implementation in the Mauritian National School System which include political will, social cohesion, and a new or revised sustainability education programme compliant with the national curriculum. The challenges for

such enablers for enhancing sustainability are the different understandings of LFS content, and the inability of working towards achieving sustainability objectives for teachers (UNESCO-Regional office for Southern Africa-ROSA, 2018). Traditionally, LFS was a part of pedagogy (MoEHR, 2016), but sustainability topics were included in the Mauritian education system which required a transition from the traditional approach to a learner-centred approach. This implies that the Mauritian education system is already primed for LFS, but teachers' mindsets must change to accommodate LFS pinciples. Since teachers as change agents must be knowledgeable about LFS, they need to be prepared to tackle issues regarding sustainability. However, according to Anyolo (2015), teachers are not equipped sufficiently on the conceptual and practical elements of sustainability. Hence, there is an incongruity between what educators understand, what they are supposed to be knowledgeable about, and how they are expected to teach LFS. In support, Evans et al. (2012), Suarez-Lopez and Eugenio-Gozalbo (2021), Green and Somerville (2015) and Lasen et al. (2017) indicate that teachers were not skilled to successfully teach LFS; hence, professional development regarding sustainability is critical.

In Mauritius, current efforts aim to ensure that natural resources are protected, and that people are constantly reminded of their duty and responsibility as citizens, at an individual and at the national level, to help preserve the island's environment. Children at school are aware of and concerned about sustainability issues as they perceive the environment to be seriously endangered given the destruction of the ozone layer, CFCs, global warming, deforestation, and evidence of endangered species. Next, they cite more local problems such as chemical pollution, pollution of rivers and seas, and car emissions (NCF, 2016). Generally, school learners demonstrate a higher level of sensitivity to environmental and social degradation which are reinforced by school lessons and school projects as sources of information.

Through projects like the School Compost Project, children learn about the law(s) of science that develop skills on how to make use of biodegradable waste in a profitable way (NCF, 2016). Linked to character-building, they learn that what is considered as waste, can be converted into recycled products. Learners can become ambassadors in defence of the environment by embracing sustainability lifestyles. They need to commit themselves to enhancing the quality of life, natural environment preservation, and improving the quality of the environment. Additionally, learners should embrace sustainability lifestyles and retreat from a dispensable to an environment-friendly mindset to become proactive in energy saving, decreasing the amount of litter, and starting to plant trees.

As a teacher and a researcher, I ponder how the principles and values attached to LFS are taught and learned at school. After so many years that have elapsed following the Decade for Education for Sustainable Development (DESD), it was observed that the main finding that emerged referred to the fact that the teaching of LFS is not being integrated into the present education system (Kang, 2019; Borg, 2012; Taylor et al., 2019) - Mauritius is not an exception. As stated in the there is insufficient LFS coverage in the Mauritian school curricula. The SITAN report (MoESD, 2011) also blames the Mauritian Education System because it presents few opportunities for teachers to acquire training in sustainability issues. Also, teachers expressed their failure to comprehend the complicated nature of sustainability and its inter-relationships with environmental, social, and economic aspects (UNESCO-Regional office for Southern Africa-ROSA, 2018).

There is thus an urgency to develop environmentally and socially-conscious citizens. This can only be possible through providing proper LFS teaching and learning opportunities. Fortunately, the unique educational context and cultural background of Mauritian school teachers offer a distinct opportunity to explore teachers' understanding of LFS. Also, this research study can possibly offer incisive discernments into how these recognised LFS problems can be overcome.

Incorporating sustainability into the education curricula is complex. Michel (2020) and Sandri (2020) have noted that empirical and in-depth research which investigates pedagogical practices is lacking in teaching sustainability in higher education. In fact, there is no research regarding sustainability issues on teachers' understanding of LFS, and how it is enhanced in Mauritian primary schools. This study which explored how teachers understand and enhance LFS in their daily lessons, shed more light on the actual situation prevailing in our primary schools. This study aimed to fill the gap concerning the understanding of LFS as a concept and its principles among primary school teachers in the knowledge that it will eventually contribute towards improving the dissemination of sustainability knowledge to our learners so that they (learners) can become ambassadors for sustainability.

The findings from this study can provide an understanding of the differing levels of knowledge about teachers' understanding and enhancement of LFS in Mauritian primary schools. Furthermore, there is an alleged disparity between what is understood between policy and literature; hence, this research tried to fill this gap. This study may also convince policymakers, curriculum designers, teachers, and school leadership to revisit the curriculum to provide an

unrestrictive environment for mainstreaming LFS, as well as for teachers to understand LFS, and how they can enhance LFS during their lessons.

3.15 CONCLUSION

This chapter (3) reviewed the concepts of sustainability education and LFS from historical, national, and international perspectives. These concepts were utilised to inform this research via questions to justify the need for this study which recognised the gap in literature. Then an explanation of the position of LFS in the curriculum was followed by an exposition of the broader and deeper understandings of LFS. The chapter also presented the different conceptions and approaches concerning the types of learning suitable for sustainability. Barriers affecting learning and the effective implementation of LFS were also described. Lastly, an overview was provided on how to fill the gap between the disparity of what policy and literature state and the realities on the ground. The next chapter (4) detailed the methodology adopted for this study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The preceding chapters (1, 2, and 3) provided the background, conceptual framework and literature review for this study. This chapter (4) explained the methodology adopted for the study. It was rooted in the interpretive paradigm which was suitable for knowing how people interpreted and understood daily occurrences, and the meaning they attached to LFS in the context of the 21st century. In this context, the qualitative research approach was considered the most appropriate. I selected a qualitative multiple case study design, which allowed me to examine the phenomenon via interviewing primary school teachers as participants. Purposive sampling was applied to select six general purpose primary school teachers from a school in Mauritius. Semi-structured interviews were conducted to generate data to make-sense of how LFS was understood by primary school teachers, and how it enhanced their teaching. Data was analysed (content analysis approach) according to themes presented in the findings to unearth intervention strategies. The chapter concluded by outlining aspects of trustworthiness and ethics.

4.2 REAEARCH PARADIGM

The term *paradigm* originates from Greek, meaning patterns (Kivunja & Kuyini, 2017). Kuhn (1962) applies of the term *paradigm* in two ways. Firstly, a paradigm is used to represent a particular way of thinking that is accepted by a community of scientists in solving problems; and secondly, to represent the commitments, methods, beliefs, values, and outlooks shared across a discipline (Schwandt, 2015; Abutabenjah & Jaradat, 2018). Schwandt (2015) adds that a paradigm is a shared worldview representing the beliefs and values in a discipline that guides how to solve problems. Fraenkel et al. (2012) and Onwuegbuzie and Leech (2005) label such worldviews as paradigms (Singh, 2019).

Jonker and Pennick (2010) and Lee (2021) state that a research paradigm acts as a cognitive framework where there is a set of fundamental assumptions and beliefs as to how the world is perceived. It is described as a whole system of thinking that provides an underlying structure

to integrate all elements central to a study (Dannels, 2018). Thus, a paradigm refers to the accepted research traditions in a philosophical framework or in a specific discipline (Collis & Hussey, 2009; Zukauskas et al., 2018). Kelly et al. (2018) elaborate that a paradigm includes accepted theories, approaches, models, traditions, frames of reference, bodies of research, and methodologies; and it is seen as a model or framework for observation and understanding (Creswell, 2015, Creswell & Baez, 2020; Babbie, 2011; Babbie & Rubin, 2010).

The paradigm determines how participants are selected, what variables are included and manipulated, and how data is obtained and analysed to answer the research questions (Asenahabi, 2019). Thus, it can be argued that a paradigm is a basic set of beliefs that guide action. Consequently, paradigms play a crucial role in the social sciences. Nevertheless, different researchers and authors such as Creswell and Creswell (2018) give different meanings to the concept of paradigm. While Creswell (2015) chose to use the term *worldview*, Abutabenjeh and Jaradat (2018) reserved their definition stating that there are still some issues of uncertainty due to the lack of clarity in literature about defining research design, research methods, and methodology in the social sciences.

According to Christiansen et al. (2010), there are four dominant research paradigms: interpretivist, positivist, post-positivist, and critical paradigms. For this research, I adopted an interpretive paradigm (cf. 1.9.1) on the premise that there is no single truth, and that the realities of the teachers must be discovered (Scotland, 2012; Kamal, 2019). Since reality is built socially, there is no single correct route or method or theory to acquire knowledge (Willis & Nilakanta, 2007; Kaushik & Walsh, 2019; Scotland, 2012). Kumatongo and Muzata (2021), and Williams (2020) assert that interpretivists presume that knowledge and meaning are consequences of interpretation, hence there is no finite knowledge which is independent of thinking and human reasoning. The interpretive paradigm is supported by observation and interpretation; thus, observing involves collecting information about events, while interpreting entails making-sense of that information by drawing conclusions or by judging the information and some abstract patterns. Greckhamer et al. (2018) acknowledge that this approach gives the research a greater opportunity to address issues of influence, and to ask questions such as *why* and *how* where technological trajectories are created and understanding of the context is acquired.

Greckhamer et al. (2018) note that the interpretive paradigm aims to understand phenomena through the meanings that people attach to them. Chen and Reeves (2020) affirm that the interpretive paradigm emphasises the need to situate analysis in context (Baskerville et al., 2018). It concerns understanding the world from the subjective experiences of individuals.

The interpretive paradigm intends and attempts to derive its constructs from the field through an in-depth examination of the phenomenon of interest. Interpretivists believe that reality is socially constructed and there are many intangible realities (Mertens, 2019). Reality is mind dependent and is a personal or social construct. It is how the researcher tries to make sense of the world around him/her. Reality is usually limited to context, space, time and individuals or groups in each situation and cannot be generalised into one common reality. Interpretivism is often described as having a contrasting epistemology to positivism (Cuthbertson et al., 2020). The contrast between the positivism and interpretivism is highlighted by Cohen et al. (2018) and Chandra and Shang (2019).

Additionally, interpretive researchers recommend a study that looks for insider viewpoints or real meanings of social phenomena from participants with a good social understanding (Wahyuni, 2012). In educational research, the term *paradigm* is used to describe a researcher's worldview (Singh, 2019). It is about evaluating and refining interpretive theories rather than generating a new theory. It should be noted that the interpretive paradigm is distinguished by its concern for the individual as its main attempt is to understand the subjective world of human experience to gain an understanding of a certain situation. This notion is reinforced by Crawford (2019), and Chandra and Shang (2019) whose interpretive research caters for the possibility of an investigator to come up with an interpretation of a typical case study and related conditions in which it has been investigated. Indeed, in this study, interpretations concerning primary school teachers' understandings of LFS were the main concern.

Usually, researchers base their work on certain philosophical perspectives; it may be based on a single or more paradigms, depending on the kind of study (Wahyuni, 2012). The essential elements of a research paradigm are ontology, epistemology, axiology, and methodology, which are rational speculations that form a fundamental platform for any investigation (Bryman, 2016; Kivunja & Kuyini, 2017; Al-Ababneh, 2020). The research paradigm is a tool to describe a worldview that is enlightened by philosophical beliefs about the nature of social reality known as ontology; that is, *what do we believe about the nature of reality*? Epistemology (ways of knowing) deals with *how do we know what we know*? Axiology (ethics and value

systems) refers to *what do we believe is true*? (Patton, 2002). According to Al-Ababneh (2020), philosophical understanding is important in social science research as it provides meaningful interpretation when there is clarity about decisions that are taken that affects the research. Similarly, Creswell and Poth (2018) inform us that the philosophical understanding and assumptions researchers bring into their research, shape the direction of their research.

4.2.1 Ontological Assumptions

Ontology is related to the assumptions we make to believe that something is real or makes sense (Scotland, 2012). It concerns our beliefs about the kind and nature of reality, and the social world. Ontology helps researchers to know how confident they know about nature and the existence of objects they are researching, and the nature of our beliefs about reality (Richards, 2003; Moon & Blackman, 2017). For Richards (2003), ontology consists of the beliefs that researchers hold on the nature of reality (Al-Ababneh, 2020; Kivunja & Kuyini, 2017). Many social realities exist due to the varied human experience, including people's knowledge, interpretations, experiences, and views (Yilmaz, 2013; Farghaly, 2018). Ontology explores the researcher's fundamental belief system about the nature of being and existence (Moon & Blackman, 2017).

There are multiple realities that can be explored and constructed through meaningful human interactions from which humans gain knowledge (Moon & Blackman, 2017). The multiple realities can also help to determine how teachers make-sense of their social worlds in natural settings regarding their daily routines, conversations, and writings while interacting with others around them. According to Cuthbertson et al. (2020), philosophical assumptions of the nature of reality are essential for understanding how meaning is made of the generated data. According to Slevitch (2011), reality is context-bound and therefore, it is continuously recreated by its participants based on their own understanding of it. Philosophical assumptions about the nature of reality are important in terms of how meaning is produced from collected data. Thus, it helps to provide an understanding of the objects and subjects that constitute the world (Kamal, 2019). Such assumptions help to situate the researcher's thinking about the research problem, its significance, how the researcher might approach it to answer the research questions, and understand the problem under investigation to contribute to its solution. Usually, one's ontological beliefs determine how one develops and understands the significance of research

questions to formulate an approach for data analysis (Moroi, 2020). For this study, both singular and multiple versions of truth were considered relevant (Mertens, 2019).

4.2.2 Epistemological Assumptions

In research, epistemology is used to describe how we know the truth or reality, what counts as knowledge in the world, and how it can be communicated to other human beings (Cooksey & McDonald, 2019; Farghaly, 2018). Epistemology originates from the Greek word *episteme,* which means knowledge, and *logos* which means theory (Kivunja & Kuyini, 2017). According to Yulianto (2021), epistemology is the investigation of the origin of knowledge, or its structure, methods and validity. Epistemology stresses the nature of human knowledge and its comprehension that enables the researcher to expand, broaden, and strengthen understanding in a particular field of research (Gall et al., 2003; Moon & Blackman, 2017). From an epistemological view, both objective and subjective truths linked to the phenomenon are generated through interactions with the participants (Cohen et al., 2018). Events are understood through the mental process of interpretation that is determined by interaction with social contexts.

Those active in the research process socially construct knowledge by experiencing real-life situations (Guba & Lincoln, 1994; Lincoln et al., 2011). Knowledge is socially constructed and is dependent on personal experience as truth lies within the human experience. Statements on what is true or false are culture-bound, historical, and context-dependent. The element of understanding is basic in qualitative research (Anyolo, 2015; Rehman & Alharthi, 2016). According to Bailey (2017), epistemology is the link between what is known and the knower (Al-Ab, 2020). Since epistemology reviews what is knowledge and the process of its acquisition through communicating with other human beings, it is a vital component for qualitative research (Cohen et al., 2018).

Schools have an official curriculum to incorporate LFS across all subjects, but there are many issues to consider in the implementation of the curriculum. The various activities occurring within a classroom are complex, but the context and interpretation of the situation must be considered as a priority. The epistemological belief that influenced this study was that a transactional and subjective relationship existed between the participants and me. The context in which the study was conducted was well-understood, and a ‘contract’ with the participants was established. Until the element of trust and mutual respect was established, appropriate data

could not be generated. Throughout the research process, I was required to make appropriate choices: what to observe, when to be involved with the participants, when to keep my distance, when to create opportunities for interaction, or when to not engage in discussions (Moon & Blackman, 2017). Moreover, I had to ascertain that my own beliefs were not influencing my interpretations and descriptions of the collected data, data recorded through document analysis, and notes from informal observations.

Creswell and Creswell (2018) state that during qualitative research based on epistemological assumptions, a researcher tries to get as close as possible to the participants in the study to gather subjective evidence (according to their personal views) as it favours a more personal and interactive mode of data collection. The inquirer and inquired-into are both interlocked in an active process of talking, listening, reading, and writing.

4.2.3 Axiological Assumptions

Axiology originates from the Greek; *axios* means 'to have value', and *logos* means 'theory' or 'reasoning' (Wahyuni, 2012; Maarouf, 2019). Axiology means a theory of desirable values or a theory of good and chosen values (Yulianto, 2021) as it incorporates ethics and aesthetics (Deane, 2018). Axiology refers to ethical issues that need to be considered when planning research (Kivunja & Kuyini, 2017). Constructivists and interpretivists assert that social inquiry is value-bound (Lincoln & Guba, 2016) and value-laden, and is influenced by the researcher's value system. This informs the paradigm that the researcher chooses for inquiry, the choice of the topic for the study, and the methods chosen to generate and analyse data (Given, 2008; Deane, 2018). Additionally, it informs how to interpret the findings, and the methods of reporting writing. It considers what value the researcher attributes to the different aspects of the research, the participants, the data, and the audience who will evaluate the results of the research included in the report (Creswell & Poth, 2018; Kivunja & Kuyini, 2017).

Therefore, the researcher should demonstrate exemplary ethical conduct by modelling what is right or wrong behaviour especially while the research is being conducted. This consideration is founded on the understanding that all humans have a fundamental right to make choices which should be respected by the researcher. My axiological stance during the research was ethical whilst generating qualitative data (Wahyuni, 2012; Maarouf, 2019). This implied that the data generation process involved a qualitative approach which entailed social interactions

through semi-structured interviews and pre- and post-lesson meetings. However, according to a study by Deane (2018), very often, axiology is overlooked by prioritising philosophical inquiry by interdisciplinary researchers.

4.3 RESEARCH APPROACH

When an investigation is undertaken, it is imperative to ascertain whether a qualitative, quantitative, or mixed methods approach is more suitable for the study (Moroi, 2021). The approach for this study was qualitative in nature (cf. 1.9.2) asit explored teachers' understandings and enhancement of LFS in Mauritian primary schools. Interpretive research methods suit such a type of research. For instance, through interviews, the researcher gained in-depth and rich insight into the ways people perceive their environment (Lee et al., 2020; Merriam & Tisdell, 2015). Qualitative research attempts to make-sense of or interpret phenomena in terms of the meaning people attach to them (Creswell, 2015; Denzin & Lincoln, 2021; Guba & Lincoln, 1994). It is inductive in nature and has several underlying assumptions since reality is a social construct (Rovai et al., 2014). This type of research lends itself to gaining a more holistic perspective on human perception, beliefs and ideas within their social context.

According to Domegan and Fleming (2007), and Creswell (2015), qualitative research aims to explore, discover, and understand the meaning of issues at hand because very little is known about it (Kamal, 2019). Ishtiaq (2019) points out that the selection of a research approach is based on the nature of the research problem, the researcher's experience, and the end product recipients of the study. Maarouf (2019) points out that the investigator and the phenomenon cannot be separated as the findings are mutually created within context through research, which proves that reality is contextual and ceases to exist when the study ceases (Kyngas, 2020).

Bleiker et al. (2019) contend that, unlike the quantitative methodology, qualitative research methodology depends more on language and interpretation of meaning; therefore, its data generation methods are likely to involve close human involvement which also necessitates a creative process of theory development (Creswell & Poth, 2018; Kamal, 2019). Considering the Mauritian school-context and the related questions posed during this study, this research was regarded as qualitative in nature since it aimed to reveal the practices of all individuals (Langkos, 2014). In support, Bailey et al. (2020) opine that qualitative research enables

researchers to survey people's complete experiences by utilising them in various investigative methods, including questioning and analysing them and their responses.

According to Creswell (2015), in qualitative research, the investigator should be au fait with the participants being interviewed and observed. This leads to individual data generation. The qualitative approach enables the researcher to comprehend the problems by investigating them in their own context, which allows for the meaning-making of information that the participants bring to the discourse (Denzin & Lincoln, 2021). For this study, the phenomenon of interest was teachers' understanding and enhancement of LFS, which elicited deep insights from participants; hence, a qualitative approach was the most appropriate. As such, this research essentially permitted me to gain significant insight into teachers' affirmations which I assessesd to make-sense of their understanding of LFS. Denzin and Lincoln (2021, p. 19-20) point out that "qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry". Human beings learn by interacting with others, and then give their interpretation of situations based on their experience. The qualitative interpretive dimension ensured that teachers' understanding of LFS in Mauritian primary schools was thoroughly investigated.

4.4 RESEARCH DESIGN

A research design focuses on the end product, and all the steps pursued in the process to achieve the desired outcome. It is viewed as the functional plan in which certain research methods and procedures are linked together to acquire a reliable and valid body of data for analysis, conclusions, and theory formulation (Dannels, 2018; Creswell & Creswell, 2018). The research design thus provided me with a clear research framework as it guided the methods, decisions and set the basis for interpretation (Asenahabi, 2019; Dannels, 2018). According to Allan (2020), Asenahabi, (2019) and Alam (2020), a research design is best described as a detailed plan according to which the respondents of a proposed study are selected, as well as the means of data generation. Analysis through studies shows that a research design approach can be convergent or divergent, and rests on the researcher being knowledgeable about the various research design approaches to be adopted in a study (Abutabenjeh & Jaradat, 2018).

The main methods commonly used in case study and multiple case study research are "observation, content analysis, and interviewing" (Borchardt & Gothlich, 2009; Swanborn, 2010, p. 74). According to Lamnek (2005), case studies allow for flexible techniques of data generation which can be open to the use of various research methods, and to a wide range of interpretative attempts. Borchardt and Gothlich (2009) highlight that data generation in case studies is not bound to any method, and that it should be modelled on the objective of the study. Hence, the method of data generation should consider the type of phenomenon being researched to successfully answer the research questions.

This research was situated in the context of a Mauritian primary school with a group of general-purpose primary school teachers who taught aspects of LFS. It endeavoured to answer *how* and *why* questions. A multiple case study was the most appropriate design (Creswell & Creswell, 2017; Yin, 2015) within a framework of participant-designed action research methodology (Frenzel, 2010; Sales et al., 2021). According to Frenzel (2010), the choice of a participant-designed action research methodology within a multiple case study design framework, was made in light of some of the major criticisms voiced against case studies; however, it was the best way to address the research objectives. Similarly, Sales et al. (2021) employed a participatory action research methodology which was framed in an intrinsic case study design to generate new scientific knowledge on a school's educational improvement to facilitate the democratisation process in Spain. Importantly, multiple case studies create a more convincing theory when the suggestions are more intensely grounded in empirical evidence (Gustafsson, 2017).

Additionally, a multiple case study can be both qualitative and quantitative (Mehrad & Zangeneh, 2019). In this study, qualitative approaches were more relevant than those of quantitative approaches in terms of providing rich insight and an in-depth understanding of the participants in relation to LFS (Lodico et al., 2010). A multiple case study research design allows the researcher to study specific cases such as the individuals, groups, or organisations such as schools to understand the differences and similarities between the cases (Yin, 2015; Baxter & Jack, 2008). Thus, it can provide existing literature with important and new information emanating from its differences and similarities (Vannoni, 2014; 2015). Moreover, multiple cases allow for a wider exploration of research questions and theoretical evolution (Eisenhardt & Graebner, 2007). Similarly, Rashid et al. (2019) view a research study as an examination of a specific phenomenon such as a programme, an event, a person, a process, an

institution, or a social group (Chowdhury & Shil, 2021; Shiddike & Rahman, 2020). In elaboration, Chowdhury et al. (2020) assert that it is a research method used in social science for social data generation as its aim is to understand human beings in a social context as it provides subjective rather than objective information.

Case studies and multiple case studies are descriptive and exploratory in nature and provide abundant longitudinal information about individuals or situations (Shiddike & Rahman, 2020; Yin, 2018). The process entails examining an occurrence where a single individual or a group of organisations are investigated in their own environment. In other words, they are specifically designed for the appraisal of an individual, a group, or a phenomenon (Rashid et al., 2019)

Additionally, a case study is defined by Alam (2020) as an inquiry that seeks a range of different evidence from the case settings to answer specific research questions. In this study, primary school teachers in one school were selected as participants and were used to explore the research questions (Naz et al., 2022). Moreover, a multiple case study provides a systematic way to generate data, analyse information, and report the results; thus allowing for the in-depth understanding of a particular problem or situation (Chowdhury & Shil, 2021; Shiddike & Rahman, 2020). It also provides a variety of participants' perspectives by using multiple data generation techniques thus allowing for interpreting a more coherent picture of a unique situation. Additionally, Cohen et al. (2018) state that multiple case studies are valuable to acquire a detailed understanding of a specific issue as it offers a high degree of flexibility and adaptability by permitting the adoption of a multitude of techniques to determine the perceptions of individuals.

However, case studies and multiple case studies are often criticised for relying on the researchers' interpretation as it can be biased, which leads to different meanings concerning the same issue under investigation. Also, the data generation and analysis processes may also be open to the researcher's bias (Shufutinsky, 2020; Lucas et al., 2018a; Asenahabi, 2019). Similarly, Lucas et al. (2018b) and Chowdhury et al. (2020) assert that a small number of participants under examination in these studies makes it unlikely that the findings can be generalised to a larger population when investigating similar issues or problems. In this study, the multiple case consisted of six general purpose primary school teachers who were interviewed to assess their understanding of LFS and how they enhanced LFS principles in their teaching. As an ethical researcher, it was a reality check that the integration of LFS in the local educational context was a challenging task.

4.5 DATA GENERATION PROCESSES

Williams and Moser (2019) and Creswell (2015), state that the data generation process entails a set of successive steps comprising of interconnected tasks that provide direction to evaluate responses and unearth answers in line with the research questions, aim, and objectives of the researcher (Goldkuhl, 2019). The data generation process is of an emergent nature, and the observation process assumes that all individuals who had expressed consent to participate in this study within the environment, were participants. To explore teachers' understanding and enhancement of LFS in Mauritian primary schools, several data generation methods were utilised in the study. After being informed of the names of the teachers, a request was made telephonically, inviting them to participate in this study. The data generation process was aligned to the sampling process such that the selection of the school as a research site and the participants were made.

Data generation was employed through semi-structured interviews, conversations, meetings, discussions, and classroom observations (Bryman, 2016) which were audio-recorded after having obtained consent from the participants. According to Verma (2021), audio-recording allows for authentic transcriptions rather than written notes. The audio recordings, which were later transcribed into text, were qualitatively analysed.

4.5.1 Selection of Participants (Sampling)

Sampling is the selection of a subset of persons or objects from a larger population intended to represent the population (Pandey & Pandey, 2021; Emmel, 2013; Wang & Cheng, 2020). Convenience sampling also termed judgement sampling (Bhardwaj, 2019; Lune & Berg, 2017) for this qualitative research was adopted for practical reasons (Wang & Cheng, 2020). I applied convenience sampling with respect to the school from where the participants were drawn. This specific type of non-probability sampling relied on data generation from population members who were accessible to the researcher (Cohen et al., 2018; Flick, 2014; Mohajan, 2018). This non-random method of sampling allowed me to select information-rich cases for study (Ames et al., 2019). Further, Cohen et al., (2018) suggest that the prime purpose of a qualitative study is the observation of tiny representatives nested in their context, and their in-depth study. This type of qualitative sampling is common where a researcher selects a sample from which the most can be learnt (Ames et al., 2019).

As Mauritius is a small island, schools are easily accessible. I wanted to discover, understand, and gain insights without difficulty, and therefore I selected a school which was easily accessible to make contact with participants from whom much could be learnt (Lune & Berg, 2017). In this instance, I already knew something about the specific group of people (Guetterman, 2015), so I conveniently selected six participants who were general-purpose teachers for my research. I only included the general-purpose teachers in this multiple case study as they met the criteria for selection which focused on obtaining rich information on the phenomenon under investigation, in addition to considerations of accessibility, time, and costs.

4.5.2 Profiling of the Research Site

There are three hundred and nineteen (319) primary schools, with eighty-five thousand seven hundred and thirty (85,730) learners as at March 2019 (Statistics Mauritius, 2020) in Mauritius, among which one primary school was selected for the present study. I conducted this study in the selected school as it provided me with the opportunity to investigate LFS in its real-life context by utilising numerous sources of evidence (Yin, 2018). I chose the school for a holistic in-depth analysis of the bounded phenomenon, LFS. This particular school had a population of eight hundred and ninety-one (891) learners with forty-two (42) teaching staff members. All targeted participants from the school for the research were general-purpose class teachers. As mentioned in section 4.5.1, my choice of the school was based on accessibility and practical reasons such as to maximise my use of time.

4.5.3 Selection, Recruitment, and Inclusion of Participants

A prerequisite to recruiting participants was that, as teachers, they should be interested in the outcomes of the study, and be willing participants. Creswell (2015) states that participants are chosen based on who can best help to understand the phenomenon. At the first attempt to recruit them, it would be wise to have a direct meeting with the participants to explain everything about the study. A presentation of at least fifteen (15) minutes was conducted to brief the participants on the aim, justification, and purpose of the study. This face-to-face meeting established a powerful relationship between me (as the researcher), and the participants such that all of them showed interest in the topic of the research.

This study involved an inquiry that yielded thick descriptions which delved deep into the project with a limited number of participants as described in the methodology (Shaw &

Holland, 2014). Six general-purpose teachers, including three teachers from the lower primary section and three teachers from upper primary section, allowed me to gain a broader perspective on what was being taught, and what impact LFS had on the learning process. This allowed me to generate data for each grade as these teachers teach learners of different age groups (6 to 11 years). So, at each grade level, different topics of sustainability were being introduced to learners. That is why, as a primary class teacher myself, I wished to explore and include other class teachers' understanding and their enhancement in their teaching regarding the phenomenon of LFS.

Furthermore, each grade was of mixed-ability where learners had different learning capacities, thus teachers also had to cater for the varied learners' capacities. Although generating data from non-class teachers (specialist teachers) could have also been eye-opening, the process would have become unwieldy and would have defeated the purpose of the uniqueness of a multiple case study. As teachers were selected based on accessibility and convenience, there was no discrimination between gender, years of experience, and grade level. Hence, the sampling was kept very open (Guetterman, 2015).

4.5.4 Researcher and the Research Participants' Roles

The selected general-purpose class teachers acted as my research participants (co-researchers), and my role was that of a non-participant observer. Table 4.1 below represents and justifies the teacher-participants' and researcher's role.

Table 4.1: Teacher and researcher roles

Research Participants (pseudonyms)	Roles	Justification
Class Teachers Rudilla Komal Sandia Vijay Ritika Nirma	**Co-researchers** Throughout the action research cycles teachers observed and determined their own understanding of LFS. **Planners and Designers** Planning and designing lessons, and intervention to develop the understanding and enhancement of LFS.	Teachers were aware of their learning and understanding during their practice so that they can implement them in their lessons. Teachers prepared their own lesson plans during their intervention, which included LFS content.

	Reflectors Continuously reflecting on lessons which they attempted to implement LFS. **Implementers** Teaching their lessons and conducting their interventions that they planned and designed. **Collaborators** Teachers discussed the type of intervention required during pre- and post-. intervention meetings, and the impact of the intervention on them and their understanding of LFS.	They were conscious about the different steps (for intervention) that they learnt during their own development. Teachers learnt and understood LFS through their own interventions, and enhanced them in their lessons. Teachers acted as co-Researchers, and collaborated to improve and change their interventions of LFS through planning and reflection.
Researcher Primary school teacher and PhD student at UKZN.	**Non-participant observer** I assumed the role of the interviewer before and after the interventions, as well as being the non-participant observer during the interventions.	Having an ethical stance such that I did not influence teachers' understanding and enhancement of LFS, but rather observed them during their lessons to identify their understandings and of LFS.

A phenomenon was identified by me that prompted this study; I recognised that several strategies and programmes were executed in classrooms based on research conducted on

teachers, but not by teachers. This study intended to include teachers in the design and execution process of their intervention during the action research. Teachers were granted the opportunity to plan, implement, observe, and reflect on their own understanding, development, and enhancement of LFS, and as such they embraced the role of co-researchers. Although teachers did not initiate the conducting of the action research on their understanding and enhancement of LFS, they expressed their interest to become involved in the study as they knew that it would benefit them in the long run. As a result, teachers felt empowered throughout the research process, especially when they noticed the transformations because of their own actions. This was in contrast to any result from any external imposition.

Regarding my role as a non-participant observer, I followed Babbie and Mouton's (2001) definition which described a non-participant observer as one who distinguishes a particular phenomenon without influencing the outcome (also known as an outsider role). Similarly, Henham et al. (2018) agrees that non-participant observation is a data generation method commonly used in case study and action research which aims to garner an understanding of events in their natural context, without participating directly in the activities being observed.

Connett (2020) states that lesson observation provides a way of identifying whether intention and practice are addressed during implementation in action research. McMillan and Scumacher (2010) concur that observation is a method for the non-participant researcher to listen and see what is occurring naturally in the research site. Also, Cohen et al. (2018) agree that the non-participant observer researcher has little contact with the participants during the research, in contrast to the complete participant researcher who is allowed a more informed view of the situation being observed. On the one hand, it is claimed that the researcher can influence the data generation during observation (Babbie & Mouton, 2001), on the other hand, Stake and Munson (2008) argue that even if non-participant observation risks subjectivity, lesson observation through non-participant observation can nonetheless produce authentic and valid data (Cohen et al., 2018).

Farrell and Weitman (2007) claim that few programmes and policies that are implemented because of research carried out by teachers in educational fields exist. This implies that research is usually conducted on teachers, rather than by teachers. In this context, being a non-participant observer implied that the action research of this study involved teachers in the formulation and implementation of their interests. Table 4.1 shows how teachers were granted the opportunity to follow and modify their ideas where required as they acted as planner, implementer, observer

and reflector which encompassed their overall role as co-researchers during this study. This feature validates the claim that teachers were participating in this study with a view to upgrade their knowledge on the phenomenon while constructing a new understanding of LFS that would benefit them along their teaching journeys.

Farrel and Weitman (2007) propose that teachers become equipped through research processes that promote change and transformation (McNiff, 2016). Hence, it was apparent that teachers become co-workers because of their commitment during the planning, observing, implementing, and reflection stages of the participant-designed action research processes. The conscious effort of teachers enhancing their understanding of LFS should be lauded and promoted to allow them to improve and transform their enhancement of LFS. My role as a non-participant observer ensured that the results of the investigation were not influenced by me as the research was conducted to capture teachers' understanding and enhancement of LFS, and not my own understanding of LFS.

4.5.5 Research Methodology

The research methodology guides how the research proceeds (Moroi, 2020; Antwi & Hamza, 2015). It refers to general approach in conducting the research project and focuses on the research process, and the kind of tools and procedures used (Yilmaz, 2013; Slevitch, 2011). To decide on a methodology, starts with selecting the research paradigm that guides the study. Interpretive research is useful for understanding individuals' experiences as the research is conducted in a natural setting such as participants' workplaces. It views the research through an interpretive perspective to understand human experiences and a multiplicity of realities (Greckhamer et al., 2018; Scotland, 2012; Cohen et al., 2018).

The methodological process is guided by the philosophical beliefs about the nature of reality, knowledge, and values including the theoretical framework that informs interpretation, comprehension, choice of literature, and research practice on a given topic (Kawulich, 2012; Moroi, 2020). The purpose of this study was to explore teachers' understanding and enhancement of LFS by applying a participant-designed action research intervention. This participant-designed action research is favoured by Farrell and Weitman (2007) who claim that not only the researcher is the one who has a vested interest in the investigation, but also the participants who act as collaborators.

Ponciano (2013) maintains that participant-designed action research removes the filter of the researcher and provides the space for the participants to speak for themselves during self-reflections. Similarly, McNiff (2016) states that collaboration through a participant-designed action research has benefits: the participants gain insights, learn and promote self-development during their involvement in the research, and they are at liberty to deliberate, express, create and take ownership of the process and its results (Hyysalo et al., 2019). Bowen and O'Doherty (2014) also acknowledge that during a participant-designed action research, participants embrace their leadership role rather than confining them to narrow roles as data collection sources. This action research created an opportunity for contemplative practice regarding the understanding and enhancement of LFS. Lewin (1946, p. 35) referred to action research as:

> ...relative research on the states and effects of numerous forms of social action involving a spiral of steps composed of a circle of planning, action and fact-finding about the result.

Greenwood and Levin's (2007) definition of action research refer to research that is conducted by one or more experts involving people in a common field or an organisation, to create a change of the context in which people exist or work (Hersted et al., 2019). The transformation leads to a more functional environment in their living or work settings (Greenwood & Levin, 2007; Ness & Heimburg, 2020; McNiff, 2016; Bartels et al., 2020). Lewin's (1946) and Greenwood and Levin's (2007) definitions of action research were adopted in this study as they acknowledged the impact of reflective practice and social interaction on transformation. Altrichter et al. (2021) defines action research as an activity that mostly aims to expand abilities and achieve liberation through collaborative processes executed by those with a shared concern (Bradbury et al., 2019; Reason & Bradbury, 2008). Objectives cannot be pre-established when the context, experience, and action are continually being amended and developed. This dynamic gives researchers more width and responsibility (McNiff, 2016; Bartels et al., 2020). It is through this understanding of action research that a holistic view of it was conveyed in this study.

Greenwood and Levin's (2007) definition of action research highlights five main characteristics. The first characteristic concerned a mode of study described by its context and provide remedies to problems that exist within that specific context. Secondly, it is a mode of

reflective inquiry which allows and requires participation and input from participants participating in the study. Thirdly, it also values the variety of skills and experiences present within the participants as it assures further meaningful action-taking processes. Fourth, according to Greenwood and Levin (2007) it fosters interest regarding participants' ability to act. Moreover, it is not only the taking of action that is beneficial for the participants, it is mainly through reflecting on actions that participants of the inquiry process develop new meanings (Greenwood & Levin, 2007). Moreover, the validity factor is measured by its ability to produce solutions to the problems, and develop participants so that they can deal successfully with intricate situations.

According to Elliot (1991) and Altrichter et al. (2021), action research improves one's practice and develops knowledge (Hersted et al., 2019). It enables researchers to develop a systematic, inquiring approach towards their own practice that engenders positive change in their quest for best practice (Holter & Frabutt, 2012; Bradbury, Lewis & Embury, 2019). In this study, participants' understanding and enhancement of LFS were observed by utilising the action research methodology.

4.5.6 Action Research Cycle Structure and Research Methodology

Action research is intended for teacher-researchers, school administration, and other relevant stakeholders from teaching and learning environments (Bradbury et al., 2019; Penuel et al., 2020). According to McTaggart (1994), action research in education is a process of studying a school situation to understand and improve the standard of the education process (Wallen & Tormey, 2019). Further, it provides teachers with new knowledge and understanding on how to improve their practice (Messikh, 2020; Mertler, 2019). Bradbury et al. (2019) suggest that in education, the main goal of action research is to discover strategies to enhance learning for learners, but at the same time enhance learning for teachers.

According to Hendricks (2019), action research helps teachers intellectually expand by gaining new knowledge, encouraging reflective teaching and thinking, broadening teachers' pedagogical repertoire, and reinforceing the link between teachers' practice and learners' achievement. Johnson and Guzman (2012), and Villacanas de Castro and Banegas (2020) agree that action research bridges the gap between research and practice by providing teachers with necessary knowledge, skills, and focus to engage in meaningful inquiry to enhance their

practice and engender positive changes. In this study, the methodological characteristic of an 'insider' action research led by the participants who designed their interventions was effective. Since participants were at the centre of the situation being investigated, attempting to develop and improve their practice by understanding and enhancing LFS to precipitate positive changes, would be advantageous (Webster-Deakin, 2020).

The action research cycle (ARC) of this study is adapted from Lewin's (1948) and Coghlan and Brannick's (2003) model of action research methodology. Lewin's (1948) model begins by exploring a concept or idea which can be achieved via the step of **planning** where the teachers recognise their limited knowledge about the concept or context to be investigated, which leads to designing a plan that attains the desired outcome. Lewin's second step of **action** requires enacting the set plan. The third step of **observation** involves noticing how teachers developed their understanding of LFS, and how they applied this understanding to enhance their teaching practice. Lastly, **reflection** on the action taken results in a new cycle which may necessitate replanning to improve the action. Hence, the cycle involved four steps of planning-action-observation-reflection (Coghlan & Brannick, 2003).

In addition, teachers were conscientised to reflect upon these steps continuously while engaging in them. Consequently, these steps were not linear steps. Each step was informed by reflective thinking that involved periods of reflection-in-action, reflection-on-action, and reflection-for-action. Figure 4.1 below is an adapted, merged version of Lewin's (1946) and Coghlan and Brannick's (2003) models of action research which guided this research.

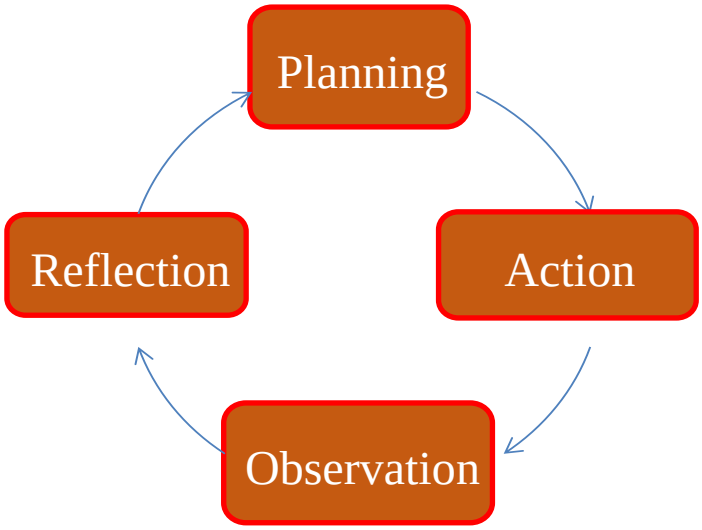

Figure 4.1: Action Research Cycle (Adapted: Lewin,1946; Coghlan & Brannick, 2003)

The intention of the **planning step,** which is also known as the pre-intervention phase, was to establish teachers' foundational understanding of LFS before the intervention phase. The first research question on teachers' understanding of LFS was partly answered by the data generated through the first step of the cycle.

The **action and observation steps** involved an intervention designed by the teachers themselves which is referred to as the 'intervention phase'. These steps aimed to observe how teachers developed their understandings of LFS and enhanced them in their teaching practice by observing *what* and *how* teachers exhibited innovative practices in their lesson presentation. Data was generated during these steps using data generation tools that were relevant for the intervention phase. The generated data assisted in answering the second and third research questions.

The **reflection step,** referred to as the 'post-intervention phase', was intended to establish the teachers' understanding and enhancement of LFS after the intervention cycle. This analysis of teachers' understanding and enhancement of LFS served to determine if teachers developed or progressed from their foundational understanding of LFS. The data generated in this step served to answer the first research question. In addition, data generated from the planning phase through to the reflection steps also (jointly) served to answer the first research question. Figure 4.2 below illustrates the different steps and intervention phases of the cycle of action research.

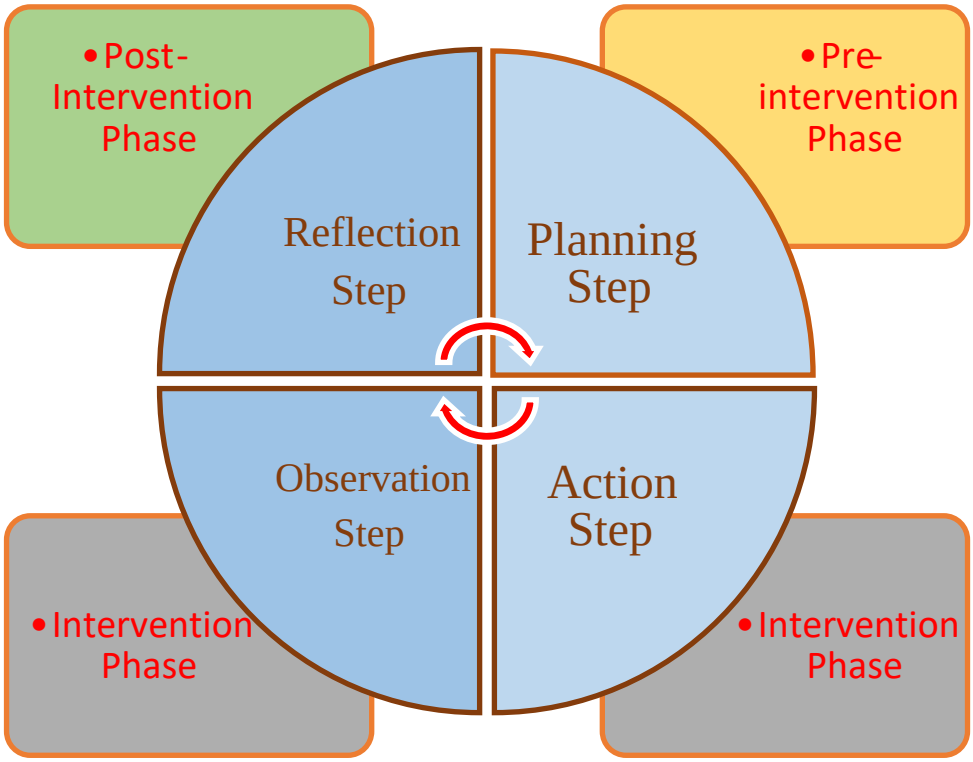

Figure 4.2*:* Action Research Cycle - steps and phases (by the researcher)

4.5.7 Data Generation Methods and Instruments

After being informed of the names of the possible teacher-participants, invitations through telephone calls were sent out to ascertain their participation in this study. Various techniques and instruments were utilised, especially during the steps of the action research cycle. The methods and instruments used were outlined and motivated by specifying the kind of data they were designed to generate. This was to ensure that the research questions were answered as planned. Thus, the data generation methods were organised to demonstrate the relevant data generation methods used to answer each research question.

4.5.8 Pilot Interview

A pilot study is a small-scale research project conducted before the final full-scale study (Ismail et al., 2018). It is a useful and important step towards conducting qualitative research successfully as it provides an essential opportunity to test the proposed pre-planned questions (Gani et al., 2020) to anticipate (and amend) possible glitches in the actual interview (Cohen et al., 2018). Although pilot studies are often conducted to assess the effectiveness of research instruments for use in qualitative research projects, few publications have employed empirical

findings related to such studies (Mlmqvist et al., 2019). For this study, I conducted a pilot interview with a colleague from another school which provided me with new ideas that had not been predicted prior to implementing the processes of the study. The importance of piloting is highlighted by Castillo-Montoya (2016) who mentions that piloting reinforced the interview protocols (Majid et al., 2017). Through piloting, flaws and limitations were also exposed in the interview schedule, and this led to modifications being made for the main study.

4.5.9 Designing Data Generation Methods and Instruments for Each Step

The data generating methods and instruments appropriate for answering the research questions and meeting the research objectives were designed so that they could be used to generate in-depth and relevant data. In Table 4.2 below, a summary of the data generation methods and instruments are provided to illustrate how they were used for answering research questions according to their purpose.

Table 4.2: Summary of the data generation methods and instruments

Cycle steps	Methods	Instruments	Research questions
Planning steps (Pre-intervention phase)	Semi-structured interview	Interview schedule	Explore teachers' understandings and enhancement of LFS. RQ1 is partly answered.
	Document analysis	Lesson plans	Identify LFS contents and concepts for lesson implementation. RQ1 is answered.
Action & Observation steps (Intervention phase)	Classroom observation	Observation schedule & reflective journals	Conscious reflections on teachers' understanding of LFS and how they shape their enhancement. RQ2 is partially answered.

Reflection steps (Post-intervention phase)	Post-lesson meeting and conversation	Questioning	Explore teachers' understanding and how they shape their enhancement through new knowledge construction. RQ2 is answered fully.
	Document analysis	Reflective journals	Existing and new understanding of LFS to partly answer RQ3 on why they enhance LFS the way they do.
	Post-intervention final interview	Interview schedule	New knowledge of understanding and enhancement of LFS through their reflections. RQ1 and RQ3 are answered fully

4.5.9.1 Pre-lesson interview

The pre-lesson interview involved the first phase of data generation (the planning step) where teachers were interviewed to inquire about their level of understanding of LFS by using the first method which was the semi-structured interview guided by the interview schedule. Cohen et al. (2018) describe semi-structured interviews as a method of asking several structured questions, and then probing with open-ended questions to gain further information (Young et al., 2018). I considered semi-structured interviews as the most convenient form of interviewing in the planning and reflection phases, because it is a method consistent with exploring teachers' initial and new understanding of LFS while focusing on how they enhanced them in their practice. Interviews consisted of a series of open-ended questions planned and based on the topic areas I desired to cover (Muzari et al., 2022). Teachers' responses were captured through an audio-recorder. This pre-lesson interview generated rich data that assisted in clarifying teachers' understandings of LFS. Additionally, the interview informed me to identify any

development of their understanding of LFS. Semi-structured interviews during the reflection step aided to probe teachers' understanding while simultaneously determining how they enhanced their understanding of LFS in their teachings. This instrument partly answered the first research question.

4.5.9.2 Analysing lesson plans

This entailed the second part of generating data through document analysis during the **planning step** where teachers were asked to design a lesson in which they incorporated features of LFS into the subject content. Their planning documents and lesson activities were analysed. Document analysis was used for identification of LFS contents within the activities designed by the teachers themselves for the lessons they prepared and implemented in their classes. According to Muzari et al. (2022), document analysis refers to text, books, newspapers, official documents, music, lyrics, photographs and artefacts (Cohen et al., 2018). This instrument which answered the first and second research questions, was also applied during the reflection steps.

4.5.9.3 Lesson observation

This third method of data generation was enacted during the intervention phases (action and observation stages) of the action research cycle. During classroom observations, each lesson was audio-recorded, and any material brought to the session was noted. Further, the tools used during the intervention phases were the observation schedule (Cunningham et al., 2020) supported by the audio-recorder. Teachers could listen to the recordings to reflect upon their 'action' lesson. Important features were recorded in my observation schedule as a non-participant observer. Post-lesson observation notes were completed once classroom observation was executed. Observation notes were an essential component of identification and synthesis in this qualitative study (Maharaj, 2015). Cohen et al. (2018) explain that this enables the researcher to monitor the process of data generation and begin to analyse the information. Early data collection and analysis allowed me to direct data generation in a fruitful manner as it is an intentional, systematic, and selective way of listening to and watching the interaction of phenomenon (Denzin & Lincoln, 2021). Teachers provided their conscious reflections on their understanding of LFS during their lesson presentation. It was also predicted that new and unexpected themes would emerge, and these were recorded in the observation schedule. Classroom observations therefore answered the second research question.

4.5.9.4 Post-lesson meeting

The fourth part of data generation was completed by using the fourth method of **meeting and conversation** during the reflection step when teachers indulged themselves in reflective processes. This assisted me in initiating the planning step for a new ARC, if the need arose. The meeting during the reflection step was very similar to the first one during the planning step. Once again, questioning proceeded to inquire further about teachers' understanding of LFS, and if this time they reached new understandings, and whether they executed them into their teaching practice. They were also questioned about how they enhanced their understandings in the lesson they had just delivered. Audio-recordings were provided to the teachers to listen to their lessons. This provided both me and the participants with valuable information on teachers' own understandings, and any newly developed understanding of LFS. This interview helped teachers to plan for the next ARC if their enhancement was found to be incomplete. This fully answered the second research question.

A reflective journal was also kept by teachers in which regular entries regarding their existing and new understandings were noted. The reflective journals were analysed using the fifth method of **document analysis**. Any difficulty, experience, limitation, and success were also noted by the participants. This type of reflection served as a 'companion' for the action research journey, both for me and the participants as it promoted reflective practice by motivating teachers to record personal experiences, observations, thoughts, and actions over time. In concurrence, Roller (2019) maintains that data from reflective journals can be a valuable instrument for the critical analysis of events during lesson delivery to construct meaning of and to refine experiences for any new ARC (Meyer & Willis, 2019). Lastly, it encourages active knowledge development for the researcher and the participants. It partly answered the third research question.

4.5.9.5 Post-lesson final interview

A final interview with teachers in the **reflection step** was conducted as the sixth method of data generation through questioning which intended to provide answers to the third research question; namely, why they enhanced LFS the way they did. This post-lesson interview acted as a rounding-up session to the research study as it generated data regarding teachers' experiences during the whole action research process. Lastly, the final interview served to validate data already collected by adding further understandings to the reflective journal entries,

thus assuring that data was correctly analysed and interpreted, which answered the third research question.

4.6 DATA ANALYSIS

During a qualitative study, researchers aim to generate data by corresponding or interacting directly with the phenomenon under study. Data analysis involves drawing of inferences from raw data (Wahyuni, 2012). Raw data, after collection, needs to be managed to be ready for analysis. According to Davies (2018) and Cohen et al. (2018), data analysis means dismantling, segmenting, and reassembling data to extract meaningful findings to draw conclusions. This process of data analysis enables the researcher to make-sense of the rich data that is generated. Mohajan (2018) views qualitative research data analysis as organising and interrogating data in ways that allow researchers to see patterns, identify themes, discover relationships, develop explanations, make interpretations, critique, and generate theories. It further helps to report what has been observed, uncover the meaning thereof, and understand the phenomenon. Data analysis is an interpretive process that intends to dissect qualitative data for symbolic and meaningful purposes (Creswell, 2015).

In this study, data generated from classroom observations was closely related because of its naturalistic essence, while data collected from semi-structured interviews was rich and interrelated due to my cordial disposition that instilled confidence and removed inhibitions in participants, especially during questioning and discussions. Constant comparative analysis was used to examine the conversations after transcription to determine which themes needed more exploration. This strategy involved collating statements from the interviews, and classifying and comparing them with other interviews. The data generated through reflective journals was also closely related due to the explanatory, descriptive, and documentory nature. Since qualitative data analysis seeks to reduce and make-sense of large amounts of information (Ravindran, 2019), the data obtained through individual interviews were indexed using pre-defined themes, while new themes were added when required. The themes were then grouped into common, salient, and significant themes to shed light to answer the research questions (Yin, 2018; Akinyode & Khan, 2018).

Thematic analysis was applied to distinguish the reiterated messages that pervaded the data sets. This form of inductive analysis induces findings to emerge out of the data through

interactions with the data. Scharp and Sanders (2019) describe thematic analysis as a qualitative method to identify, analyse, and report patterns within a data corpus. The categorisation and interpretation of data in terms of common themes which occurred, were later synthesised and generalised into an overall portrait of the constructed case (Braun & Clarke, 2006). In qualitative analysis, the researcher needs to create or adapt concepts relevant to the data, instead of imposing a set of pre-established rules. Therefore, consistent with the qualitative, interpretive methodological framework adopted in the study, themes emerged naturally from the data rather than being pre-specified (Scharp & Sanders, 2019). Themes, which are defined as salient characteristic features of a case, give rise to new themes that were not anticipated at the beginning of the study, but would emerge during the data analysis process.

4.6.1 Data Reduction Strategies

All responses to the interview questions by the participants were audio-recorded (with the permission of the participants) to capture their points of view. The audio-recorded interviews were thereafter transcribed verbatim into a hard copy, then coded (Ravindran, 2019) and categorised for common and emergent overarching themes (Nowell et al., 2017).

4.6.2 Data Coding Process

Data coding enables generated data to be assembled, categorised, and thematically sorted to provide a platform for meaning-construction (Williams & Moser, 2019). It employs a process which is a key structural operation in qualitative research which reveals themes that are interwined in the data. The first steps followed describe transcribing the interviews verbatim before analysis, and reading the interview questions and responses repetitively to get a better understanding of what participants were expressing. Secondly, I listened to both the spoken and unspoken implications in the participants' responses. After the initial reading of the transcripts, the uncoded transcripts were transposed into a chunky format, and attached responses by the participant were grouped together to develop a code per response. A second coding over the first coding was done as a cross-validation exercise to further condense and distil the participants' responses in a meaningful and interpretive format. The third stage allowed me to condense each line of the second cycle of coding down to a few words that fully encapsulated and accurately represented the core meaning behind each response of the participants.

4.7 TRUSTWORTHINESS

Unlike quantitative researchers that apply statistical methods for establishing validity and reliability of research findings, qualitative researchers intend to design and integrate methodological strategies to ensure the findings' validity or trustworthiness (Denzin & Lincoln, 2021). The strategies include accounting for personal biases which may have influenced findings, recognising biases in sampling, and ongoing critical reflection of methods to guarantee enough depth and significance of data generation and analysis. These include conscientious and meticulous record-keeping, evidence of a clear audit trail, and ensuring the consistency and transparency of the interpretation of the data. The establishment of a comparison case, seeking out similarities and differences across accounts, is also done to ensure that different perspectives are represented.

Participants in each case were general-purpose class teachers from the selected school. The observation process allowed for the generation of data involving different stages of the activity conducted at the setting. The use of different methods to generate information was also beneficial to produce a more extensive set of findings. Independent colleagues showing interest in the research findings were asked to analyse the data to determine whether similar conclusions in terms of themes and contents were reached (Muzari et al., 2022). Lastly, trustworthiness was achieved by devoting sufficient time in the field with the participants (Lune & Berg, 2017) which produced rich descriptions such that interested readers can relate to the research.

4.8 ETHICAL CONSIDERATIONS

The inclusion and consideration of ethics in research is currently more than ever emphasised in educational research. "The awareness, focusing chiefly, but by no means exclusively, on the subject matter and methods of research in so far as they affect the participants, is reflected in the growth of relevant literature and in the appearance of regulatory codes of research practice planned by various professional bodies" (Cohen et al., 2018). Ethical issues are crucial in research since people have moral and legitimate human rights to privacy and protection from harm (Walliman, 2005; Lune & Berg, 2017).

Cohen et al. (2018) describe ethics as a collection of moral concepts acceptable to most people which determines the best possible code of conduct by setting rules to be adopted by the

researcher towards the respondents. These rules of conduct are also favoured by Cohen et al. (2018) who emphasise that ethical considerations should encompass all aspects of respect; namely, dignity of people, authentic knowledge, democratic values, and high quality of research (Muzari et al., 2022). Extensive consideration was afforded to ethical obligations during the period of this study; for example, the participants were assigned a pseudonym to protect their identities, while confidentiality was assured on all information that they provided.

The issues that were addressed led to information extracted from semi-structured interviews, classroom observations, and post-lesson final interviews with the teachers only after being granted ethical clearance from the UKZN Ethics Committee (Appendix B) and the MoETEST (Appendix A). This implied that the consent and collaboration of the gatekeepers were required to access data (and the research site) from individuals prior to commencing the research (Cohen et al., 2018). Also, according to Muzari et al. (2022), if a researcher justifies the necessity for gathering and identifying further information after the study has been concluded, safeguards must be installed to protect such information as well as the identities of individuals who volunteered the information. Additionally, it was clearly stated in the consent letter that participation was voluntary and that a participant may withdraw from the research process at any time without any being penalised in any way.

No harm was done to participants considering my cordial approach; for example, I created a harmonious research environment to generate data. During the interview when I sensed that a question cause discomfort to the participant, I reformulated it, or did not force the participant to answer it as I respected the rights of all individuals (Briggs et al., 2012). According to Clough and Nutbrown (2012), the researcher also ensures that the identities of all participants remained unknown and that the information they provide remains confidential. In this regard, all information was stored in a password-protected electronic file (pendrive), only to be accessed by the researcher and his supervisor. All recordings and hardcopies were stored securely in a lock-up safe in the office of the researcher. All anonymity and confidentiality procedures were observed in line with advice proffered by Sullivan and Sargeant (2011) and Fraenkel et al. (2011). Once transcriptions were completed, the audio-recordings were erased. Furthermore, after five years, all data sources will be shredded (UKZN protocol). The researcher will delete any identifiable names that could be traced back to the participants from any reports and/or findings. Feedback was provided to the research participants verbally during one-to-one meetings. Lastly, any individual interested in perusing the final reseach report because of a

desire to understand aspects of the study, including other researchers in the field, was welcome to request for a copy of the report.

4.9 CONCLUSION

This chapter (4) discussed the research design and methodology. The interpretive qualitative multiple case study aimed at primary school teachers' understanding and enhancement of LFS. The interpretive paradigm used in the study, enabled the participants to become change agents in LFS through collaboration and co-creation by utilising participant-designed action research. During this study, the participants comprising of six general-purpose class teachers from lower and upper primary sections of a Mauritian school, were chosen through a convenience sampling method. Both purposive and convenience sampling were applied. The context in which data generation and selection of participants were also described. Data was generated by using different research tools in this participant-designed action research. Also explained in this chapter were the planning-action-observation-reflection steps. The appropriateness of the different instruments to generate data to answer the research questions was also outlined. Ethical issues were articulated with special reference to informed consent, confidentiality, anonymity, risk, and voluntary participation. The following chapter (5) explored and analysed the six participants' understanding and enhancement of LFS during cycle one of the action research.

CHAPTER FIVE

FINDINGS, AND INTERPRETATION, DISCUSSION,

CYCLE ONE

5.1 INTRODUCTION

In the previous chapter (4), the multiple case study research design and participant-designed action research methodologies were discussed. This chapter (5) presented and interpreted the data generated during cycle one of the action research. As mentioned in chapter four, each cycle was devised according to the planning-action-observation-reflection steps of the action research. These steps for each ARC constituted different sessions of data generation which served to explore and provide insights on participants' level of understanding and enhancement of LFS. This also informed the researcher to identify any progress in the development of participants' understanding of LFS. The semi-structured interviews produced data that informed the study about teachers' initial understanding of LFS before the action research took place. Further analysis of the data produced through the lesson-planning exercise provided additional enlightenment about how teachers intended to address and enhance their understanding of LFS at school. Data generated through the above steps were analysed in line with the conceptual and theoretical frameworks mentioned in chapters two and three.

5.2 PROFILING THE PARTICIPANTS

Before examining the conceptions and related issues of this study, this section provided a brief description of the backgrounds of the six selected teacher-participants to illuminate each participants' character and history of teaching. As mentioned in chapter four, anonymity and confidentiality were provided to safeguard all participants' identities and information (Sullivan & Sargeant, 2011; Fraenkel et al., 2011). Accordingly, the real names of participants were not used, but pseudonyms were assigned to each one.

Rudilla

Rudilla is a female teacher who joined the teaching profession in 2020, and it was her first posting as a fully-fledged teacher at school. She was responsible for a Grade 1 class as a

general-purpose teacher. She joined the MoETEST in January 2018 and attended teacher-training from 2018 to 2020 at the MIE, a tertiary institution for teacher-education where she completed her Primary Teachers' Diploma course. Before becoming a teacher, she completed a bachelor's degree with specialisation in minor law from the UoM. Rudilla, even though a novice teacher, displayed a lot of dedication and passion towards teaching her learners. She wanted to translate the care for her Grade 1 learners into action.

Komal

Komal, a female Grade 2 teacher, had twenty (20) years of teaching experience in primary education. Before joining the education sector, she worked for more than five years at a non-governmental organisation (NGO) that managed a specialised school for disabled learners. After joining the Government primary sector, she completed her teacher's certificate at the MIE. Later, she completed her Diploma in Educational Management. By her own admission, she had never heard of the term *sustainability*, and she was unaware on any issues regarding LFS.

Sandia

Sandia had been teaching in her school for five years at the time. The year 2021 was her last year of service at the school. She started her career after completing secondary school education, by joining the MoETEST. At the MIE, she completed her Primary Teacher's Diploma and was deployed to the school for the first time. Although, Sandia had been a fully-fledged teacher for over five (5) years, during our interview she did not show much concern for LFS as she was unaware that it existed. Nevertheless, she showed great concern regarding discipline and cleanliness in her class and school. Her class had a green corner, and was well-equipped with various teaching aids. This reflected her enthusiasm for teaching and learning at the school. Sandia was also very much involved in school projects such as cleanliness campaigns, maintaining discipline in the school grounds during breaks, and participating in Parent Teacher Association (PTA) meetings.

Vijay

Vijay was the only senior male teacher who participated in this study. He was the responsible teacher for Grade 4. Vijay has over twenty-five (25) years of teaching experience in primary education. It was his fourth year at this school. He joined MoETEST after completing his

secondary education but later enrolled at the MIE for teacher-training. After passing in-service courses, he obtained a Diploma in Educational Management from the MIE, and a bachelor's degree in primary education from OUM. He was a dedicated teacher who worked in upper primary classes to produce many laureates. Moreover, he possessed extensive knowledge of science subjects as he studied science at upper secondary school level and claimed that he had a sound knowledge of LFS. His Science and History/Geography classes were lively as he employed various types of teaching aids and strategies. Learners were very enthusiastic and enjoyed being part of Vijay's class.

Ritika

Another female teacher, Ritika, had eleven years of teaching experience. This school was her second posting. After completing secondary school education, she worked at an establishment as an officer. Her enthusiasm for the teaching profession allowed her to gravitate to a teaching career. After her stint at the MoETEST, she enrolled at the MIE where completed her Teacher's Diploma. During her first posting, she did not get an opportunity to teach in the higher primary section. At the time of this study, she was teaching Grade 5 for the first time in her career. Ritika showed great passion towards the profession and her learners as she was involved in nearly all the school's projects. She always allowed her learners to participate in extracurricular activities organised at school. However, she admitted that she had much to learn in science subjects and sustainability topics since she was barely aware of LFS. Hence, she was inspired to transmit new knowledge for the benefit of her learners and society.

Nirma

Nirma was a senior teacher responsible for Grade 6. She held a Teacher's Certificate from the MIE. She joined the teaching profession about twenty years ago. Nirma, who was at her fifth school since she started her career, was a dedicated and knowledgeable teacher regarding the subjects she taught. Also, she had been influential in forging an educational path for many of her learners during her career. In relation to this study, she exhibited enthusiasm for learning about sustainability teaching. Although she acknowledged that she knew very little on the subject matter of sustainability, she saw that participation in this study would be an eye-opener and an opportunity for her to learn more about it.

5.3 MEETING THE PARTICIPANTS

It was difficult for me to gather all the teachers for a general meeting at the school since they were class teachers responsible for their respective classes, and the management of the school did not grant me permission to organise a group meeting. I had to go personally to each of my selected participant's classroom to explain the purpose, objectives, and finer details of my research. I had selected six teachers who agreed to participate in the study from each section of the primary level. Being a class teacher myself, I had no difficulty to establish a friendly but professional relationship with them. During the meeting, I had to give the teachers the opportunity to communicate their understanding of LFS. Furthermore, I provided them with a detailed plan of my study in line with the different steps of the action research cycles, together with the details of the intended different interviews including the reflection processes. The informed consent forms were provided, explained in detail, signed, and collected after clarifications were made to obviate any ambiguities and misunderstandings.

These one-to-one meetings aimed to create a co-working partnership between myself as the researcher, and the participants. All selected participants agreed voluntarily to form part of the study, and promised to contribute to the common goal. The meeting also intended to offer the possibility to share our knowledge and understanding of LFS in the research's context. Lastly, it aimed at preparing and 'planning' around how each participant intended to develop his/her understanding and enhancement of LFS. It was clarified that participants were going to be the actors of the participant-designed action research, and that I would be an observer (etic stance) during the action and observation steps.

5.3.1 Developing an Understanding of Action Research

Only two of the participants possessed a bachelor's degree, with only one in the education field. The participants were not accustomed to any type of research, including action research. At first, I had to explain in detail what comprised an action research, in addition to providing a brief plan of my study including the description of the different steps.

For example, Sandia who was very enthusiastic about gaining and developing new knowledge from this study, was unaware of research procedures in the education field, so she really wanted to be a part of the study. Her views are articulated below:

Sandia: *Frankly speaking, I did not know that there exists such type of research in education. In fact, I have never heard of an action research but would really want to know more about it so that I can participate appropriately in your study.*

The teachers expressed their fear that they would not be able to give their full support in the study due to their ignorance about the LFS subject matter, and the action research process. Since they were not acquainted with the topic, they were not confident about contributing positively to the action research. I had to give them a brief description of what action research is about, and the different steps involved in its implementation. The different steps and cycles involved in the action research were also explained extensively. Furthermore, primary school learners being young, cannot comprehend the term LFS so teachers thought that it would not be appropriate to include them in the research. Their comments follow:

Rudilla*: ...my learners are too young. As I said it depends on the topic or area of study which I am teaching to them.*

Sandia: *Learners are young and they do not have the high level of maturity to understand things in the way they do.*

Vijay: *I think I must adapt my lessons accordingly to the level of my learners, and I have to choose things that are easier for them to better understand the lessons.*

Nirma: *I can introduce the word LFS to my learners, but then I can use words and expressions which are much easier and simpler to explain LFS, as learners have different ways of thinking.*

Ultimately, they agreed that LFS is not perceived to be new, but that it actually forms part of the NCF of the MoETEST. They concluded that explaining LFS was about giving learners something that they would take with them into the future to create a better society that is conscious to preserve its environment, society and economy.

5.3.2 The Pre-lesson Meeting before the Action

The teachers were well-prepared for the steps of the action research due to consistent engagement before it commenced. The conducting of semi-structured interviews was a crucial step in expanding teacher-participants' understanding and enhancement of LFS. In fact, frequent meetings with the participants familiarised them with the study's processes which became more visible in subsequent meetings.

From the first meeting, some teachers had read articles related to this study so that I would not be discouraged if something did not go according to plan during the action and observation steps. I asked the teachers to prepare their first lesson plan for the first cycle of the action research, and to select a topic which they thought their learners and themselves would be familiar with. Sandia commented that during her free periods at school she engaged in conversations with her fellow-participants regarding the steps that needed to be followed for the smooth running of the study. They required clarification on whether they could only include science subjects for their lesson plans, or if they could include other subjects in a cross-curricular exercise. I explained clearly to them that my position in the research was that of an 'etic one', as I would act only as a non-participant observer throughout the duration of the lesson in the implementation phase of the action research. This was based on Babbie and Mouton's (2001) view that a non-participant observer is one who observes a phenomenon without participating in the activity (known as an 'outsider researcher'). Henham et al. (2018) add that non-participant observation is a data generation method commonly used in case study and action research which looks at the understanding of events and behaviours in their natural context without participating directly in the activities. So, I had to refrain from influencing their choice of subject, and how they implemented their plans. The participants were free to choose the any subject and topic to prepare their lessons for the action step.

In so doing, I felt this was the best decision as it displayed teachers' creativity in exploring their own ideas for planning and implementing their lessons. They were free to include as many teaching strategies and methods as possible to foster engagement with learners, encourage interactions, and promote learner-centredness. The use of technology such as interactive white boards and overhead projectors (among others) were also considered in disseminating knowledge to their learners.

Furthermore, the teachers were requested to write down their reflections in a reflective journal after they had delivered their lessons in the first cycle. The reflective journals were also to be utilised for entries regarding participants' existing and modified understandings of LFS. Any challenges, experiences, limitations, emotions, and successes were also to be noted in reflective journals. This type of journal promotes reflective practice by motivating participants to record personal experiences, observations, thoughts, and actions during the course of time (Boud, 2001; Barrett et al., 2020).

Pursuant to the briefing of the participants on the various distinct research steps, I managed to negotiate and prepare a timetable for implementing the lesson plans in the different classes. Appointments to observe, as planned in the timetable, were agreed upon and confirmed by the participants to take place on different days during the research period. A copy of the timetable was given to the management of the school for administrative purposes. Telehone numbers were exchanged to communicate any changes in dates and/or times.

5.3.3 Reflections Regarding the Action Research Steps

The reflective journals were of great assistance in gaining an insight into participants' thoughts regarding the different procedures. In fact, not all participants could keep up-to-date reflective journals, while some summarised all their experiences of the action research. Most of them had written the salient features and details of their plans during the semi-structured interviews and for the pre-lesson meeting. Rudilla reflected that during the semi-structured interview she had gained several novel insights on LFS trends in research and development regarding SD and ESD. Sandia had a very superficial point of view on what is meant by LFS but later realised that she had to develop her knowledge on LFS and learn more on the topic from relevant sources on the internet. Both Rudilla and Sandia who were anxious about the action research, were among my greatest 'followers'as they shared similar views and feelings by displaying different levels of understanding of LFS. For them, learners' education should come first as they (learners) were the ones who were going to benefit from the project. Komal and Nirma shared the same level of confidence when they accepted to form part of my research group because they knew me, and found it difficult to refuse to participate in the study. Their journals reflected their fear of not performing at their optimum level to maintain sustained progress during research processes. Sandia expressed the following:

Sandia: *Oh really…* (laughs)… *No, but I thought I was not covering the topic directly when I was preparing the lesson plan for the action step for the learners.*

According to Ritika, the reflective journal helped her immensely to create a comprehensive lesson plan for her first cycle action step. She was able to situate herself in the process of the research. She pointed out that the reflective practice was very interesting, and deemed it important for her to develop her own understanding of LFS. In comparison to other participants, Komal was not confident with the way the reflective journal had to be updated and written because she expressed concern that she might write down things that she was doing incorrectly. However, she felt it would help me, as the research leader, gain an insight of what the actual situation was during the different steps. Vijay was very confident and ready to start the research. He articulated:

Vijay: *...ready to be part of the project where I can find myself upgrading my knowledge and understanding of LFS in the context of action research…. will be able to develop my enhancement due to my new understanding of LFS…it will benefit my learners.*

All the participants were in agreement that in the end learners would benefit from the project. Disappointingly, they did not subject the aims and objectives of this action research to reflection to provide a deeper insight into teachers' understanding and enhancement of LFS.

5.4 ACTION RESEARCH: CYCLE ONE

The main aim of the research cycle one was to gauge teachers' understanding of LFS. The lesson planning and document analysis processes looked at teachers' practices and enhancement in terms of how they address and integrate LFS in their classrooms. It also revealed the methods teachers prefer when addressing LFS. Both analyses of the interviews and lesson planning documents provided a synthesis of understanding the relationship between teachers' comprehension of LFS and how to enhance LFS. It was noted that teachers were only able to reflect on the steps of the action research after cycle one. The results and findings were discussed in line with the type of research tool and the adopted strategy.

Furthermore, a case analysis and interpretation served to outline the main findings from the six teachers' understanding of LFS during the first cycle of the action research, and how it contributed to the shaping of their enhancement of LFS. Because of the cyclical nature of the action research, the analysis of the semi-structured interviews, lesson planning exercise, and documents revealed enlightening understandings to respond to the first research objective which was to explore teachers' understanding of LFS. Reflective journals and observation schedules throughout both action and observation steps, were pertinent in answering the second research objective which was to explore how teachers' understanding of LFS was enhanced, and to some extent why teachers enhanced LFS the way they did.

5.4.1 The Process of Cycle One of the Action Research

The purpose of cycle one was to initiate the action step based on the understanding of LFS. This was executed through information gathered from the planning step of the action research where the teachers planned their own lessons. During the cycle, care was taken to include suitable learning approaches and methods for teaching LFS in the lesson plans. The planning stage started with an interview with participants, followed by meetings with them where they were exposed to the necessary content pertaining to LFS which they attempted to teach during the first cycle. This LFS content would further help the teachers to confidently address LFS related concepts using appropriate pedagogies. The notion of action research was also brought to light to the teachers, ncluding the ways classroom action research is conducted in education. The concept *action research cycles* was highlighted, focusing mainly on the roles of the participants as the 'action-makers', and myself as the observer. It is important to note that, as specified by many of the teachers, the understanding of the different cycles was not clear but provided expansive insights on the research itself. Sandia stated her opinion:

> **Sandia:** *I have never thought that such a type of research exists in education...it actually made me more knowledgeable about action research and also LFS, which is in fact present in our curriculum without us noticing it.*

Among all the participants, one of the teachers was about to exit the research process as participating in the research project made her feel uneasy. She saw it as a challenge to conduct a lesson in her classroom which was recorded in the presence of another teacher (myself). To

help her, I decided to brief her that the lesson that she was engaging with was not different from what she does in the classroom on a daily basis, except that I would be at the rear of the classroom with an audio-recorder. I assured her that the whole classroom would be under her total control, and that her classroom management skills was not a reflection of her true performance as a teacher.

5.4.2 The Themes and Sub-themes

Thematic analysis was used to construct the teachers' understanding and enhancement of LFS following cycle one of the action research. The themes and sub-themes that emerged from the data are captured in Table 5.1 below:

Table 5.1: Thematic Analysis in Cycle One

Thematic Analysis- Cycle One			
Data generation	**Coding (Sub-themes)**	**Theme**	**Implication for next cycle**
• Semi-structured interview • Document analysis • Classroom observation • Pre- and post-lesson meetings • Reflective journals	• Teachers' perceived knowledge of LFS • Teachers' attending to LFS in the curriculum • Classroom activities relating to LFS • Participation in LFS	Theme One: Understanding of LFS	What are the teachers' understanding of LFS and how they shape their enhancement?
	• Surface approach to learning • Teacher-centred learning • Didactic learning • Traditional/Conventional learning	Theme Two: Limited approaches to LFS	How do the approaches to learning affect teachers' understanding and enhancement of LFS?

	• Situational/Institutional barriers • Education system • Management support • Inadequate teacher training	Theme Three: Constraining factors affecting LFS	How do constraining factors impede teachers' enhancement of LFS?
	• Initial teacher-preparation of LFS • Teaching of LFS • Teacher engagement and enhancement of LFS	Theme Four: Teachers' perception and engagement towards LFS	How are teachers' enhancement of LFS shaped?

5.5 FINDINGS, INTERPRETATION, AND DISCUSSION: CYCLE ONE

The following sections revealed the main findings and the themes that emerged during data generation. The responses are expressed in terms of words and sentences to the questions posed during the interview. The information gleaned from the interviews, document analysis, meetings, and class observations are grouped according to the themes that are generated (Table 5.1). The findings were informed by the two research questions, *what are teachers' understandings of LFS* and *how does their understanding shape their enhancement of LFS*? These were based on the experiences of professionals in the field. The purpose of cycle one was to provide an initial teachers' understanding of LFS and how their understanding shaped their enhancement of LFS. Furthermore, it also identified areas of deficit in teachers' enhancement of LFS that could be addressed in the next cycle. The following themes were identified:

5.5.1 Theme One: Understanding of LFS

According to Green and Somerville (2015), as discussed in chapter three, many teachers are determined to implement sustainability education in primary schools, but they lack the appropriate knowledge and skills to do so. In this section, teachers' understanding of LFS were observed during lessons, and through the semi-structured interviews. Four sub-themes were identified from the data set with the main theme being the understanding of LFS.

5.5.1.1 Teachers' perceived knowledge of LFS

The focus in this part of the data generation was to determine how teachers were informed or learned about LFS in terms of their current knowledge of LFS. Only three out of the six teachers acknowledged having heard about LFS but the rest were unaware of the concept. The responses revealed the different sources from which they heard about LFS. While combining these responses organisationally, a clear image of teachers' perceived knowledge on LFS emerged. The participants who had heard about LFS could explain a little more about it, but those who had not heard about it, had no idea of what it was. Rudilla stated that it was back in 2008 when she was in secondary school that she heard about sustainability. Her response is noted below:

> Rudilla: *... first time I learnt about sustainability was when I had participated in a contest where we were referring to the depletion of the ozone layer and climate change. So, I had to go and research these topics. But I can tell you that I do not have complete knowledge of it.*

Komal and Ritika admitted to not having heard about LFS, but Komal acknowledged that she heard about Sustainability for Environment and Development. They did not know about education for sustainability or LFS, as they were attending secondary and tertiary levels for quite a long time. Ritika admitted that she had never heard about LFS. Her articulation follows:

> **Ritika:** *No, I have never heard of LFS, but I have come across the word on the internet, but I never went in-depth to find out what it was*.

However, Komal affirmed that she knew that the term sustainability is associated with the environment. On her understanding of LFS, she stated that *"You sustain, you maintain, and you preserve something".* She only mentioned this to explain her understanding of LFS, but she could not elaborate. In class, Komal stated that one of the topics refers to *"values, the family, and how to behave in front of elderly people"* but was unable to link her teaching to LFS. According to her, she is still learning new things from others while she is teaching LFS. She also stated that she was enhancing her understanding of LFS in her teaching. She supported her argument by saying that children indicated an understanding of LFS when they answered by quoting appropriate examples when questioned on sustainability issues.

As far as Sandia was concerned, it was only when I provided her with some brief information through the informed consent document for participants that she gained some knowledge on LFS, and she stated:

> **Sandia:** *No…in fact I have never heard about it. It is only after I read your informed consent document for participants that I got some knowledge on LFS. I did a quick internet search to know more about it.*

In a response to what she (Sandia) learnt through her search on the internet, she articulated the following:

> **Sandia:** *I came to know how we use resources, especially at school to teach in classes. I also realised the last time there was an NGO which came to school to talk aquaponics to the children. I learnt a lot from their presentation on how we can do much for our environment and our planet. It was interesting to know that also at university level sustainability is being offered for further use in our daily life.*

The participant (Sandia) immediately used this knowledge and talked to her learners about how it was imperative to protect the environment and our planet. She also knew in a past project at school about how a compost bottle could be used to grow vegetables and be used to keep fish in an aquaponic setting. At this point, it was noted that Sandia could gradually develop her knowledge on LFS to engender meaningful learning about sustainability among her learners.

Vijay's extensive experience in teaching as a senior primary school educator was attributed to his knowledge about LFS. Furthermore, he mentioned that most of the time he had access to articles on the internet and social media that enabled him to expand his knowledge and understanding of LFS. Whilst Nirma, admitted that she came across LFS at school when teaching her learners from the learners' workbooks, it was only when I circulated the consent document for participants' perusal that she searched on the internet for more information. The finding disclosed that half of the number of participants were not aware of LFS. Basically, they were aware of the best recourse for social, economic and environmental wellbeing, but they could not relate it to LFS (Kuzich, 2019). They did not seek in-depth knowledge about LFS from the internet and other sources such as the media, NGOs, and community working groups.

This finding is consistent with studies by Shah et al. (2022) and Walter et al. (2020) who affirm that teachers lack content knowledge on sustainability issues which hinders the proper teaching of LFS in classes. Similarly, Smith (2019) concludes that teachers do not have the required attitude and competencies that favour environmental protection and, consequently, they do not act responsibly. Kuzich (2019) contends that this shortcoming disrupted teachers from engaging in principles and practices of LFS which is crucial to change our unsustainable practices.

5.5.1.2 Teachers attending to LFS

According to the findings, teachers were struggling to teach LFS in their classes. Initially, some of them admitted to not having heard about LFS, and this reflected in their lessons. As far as Rudilla was concerned, it was not visible that she was addressing LFS in her class as her class was cross-curricular. She moved on by giving an example of how she usually addresses LFS in her classroom by referring to a topic on 'taking care for the environment'as she believed that the concept of LFS was encapsulated in this topic. She gave consideration to the environment by articulating the following:

> **Rudilla:** *... environment is something that was very interesting for me individually. The research that I did, helped me so much in understanding the different aspects of the environment.*

Rudilla's exposure to environmental issues during her teacher-training days at the MIE shaped her enthusiasm for the subject, which changed her point of view about the environment. Rudilla regarded teaching about the environment also referred to sustainability, and that she was applying her knowledge and understanding of LFS during her lessons. In the end, she revealed that sustainability was too complex for her learners. Her response follows:

> **Rudilla:** *For instance, for Grade 1 learners, they are only 5 or 6 years old. It is not a class where I can talk about learning for sustainability. They won't understand. But while teaching the different subjects in class, I try to include those teachings.*

Sandia's response to the question on addressing LFS was negative as she believed that she was not addressing LFS at all in her classes. Sandia believed that her learners were too young to assimilate the complex explanations pertaining to LFS. She expressed the following view:

Sandia: *No… my learners are too young to understand the concept of LFS environment. Last time I was doing a class in French and explained a passage on composting, but my learners did not know what composting is. Thus, they were very interested to know more, and I had to elaborate. Maybe they are going to engage with LFS in Grade 4 in the next school-year in subjects such as Science and History/Geography. I understand that LFS is very complex and vast and that for Grade 3 learners it is not appropriate to teach by going into too much depth.*

Vijay claimed that he used concepts of LFS every day while conducting, History and Geography classes by relating to sustainability as recommended by the NineYear Schooling Project of the MoETEST. His knowledge were from his numerous years of experience while working in the upper primary classes. Vijay articulated the following:

Vijay: *We are doing LFS across all subjects. The topics span across all the subjects, mostly History/Geography and Science. With the new concepts gained from the NineYear Schooling Project, we are told to teach values which are related to sustainability.*

Furthermore, according to Vijay during the interview, he demonstrated sustainability concepts through class activities by going outside to do some activities with the learners, especially if there was an observation to do in Science. However, during cycle one, his actions were incongruous. Vijay remained in the class for the explanation, and his class activity was not outside the classroom.

Although Ritika is an experienced teacher and good at teaching other subjects by applying sound class management skills, she used the surface approach while incorporating LFS in her lesson. She possessed very limited content knowledge and understanding of sustainability. Usually, the teacher when concluding a lesson questions the learners to ascertain whether they had understood the topic, but with Ritika's scant understanding of LFS this would have been fruitless.

Nirma believed that LFS is already in the school curriculum. In response to a question on how she perceived its presence in the curriculum, she admitted that it was too complex to be taught to primary school learners. She responded in the following manner:

Nirma: *So, normally it refers to a message being conveyed to the learners through talking and discussing in class, through teaching and lecturing… but there are activities that I do not carry out to deal with LFS so often.*

Nirma did not display much interest in projects regarding LFS at school, but her learners learned about LFS; for example, composting and other techniques to keep the environment clean. According to her, she did not always discuss sustainability, and when she did, it was mainly while covering certain chapters and topics when she incidentally came across LFS principles. Thus, it emerged from findings that the teachers did not address LFS as expected in their lessons during cycle one. This finding is consistent with Kuzich (2019) who posits that teachers are not able to address LFS in their lessons as they have a fragmented and hazy view of sustainability. Similarly, Shah et al. (2022) conclude that although teachers show an appreciation of LFS, they face many difficulties in the actual delivery of the content knowledge. Watson (2017) also agrees, but states that teachers have limited time to imbibe the content knowledge of LFS, and to be able to teach sustainability because of an overwhelming workload.

5.5.1.3 Classroom activities relating to Learning For Sustainability (LFS)

This sub-theme was generated when analysing teachers' interview responses and classroom observations which exposed the level of engagement that they personally presented during LFS integrated lessons. Watson (2017) and Shah et al. (2022) propose using different teaching experiential and participatory activities to teach sustainability in primary schools. Unfortunately, in cycle one, findings revealed that the teachers were unable to design concrete classroom or outdoor activities to teach LFS, claiming that time-constraints and the need to obtain prior permission from parents and the principal were barriers. Although Rudilla explained that she engaged herself in LFS and addressed its concepts daily in class, this was not evident in her first lesson in cycle one as her explanations were limited to the classroom and the copybook. Rudilla claimed the following:

Rudilla: *I teach my learners to queue up silently without making any noise, to close the tap when it is not in use, and not to throw garbage in the school yard. I try to inculcate values in them, but they are not able to practise them when I am not with them.*

The above evidence demonstrates that children had not grasped knowledge on sustainability, hence they were not implementing LFS principles correctly. This meant that LFS was evident only in theory, but not in practice as there was no genuine effort from the learners to show that they had learnt the principles of sustainability.

Considering Komal's point of view, it was not apparent that she taught sustainability under the topic 'Value Education in the Family' which originated from learners' textbook. This topic centres on learners' families where learners are made aware that there are nuclear families and other types of families where values and ethics are taught, especially on how to behave towards elderly people. During the class activity learners remained silent and passive, and were hesitant to speak fearing that they will expose their lack of knowledge to the class.

Similarly, Sandia integrated limited LFS content in other subjects, except in Social Scientific and Environmental Education. For example, she referred to school texts when teaching topics such as *how you care for each other* or 'How to beautify the environment'. This meant that she was engaging in LFS issues while teaching her lessons. According to Sandia, learners did not understand the message that she tried to convey to them through topics pertaining to recycling of used resources. It was obvious that from what she had already told me earlier that LFS was not covered during classes very often, but it LFS content was conveyed just because it was required for this study. I realised from her comments that she was already engaging, to some extent, in LFS concepts during lesson presentation, but she was unconscious of it. To her astonishment, she discovered that LFS was not a topic but a multidimensional concept with many aspects linked to sustainability.

On a positive note, Vijay claimed that while teaching his classes, opportunities arose to learn about new aspects of topics related to LFS. In so doing, active engagement was achieved in LFS-related lessons; hence, learners and teachers benefited from generating new knowledge. The following explains Vijay's practice:

> **Vijay:** *I learn while I am teaching as there is information that the learners bring to the table. They ask me questions about it and I try to to answer them, but I must do a little research on the web and from reading books. Classroom activities for LFS is not the same as those of English and French as much preparation is needed, time is needed, and resources are needed. And you know how the situation is nowadays, we have so many topics to complete. Also, learners nowadays absent themselves more frequently and this affects their education too.*

The above evidence indicates that Vijay accepted that there were many aspects of sustainability that he did not know, and were not being addressed. Also, a crowded curriculum meant that teachers will have to design and deliver lessons by applying innovative methods of teaching. This finding is consistent with Watson (2017) and Kuzich (2019) who found that teachers' lack of confidence and pedagogical content knowledge, coupled with outdated methods of teaching, act as barriers in addressing LFS in schools. Shah et al. (2022) agree that LFS should be taught beyond the classroom by using innovative teaching methods. Seatter and Ceulemans (2017) concur that traditional teaching is too monotonous for learners, and it does not prepare them for a changing world. The above findings that emerged from participants' responses revealed that creative activities should be designed by teachers so that learners can actively participate in the teaching activities that stimulate interest in aspects of sustainability.

5.5.1.4 Participation in Learning For Sustainability (LFS)

According to Rudilla, it was an opportunity for her, as well as her learners, to enhance her understanding of LFS. She stated the following in this regard:

> **Rudilla:** *Yes, of course. Sometimes, I am amazed that I learn from them. Then I realise that I did not think about it in that way before …. Yes, it is a way of learning. Everyone is still learning.*

Furthermore, learners also learn from their own participation in LFS discourse as reported by Rudilla during her interview when it was stated that learners also act as role-models for themselves. Rudilla elaborates:

> **Rudilla:** *If a learner is taking handwash from the classroom and he is going outside, he knows what his responsibilities are. And if he is wasting it, another learner will stop him or come to tell the teacher that the learner has wasted water. Since wasting is a bad habit, learners learn from each other to do the right thing.*

Since teaching evolves with time mainly through enhancements, the change is positive. However, Rudilla and Komal admitted that they did not learn sufficiently from their classes, nor their learners, as they did not enhance their teaching and learning processes. They realised that they were not enhancing their own teaching which made them to think critically about their 'unprogressive' situation (and that of the learners) about what strategies they could implement to make LFS content interesting during lesson-delivery. Rudilla admitted that her actions as an

individual were not beneficial to the environment, and this apparently impacted her attitude towards LSF teaching. Komal also believed that when she was teaching, new things were not absorbed sufficiently by her, and thus she was not actively participating in LFS matters.

Similarly, Sandia could not relate her understanding of LFS to enhancing her subject lesson. She claimed that her lack of conceptual and pedagogical understanding of LFS had a negative impact in her LFS participation, and in her professional life. In other words, there was a mismatch between her understanding of LFS and how she enhanced it in her class. The following statement proves this finding:

> **Sandia:** *I try to introduce something new each time I conduct a new lesson with my learners such that they can learn new things, but I am not so sure if they are learning ot if I am doing things right or wrong.*

> **Sandia** [elaborating]: *I didn't know that I was already covering LFS and that things that make my learners become better human beings form a part of LFS. I am happy that we are learning new things together. I never knew that I am already involving sustainability education in my lessons. I wasn't aware about sustainability at all before I came to know about your study, and the best part is that I am already covering LFS in our classes. That means I am already including LFS at class level without realising it.*

According to Vijay, his understanding could enhance his lessons through better learner-participation in LFS activities to benefit the learners. In his response, he specified that due to a lack of space, time-restrictions, and an expansive syllabus, he might not make use of his understanding to enhance LFS during classes, but he tried his best to play a part in enhancing aspects of LFS teaching. He expressed the following:

> **Vijay:** *It depends on time and space availability as my learners are too young. Sometimes ideas can come up incidentally which I I can share with my learners. There are moments I need to jump out of my class context to talk about issues outside my subject area while teaching. I think it is a good way to enhance my lessons further. As I said earlier, it depends on the topic that I am teaching in class at a specific time.*

In support, Ritika agreed that LFS is an essential part of the curriculum, and that teachers need to participate actively to address it and enhance their teachings using their constructed understanding of LFS; as stated in the following excerpt:

> **Ritika:** *Yes, they are interesting as there are many things to share with the class. Learners are young and they don't have a high level of maturity to understand things in the way we do. So, it's our duty as teachers to make them know and understand things they are unaware of. At least, they can get the basic knowledge that we as teachers already have. My learners, in return, can share it with their friends and parents. Good habits are also learnt in this manner. Classes that need more time and focus are taught in the morning, to get better inputs and comprehension on the part of the learners. I must also adapt my lessons according to the level of my learners. I have to choose aspects of the topic that are easier for them so that they can better understand the lessons. For example, I cannot introduce LFS to my learners, but I can use words and expressions which are much easier and simpler to explain LFS concepts. Each child has a different level of understanding things, and their opinions and styles of thinking are also different.*

It was clear from the above extract that Ritika could not understand the meaning of the enhancement of LFS in context, and thus could not relate to her new knowledge gained from teaching classes regarding LFS concepts. Ritika should enhance her knowledge and understanding of LFS topics so that her learners could benefit.

Nirma expressed her view in the following statement:

> **Nirma:** *It depends on the topic that I am working on, and the level of interest that learners demonstrate in the lesson. Unless a teacher is doing something specific in her class that learners have a special interest in, learners' attention will wane. For example, sustainability issues will motivate the learners to preserve the environment. Also, impediments such as time-constraints and wide syllabi stifle LFS engagement.*

The above evidence revealed by Nirma, explains that the level of participation in LFS activities (in her case) was limited as learners mainly engage in lessons that are creatively presented, in addition to them being about topics of interest. Also, challenges such as time-constraints and a congested syllabus prevent LFS topics from being taught extensively. Thus, it was proposed

that a special resource person could be appointed by the school or the Ministry to facilitate workshops or professional development seminars on topics related to LFS issues. Nirma elaborates:

> **Nirma:** *As I was saying, there is a lack of resources, and learners themselves will not come up with something new to share so that they present it in front of the class. There is never that response on their part. Teachers are the ones who are delivering everything. Learners just listen and if they learn, they learn; if they do not, they do not. The school, the Government, the Ministries are not guiding the learners towards sustainability that much. Everything that is contained in the book we are doing, but the concept of LFS has truly very little exposure.*

It was clear from the above response that teachers were unable to relate LFS teaching-learning aspects on an ongoing basis as they did not understand the real meaning of the LFS concept. In this study, the teachers' participation in the enhancement of LFS was limited. This finding was consistent with UNESCO's (2009) cited in Kuzich (2019) which revealed that there was limited awareness and understanding regarding sustainability. It was more than obvious that LFS was something new to them such that they could not relate it to the environment, the economy, and society. This is confirmed by Suarez-Lopez and Eugenio-Gozalbo (2021) who observed that there is limited presence of sustainability in the curriculum and a deficiency in its inclusion of the social and economic dimensions of LFS. Consequently, Natkin (2016) recommends that teachers must reflect on their teaching practice and commit to LFS involvement in the learning process. Teachers must promote behaviour directed towards the protection of the environment and entrench transformation that mitigates natural and social catastrophes. Teachers' participation is critical in LFS since they are the role-models in society.

5.5.1.5 Synthesis of Theme

This theme shed light on four essential components that contributed to exploring teachers' understanding of LFS. It generated data to respond fully to the first research question: *What are the teachers' understanding of LFS in Mauritian primary schools?* Also, it partly answered the second research question: *How do the teachers' understanding of LFS shape their enhancement of LFS in Mauritian primary schools?* It was observed that teachers did not have sufficient LFS knowledge so they could not address LFS successfully in their lessons. Moreover, their

classroom activities evoked passivity as learners could not grasp the LFS concept. It was also concluded that teachers' participation in their enhancement of LFS was very limited during cycle one. They, themselves, declared in their post-cycle one interview they needed to update their knowledge on LFS. Hence, these factors limited the teacher to embed sustainability education more explicitly in their classrooms (Dyment & Hill, 2015). This accounts for the rise in challenges related to sustainability issues. By not grasping an understanding and knowledge of LFS, teachers become 'incompetent' when teaching learners sustainability aspects which may lead to learners being prone to exhibit actions that run contrary to saving the planet and thus also exacerbating the downward slide regarding the degradation of society and the environment.

5.5.2 Theme Two: Limited Approaches to LFS

The previous section deliberated on the first objective of this AR. Data was mostly generated through classroom observations during cycle one, which helped to gain insight into the different strategies and approaches that teachers used to conduct their first lesson. By not having sufficient knowledge of LFS and modern teaching strategies, most teachers were stuck in using traditional and surface approaches to learning which contradicted what they reported during their semi-structured interviews. The emergent sub-themes emanating from the main theme were teachers' surface approach of learning, teacher-centred learning, didactic learning, and traditional learning.

5.5.2.1 Surface approach to learning

Biggs (1979) defines learning approaches as the mixture of motivation and strategy that learners use in their learning process which is either *surface* or *deep*. A surface approach is choosing the quickest way to accomplish the task where learners learn in a linear manner, do not ask questions, and do not show interest in comprehension (c.f. 3.9.2). It was confirmed that Komal used the surface approach of learning while executing her class lesson on 'honesty the best policy'. Although she had sufficient experience in classroom management, she was deficient in conveying LFS content creatively to learners. She looked quite uneasy when starting with her lesson with the Grade 2 learners (6-7 years); she asked the learners: What do you understand by the term *honesty*? The learners looked amazed at their teacher (Komal) because she was only repeating the explanations and comments from the video to the learners. This meant that

she was not applying the deep approach to learning as new ideas were not being elicited from her learners.

Similarly, Ritika's lesson on *climate change* was also taught via the surface approach. Although she was informed one week beforehand that she was going to implement her lesson plan during cycle one, she made no effort to engage the class through the implementation of innovative teaching-learning strategies to dissect concepts of LFS in a creative manner. As I observed, the class was not interactive and learners were not able to express themselves clearly.

Unfortunately, Nirma was also guilty of conducting her lesson by using the surface learning approach. She was diffident and seemed 'unprepared' when presenting her lesson in class. As a result the learners were not gainfully engaged, so the class ended up without quality teaching or learning occurring as evidenced by only two or three learners responding to her questions while others just listened passively. Through interrogating this sub-theme, one can deduce that LFS contents cannot be taught via traditional methods which evoke passivity; a concerted and committed effort to deliver lessons through innovative teaching-learning strategies is necessary to encourage learners to become interested and interactive in sustainability topics.

From the information gathered, it was revealed that learners did not respond well to traditional teaching and learning styles, such as lecturing. Tularam and Machisella (2018) define traditional teaching approaches, such as the surface approach, as generally teacher-directed, where learners are taught in a way that results in passively sitting and listening (c.f. 3.9.2). This does not develop learners as critical-thinkers (Giraldo-Garcia et al., 2015). During the end of the cycle one meeting, it was noted that learners were not enjoying their lessons; hence, a modern approach encompassing creativity and innovation in lessons is crucial to instil sustainability values in learners (Tularam & Machisella, 2018).

5.5.2.2 Teacher-centred learning

The teacher-centred approach, a traditional approach, is distinguished by learners' passivity where the teacher talks extensively and dominates the lesson, while learners continue to listen and remain silent (Tularam & Machisella, 2018). There is no proper learner-teacher collaboration – hence, activities are performed 'robotically' in the classrooms which results in learners not developing critical-thinking skills (Giraldo-Garcia et al., 2015).

Regarding Komal and her classroom teaching, the use of the video on *honesty* facilitated the holistic approach; however, she was unable to link the aspects in the video to the topic being taught. Learners were very happy to watch the film, but they could not grasp its meaning for future use. This was evident while observing the class when learners were incapable of mentioning more examples of *honesty* and how they can be used in real-life situations to protect the environment and society.

Alarmingly, Ritika used the traditional method of teaching to explain to her learners about aspects of climate change, but she was the only one talking. There were no responses from learners even when she was asking questions. This finding contrasts Watson's (2017) claim that LFS should be taught beyond classroom lessons. Below is an extract of the conversation between **Ritika** and her learners during her lesson presentation which demonstrated that learners were not able to participate actively during the lesson:

> **Ritika:** *Ok, look out carefully in this sentence, we have changed mainly temperature, rainfall and other weather conditions… where?*
>
> **Ritika:** *All over the world.*
>
> **Ritika:** *Now, you know with climate change, does it impact positively or negatively on the world?*
>
> [After a long pause]
>
> **Learner (1**): *Negatively.*
>
> **Ritika:** *How does it impact negatively?*
>
> **Ritika:** *Ok, make an effort!*

The above evidence proved that learners could not reply to the questions asked by the teacher (Ritika), confirming that the learners were 'lost' as Ritika herself responded to her questions. As far as Nirma was concerned, the class was conducted as if she was trying to impress me. The teacher did not have any notion of the capacity of learners' to imbibe and understand new knowledge; thus she continued for long periods with weighty explanations.

The findings from the data revealed that the teachers used the teacher-centred approach to teach sustainability in their classrooms. The teacher-centred approach hinders communication between the teacher and learners and lacks the promotion of collaborative skills necessary for LFS teaching-learning, thus creating a monotonous atmosphere in the classroom. Serin (2018)

elaborates that this approach discourages learners' from asking questions which leads to the stifling of critical-thinking and problem-solving skills. Additionally, Shah et al. (2022) are also of the view that teachers have limited experience in teaching sustainability, and should be re-schooled on how to plan and deliver lessons effectively. Moreover, UNESCO (2021) states that a humanistic and holistic approach to sustainability education can assist teachers and learners in the realisation of recent dire global events - the field of LFS will create a definite awareness to promote sustainability to preserve the world.

5.5.2.3 Didactic Learning

Didactic learning is also known as direct instruction or deduced learning. In its pure form, according to Serin (2018), the method assumes that the teacher possesses the knowledge to impart to learners which is very common in schools, whereas in experiential learning, knowledge is discovered by applying exploratory and inductive methods (Calavia et al., 2021). Ritika and Nirma stated during their pre-lesson interview that they usually integrated different types of learning approaches while presenting their lessons. During classroom observations, the data generated from teachers' lesson presentations was devoid of experiential learning; rather they favoured lecturing, speech-delivery, and drilling facts about LFS. This was evident in their interviews as articulated below:

> **Ritika:** *So, normally it refers to a message being passed on to the learners to convey a message. … rather talking and discussing in the class, through teaching and lecturing… and there are often activities that I do not carry out to deal with LFS. I told them myself while they were throwing out rubbish that we can sort out the rubbish by recycling …*

While Ritika was lecturing during her lesson delivery, the learners seemed very restless and bored. The class was a passive one, and learners could not answer simple questions on what the teacher just taught them. Ritika felt embarrassed in front of me and started answering the questions herself. The extract below justifies the above findings made during Ritika's lesson delivery:

> **Ritika:** *What is climate change?*
>
> **Ritika:** *Ok, how many words are there in climate change?*
>
> **Learner (1):** *Two*

Ritika: *What is climate?*

Learner (2): *Weather*

Ritika: *Climate change refers to change mainly in temperature, rainfall and weather conditions all over the world.*

Ritika: *Where is the change in temperature?*

[Long pause… learners kept silent]

Ritika: *It happens all over the world. Learners!!!*

Regarding Nirma, who seemed to be concentrating on details of my study rather than the learners in her classroom, she continuously talked about sustainability and SD. She crammed the entire contents of a long chapter from the text into one lesson by explaining extensively about the planet, land, air, global warming, melting of icebergs, and water pollution, among others. The evaluative questions posed at the conclusion of the lesson mainly elicited *yes* or *no* answers. Through my observations and recorded (written) information, the findings indicated that addressing LFS appropriately in lessons by applying the modern methods of teaching LFS (as discussed in chapter three) were largely absent.

Didactic teaching is a teaching method that involves teachers structuring lessons that focus on the lecturing style (Serin, 2018). From the data collected, it was obvious that learners were opposed to traditional teaching and learning styles (c.f. 3.9.2). During the end of cycle one's interview, it was found that teachers recognised that their learners stayed passive throughout their lessons. Moreover, the content on sustainability emanated from a lesson pre-planned in the learners' textbooks which was the primary resource for teaching and learning. As a result, this 'textbook teaching' approach proved to be ineffective in engaging learners in the lessons being taught. Kim (2016) and Shah et al. (2022) agree that the didactic or traditional approach to learning does not serve the needs of the current generation of learners.

5.5.2.4 Traditional learning

Komal expressed her opinion (below) on how to elicit better responses from learners when delivering a lesson:

> **Komal:** *Learners must be taught good manners and actions, and they must be trained to implement these teachings using role-play, groupwork, experimentation, and learning by observation, among others.*

The above excerpt expresses views that are in contrast to Komal's first lesson interview where it was evident that she preferred the traditional method of teaching which elicited limited interaction with learners, few responses to her questions, and a lesson that seemed to be mainly teacher-centred. While, Vijay's lesson proved to be more interesting, he also utilised traditional teaching methods when he explained judiciously to his learners the features of materials in the environment. Vijay expressed his sentiments in the following extract:

> **Vijay:** *To take learners outside, I need to get permission from the school head who, in turn, needs to inform the MoETEST, and it becomes a lengthy procedure. I prefer to do it inside the classroom where I can use whatever strategy I want to.*

Ritika was teaching a Grade 5 class for the first time in her career. According to her, she was still learning how to implement innovative teaching strategies to enhance her lessons. She also admitted that most of the time she delivers her lessons according to the instructions provided in the teacher's manual, and also from her own past experience. During her teachers' training at the MIE, she claimed:

> **Ritika:** *I did not have any exposure to sustainability concepts and knowledge and LFS teaching strategies fit to be used while conducting my lessons.*

After cycle one, Ritika confidently proposed to move to another cycle as she acknowledged that the method she used while conducting her lesson in cycle one was not appropriate for teaching LFS. Data revealed that most of the teachers used traditional methods of teaching LFS in their classes during cycle one of the action research.

Nirma also 'lectured' on pollution as one of her lessons. She talked about water, land and air pollution, and then kept on talking about complex issues such as global warming, icebergs melting, rising sea levels, tsunamis, and non-renewable sources of energy (such as fossil fuels) in a single lesson. Her learners looked quite confused since she was conveying too much content in one lesson. She did not realise that children have a certain retention capacity. She kept on talking for a whole hour which led me to the conclusion that she did it just to impress me with her performance and her knowledge of LFS. From this, it can be deduced that no effective learning had taken place as learners were bored as she kept on lecturing using the traditional method of teaching.

Evidence that most of the teachers used traditional learning instead of innovative and transformative teaching approaches, was conspicuous - thus corroborating Watson's (2017) observation. Seatter and Ceulemans (2017) confirm that traditional methods do not prepare learners for change, but for the status quo as it discourages reflection. Teachers are not well equipped with innovative teaching strategies to address LFS (Suarez-Lopez and Eugenio-Gozalbo, 2021; Kuzmina et al., 2020). Lastly, Seatter and Ceulemans (2017) advocate that teachers plan and deliver lessons so that their learners may be exposed to critical-thinking and problem-solving activities, while teachers continuously search for new sources of information which are crucial to enhance LFS understanding.

5.5.2.5 Synthesis of theme

Theme two dealt with teachers' limited approaches to learning in the classrooms. Most of the teachers used the surface approach to a great extent such that the concept LFS was not sufficiently addressed. The teaching of LFS was effected most of the time by using traditional teaching methods. This meant that priority was not given to LFS. As stated in chapters two and three, teaching LFS required innovative, place-based, and active learning strategies as supported by the Burns' Model of Sustainability Pedagogy and O'Donoghue's Active learning Framework. Moreover, lessons were not sufficiently interactive for children to grasp the essence of LFS concepts to implement them in their daily lives. Seatter and Ceulemans (2017) propose transformative learning for the learners to understand LFS effectively, and to put it into practice. In sum, the traditional way of teaching implemented by the participants was not convenient for the 21st century learners who get bored easily.

5.5.3 Theme Three: Constraining Factors Affecting Learning for Sustainability (LFS)

Implementing educational change is complicated, hence it is very important to identify factors affecting LFS to find strategies to circumvent them. Miedijensky and Abramovich (2018) enumerate various factors affecting LFS stating that these must be addressed for the efficient implementation of LFS in schools. In this study, a few sub-themes emerged from the data which identified situational and/or institutional barriers such as the educational system, lack of management support, and inadequate teacher-training.

5.5.3.1 Situational/Institutional barriers

Pennacchia et al. (2018) state that situational barriers arise from persons and family situations such as time, pressure, and financial constraints. In this regard, LFS has significant situational barriers according to the participants. Vijay pronounced the following:

> **Vijay:** *Parents do not like their children to go out of the classroom and learn outside or to perform tasks such as cleaning the garden, planting flowers, picking rubbish, and doing co-curricular activities.*

The above response implies that according to parents, children only learn while being in the classroom and doing exercises in their copybooks. Some teachers even agree that they do not like children to take additional risks such that they can get hurt and dirty themselves. Komal added that taking the learners outside the classroom required much red tape. Teachers cannot decide by themselves if they want learners to engage in extra-curricular activities outside the school premises as the MoETEST is not always willing to grant official permission. Further, Ritika and Nirma complained that they did not have adequate time to consolidate their teaching, and that going outside to apply experiential or holistic approaches of learning is not practical when they have a congested syllabus to complete. They also disclosed that the rate of absenteeism is very high, and that learners are especially absent during festivals or special occasions.

Moreover, Nirma related that Mathematics lessons require more time and practice, so she devotes extra time to Mathematics every day (at the expense of LFS), whereas time for Science and Geography is adequate as they are taught only twice a week. Nirma elaborates:

> **Nirma:** *These learners nowadays are too naughty, thus taking them outside for extra-curricular classes is very risky. They make too much noise and cause a disturbance to other classes.*

The above evidence implies that teachers prefer to conduct their lessons inside the classrooms by 'lecturing' and utilising traditional methods of teaching. As explained by Howell et al. (2022), barriers are instances where learners do not experience learning success. Thus, educational institutions are responsible for institutional barriers to learning. Vijay claimed that very often permission is not granted by the head of school to perform holistic activities outside the classroom as it may entail parental consent. Vijay elaborates:

Vijay: *Usually parents do not give consent for their children or wards to perform activities outside the classroom where the risk of injury is high.*

Furthermore, Komal claimed that the head of the school had conservative views of teaching who believed that taking children outside the classroom presented a serious risk, and also feared that teachers do not want to work in their classrooms as they prefer to 'play' outdoors - they are thought to be 'killing time' and 'gossiping' outside. Thus, Komal believed that learners are more prone to be obstructed by management's conservatism and paranoia for safety. This was evident by the head of the school who did not want to take the risk of a learner getting hurt and then dealing with parents'anger. A clear example was when Rudilla wanted to take her learners to a nearby river just at the back of the school to observe the extent of pollution, but was denied permission by the head of school and the Ministry of Education because of safety and security requirements. This 'curing is better than prevention' thinking hinders innovative teaching and stifles learners' critical-thinking.

Nirma from the upper primary class elaborated:

Nirma: *Due to the overloaded curriculum and the race to complete our syllabus, I don't have enough time to cater for different learning strategies.*

This statement reinforces the increasing concern of the teachers and education institutions to produce learners for academic excellence rather than for holistic development involving concerns about the environment, society, and the economy. As such, it is clear that there is pressure regarding time precipitated by an already crammed curriculum. Also, since the teacher considered sustainability topics as being non-disciplinary, it was often difficult to include LFS into lesson plans.

Nirma acknowledged that LFS is included in the school curriculum, and when answering the question on how she perceived its presence in the curriculum she stated the following:

Nirma: *Yes, through the school curriculum, yes, we have it. I see it presented in the curriculum. It is vague and limited. It is apparent but also a bit hidden everywhere in the curriculum. It is hidden pretty much everywhere, and we do not really say that here we are engaging in sustainable development. In chapters like recycling, environmental*

issues, pollution and many more, it tells us to use green energy instead of using fossil fuels. When we are providing the learners with examples like that, then it is LFS in disguise, and we do not really say aloud that we are conducting sustainable development and that we are protecting the environment for future generations - it is not really apparent.

Nirma pointed out that although LFS is 'hidden' in the curriculum, the awareness of sustainability issues is important to the learners which can be done by discussing LFS topics. Nirma does not show much interest in projects regarding LFS at school, but her learners are aware of LFS at school; for example, composting and other techniques to keep the environment clean. According to her, she does not always plan sustainability lessons, as it is mainly done incidentally while covering syllabus in other subjects.

Although new topics have been added to cater for the provision of LFS in the curriculum (c.f. 3.13.1), teachers are very selective when covering LFS content in lessons. Learning objectives are vague and short and only factual content is given priority as evidenced in teachers' lesson plans during the document analysis process. These institutional barriers result in obstacles that inhibit the implementing of holistic, interdisciplinary education for sustainability as attested by Kang (2019), Borg (2012) and Taylor et al. (2019) in chapter three. Therefore, the evidence is convincing and overwhelming that there are several situational and institutional barriers which negatively influence the enhancement of LFS (Parry & Metzger, 2021). Similarly, Evans et al. (2012) and Kang (2019) report that teachers' resistance to adopting sustainability and the whole-school approaches also hinder the proper implementation of LFS in schools which could be facilitated through action-oriented, experiential learning, and applying them in real-world situations. The institutional obstacles 'sabotage' the crucial role of LFS to preserve the environment. I also observed, as a teacher, that there is no motivation either in helping the teacher to enhance the LFS lesson, or to obtain permission for outdoor activities for fear that parents may complain that teaching and learning is not taking place. Such thinking will not lead to a sustainable future, especially knowing that schools are institutional agents that should promote progress to save the world from disasters.

5.5.3.2 Education system

According to the MoETEST (2021), the aim of sustainability education is to prepare learners through social learning to make a sustainable choice for their future. Children should have the

opportunity to inquire about the environment to enhance, support, and protect the lives of people and other living creatures. Vijay revealed the following:

> **Vijay:** *Nowadays our education system has become too exam-oriented. This is promoting rote-learning and learning without understanding. Consequently, learners are learning just to satisfy exam requirements, and they are not made aware of the true issues that the world is facing. The education system is not prepared to make sustainable decisions concerning humanity's future survival.*

Moreover, there is also the structural barrier which negatively influences the educational system. The way teachers' lesson-planning and daily routines have changed through the years is an indication of bureaucratic interference and control that have plunged the teaching profession into a state of confusion. For instance, teachers are burdened with heavy workloads and school pressures, in addition to piles of administrative duties. Nirma's complaints follow:

> **Nirma:** *We do not get much support from the authorities and cannot come up with new ideas or concepts such as setting up a school garden or an endemic garden at school...as teachers cannot continue to monitor the projects in addition to our everyday workload. We have a lot of topics to cover and reaching the second term means also that the exams are nearing. As such, taking the learners outside becomes really difficult. I think that the Ministry of Education should review the assessment criteria and lessen learners' and teachers' pressure. Thus, we will be able to do more field work, experiential learning such that learners will get accustomed to action, and ultimately implement them.*

From the above extract, it was clear that teachers felt pressured by the requirements of the present education system where they have to dedicate their energy and time to core subjects to produce quality academic results rather than spending some time on extracurricular activities. The abobe evidence also revealed that although LFS has been woven throughout the primary curriculum, it is not being addressed efficiently in schools. Insufficient training, inadequate content knowledge, and a lack of relevant skills in LFS prevent the inculcation of the sound behaviour in learners through LFS lessons. Similarly, participants were unable to address LFS issues efficiently in their classrooms, stating that they have a congested syllabus and no time to integrate LFS into their subjects.

These above findings concur with that of Timm and Barth (2021) who allude that teachers are disappointed in the system and become depressed; thus they are unable to become involved in aspects of LFS, especially when they are burdened with additional tasks like managing projects at school. Similarly, Miedijensky and Abramovich (2018) perceive the education system as a barrier to the implementation of LFS in schools which aligns with Watson's (2017) suggestion that it was time to revise the school curricula to guarantee that learners to cope with 21st century demands.

5.5.3.3 Management support

Fernandez-Sanchez et al. (2014) state that resources, knowledge, and management incentives are imperative to successfully implement LFS in the education system. It was claimed by teachers during the interviews and meetings that very often school management does not support projects related to gardening and the cleaning of the schoolyard. The management insists that the caretakers and the labourers are there to conduct such projects. Vijay added that there was no internet facility for learners in the school, and that teachers cannot access YouTube videos as a teaching tool to enhance the understanding of LFS in their lessons. Moreover, Vijay stated that due to the lack of space, time-constraints, and a congested syllabus, he may not be inspired to use of his understanding to enhance LFS during classes, but tries his best to play a part in LFS. Vijay elaborated:

> **Vijay:** *It depends on time and space availability as my learners are too young. Sometimes something can come instantly which I think I can share with my learners. There are moments when I need to jump out of my class context to talk on issues outside my subject area while teaching. As I said, it depends on the topic that I am doing in class at a specific time.*

Nirma, who bemoaned that there was a lack of resources and managerial support at school that impeded the successful implementation of LFS. Her advice follows:

> **Nirma:** *Outside, in the hallway, there is a bin but there are only plastics in the bin. Why not a bin for paper and a bin for metals to enable the learners themselves to do the sorting. When there are only plastics, there is no concept of sorting as they do not know about the other materials such as paper and metals. This calls for better support for sustainability education.*

Additionally, Nirma also observed that a garden corner where children can grow plants by themselves lies bare. Learners can 'adopt' this space to experience their own taste of nature by indulging in sustainable agricultural pursuits. Nirma was more than convinced that a lack of leadership and management support was hindering proper LFS teaching and learning. She added:

> **Nirma:** *No, unless a teacher is doing it in class, learners will be motivated to become interested in sustainability projects. However, learners are not motivated by school management's lack of support to do it by themselves.*

Unfortunately, there is no inspiration for learners to engage in activities which protect the environment. In terms of enablers for LFS, Vijay noted that LFS can be an essential part of the curriculum but teachers must address it and enhance their teachings of it by applying their understanding of LFS. Also, teachers' leadership skills can also come into play by imparting the values related to LFS. Vijay elaborates:

> **Vijay:** *Good habits are also learnt the LFS way. Classes that need more time and attention are conducted in the morning so that there are better and fresher inputs and comprehensions on the part of the learners. I must also adapt my lessons according to the level of my learners. In this way, if I get the help of the management, it would be an enormous relief for me.*

The above findings revealed that the lack of management support was an issue at school. Heads of schools and administrators find it bothersome to supply resources to assist teachers with their lessons or outdoor activities. This is consistent with studies by Fernandez-Sanchez et al. (2014), Kadji et al. (2012) and Shah et al. (2022) who concluded that teachers need management support such as the provision of learning materials. The provision of resources could have been prioritised by management instead of financing social events like staff get-togethers. If the head of the school is aware and understands the term *LFS* and its advantages, he/she would surely have sought the required permissions and the necessary resources to enhance LFS teachin-learning. Unfortunately, many heads of schools lack the understanding of LFS.

5.5.3.4 Inadequate teacher-training

According to Rudilla, her project that she executed at her secondary school on climate change and its effects, including the responsibility for the depletion of the ozone layer, capacitated her

to understand aspects of sustainability which urged her to plan on how the negative impact on our environment could be mitigated. She displays this notion in the following quote:

> **Rudilla**: *Since the erosion of the ozone layer was a very big catastrophe, I had to talk about climate change and its effects, together with the ways that it could be reduced, among other solutions. We talked about bans on Chlorofluorocarbons (CFCs). There were things such as how to use perfumes that are safe for our ozone layer, as well as products that don't harm the atmosphere, including non-CFC substances.*

It was heartening when Vijay explained that his long experience in teaching as a senior primary school teacher and working most of the time in the higher primary section can be attributed to his perceived knowledge of LFS. Further, the time he spent accessing articles on the internet and on social media allowed him to gain basic knowledge of LFS. However, all the other teachers stated that during their in-service teacher training at the MIE they had never been introduced to the concept of SD or LFS. It could be advantageous if modules for SD, ESD and LFS could be introduced at the in-service teacher-training stage so as to be exposed to the concepts of sustainability. Surprisingly, Komal, Sandia and Ritika had never heard about LFS before I introduced to them this research project. On a brighter note, Nirma as a senior teacher like Vijay, conceded that LFS was introduced through the content of textbooks in the upper primary phases (Grade 5 and Grade 6).

Teacher training thus poses difficulties for context and sustainability pedagogy. The salient feature emerging from the data analysis clearly denotes inadequate teacher training that acts as a drawback for the successful implementation of LFS (c.f. 3.13.5). This finding is consistent with Waltner et al. (2020) and Miedijensky and Abramovich (2018) who suggest adequate teacher training on sustainability for teachers. Natkin (2016) also postulates that teacher training is very crucial for teaching LFS. However, the MIE mandated by the MoETEST for teacher training and teacher development claims that ESD was implemented at the institution as its strategic plan 2007-2014 which has set out its SD Agenda. Far back in 2008, the MIE had been very active in promoting "ESD activities related to curriculum development, educational research and outreach, and community engagement". Furthermore, ESD has been mainstreamed in several teacher education programmes at the teacher training centre.

5.5.3.5 Synthesis of theme

The findings in this theme indicated that there were many factors that restrict the proper enhancement of LFS in primary schools. Firstly, there are situational and institutional barriers that hinder the teaching of LFS. This was evidenced by the barriers caused by parents, teachers, and the school management in the proper teaching of LFS. Also, participants stated other barriers such as the education system and inadequate teacher-training pertaining to LFS in primary schools. It was also found that the above barriers also hinder appropriate change in behaviour towards sustainable living and healthy futures. Pompeii et al., (2019) propose that all these barriers should be overcome so that effective LFS can be enhanced in schools where learners will be able to grasp the knowledge and be ready for the required change.

5.5.4 Theme Four: Teachers' Perception and Engagement of Learning for Sustainablity (LFS)

Teachers' perceptions of the importance of teaching ESD play a vital role regarding their attitude towards ESD (Maidou et al., 2019). Nousheen et al. (2020) also noted that teachers perceive the importance of teaching LFS as being very relevant to their learning. As such, gaining an insight of the perspectives and engagement of the teachers on LFS was very useful for this AR study. Further, from the data analysis this theme (4) emerged and generated the following sub-themes: initial teacher-preparation for LFS, teaching LFS and teacher engagement, and enhancement. Mostly, the semi-structured interviews, pre- and post-lesson meetings, and document analysis from teachers' reflective journals were analysed to reach conclusions.

5.5.4.1 Initial teacher-preparation for LFS

According to Green and Somerville (2015) and Evans et al. (2012), teachers are prepared to teach sustainability education but because of the lack of appropriate knowledge, confidence and skills they failed to implement them properly. Through my observation and data analysis, I deduced that four of the six participants did not have much knowledge about sustainability and that is why they could not plan and conduct a comprehensive sustainability lesson effectively. They demonstrated a fear for teaching the class 'incorrectly' in my presence while observing their lessons. The teachers attempted to seek reassurance from me that they were conducting their lessons properly; but based on ethics, I was not in a position to respond to their apprehensions. This proved that teachers were not confident in their teaching approaches which reflected in their lessons. For instance, Ritika was not equipped with teaching aids such as

charts, pictures, and live specimens to energise her lesson despite having included them in her lesson plan. Komal confessed the following:

> **Komal:** *These things were not taught in teacher-training. This was not my field of education, and that is why I am not much aware and interested in sustainability.*

Ruduilla, a novice teacher, wanted to choose a topic closely related to my subject of interest which was LFS. So, she deliberately chose a topic that she had already covered during the first school term of the year. According to her reflective journal entries, she chose the topic *'keeping our environment* clean' from the learners' textbook. She reflected that while she was teaching in cycle one using the above topic, she thought it would be an occasion for her learners for a quick class revision of the different concepts already taught. Rudilla and Sandia prepared their lessons before coming to the class. Since LFS is a complex subject, it needed concrete hands-on and interactive activities. Learners were expected to practise these activities regularly so that they become habituated to them to sustain the environment. Komal, who had chosen a very interesting topic on *honesty* described the following intention:

> **Komal:** *I wanted to inculcate moral values in my learners; something that each citizen needed in life. For this, I used the story-telling strategy for the first part of the lesson after which we critiqued the story, and finally screened a short film on honesty.*

Komal taught her class without introducing any innovative strategy to impart the principle of honesty to her learners, but by screening the film on honesty and narrating the story from time to time, she indirectly inculcated honesty as a profound value of the social and physical world. Sandia introduced the topic, *making your own compost bottle* where the teacher and her learners showed a lot of enthusiasm in the lesson, but most importantly in LFS concepts. Sandia introduced the concept of utilising natural resources and sustaining a non-toxic environment by reducing waste production and toxic emissions into the atmosphere. Vijay chose a topic in Science that he was already covering in class: *materials in the environment*. So, for Vijay, it was a continuation of his scheme (plan) of work for his normal class lessons which was in no way a hindrance to participating in the action research.

Ritika had chosen a topic that she thought would best align to my research objectives, and would be close to my field of study. The topic presented by her was on *climate change*. Nirma

was also very anxious as to which topic to choose for the first action research cycle. According to her reflection as per her reflective journal entries, her choice of topic related to LFS where she would demonstrate a better understanding of LFS.

According to the data generated and trends in teachers' perceptions, participants were not well-equipped with baseline content and pedagogical knowledge regarding LFS and sustainability issues despite them being present in the NCF. They needed to have sound pedagogical content knowledge to prepare their lessons thoroughly to present them to the learners. Moreover, it was observed that teachers tried to achieve the objectives of their lessons, but they were not successful in attaining them. This finding is consistent with Maidou et al. (2019), Evans et al. (2012) and Redman (2013) who agree that the lack of thorough lesson-preparation and deep knowledge and understanding of sustainability were significant barriers in implementing LFS. Importantly, the transition towards sustainability requires teachers with skills to implement sustainability practices as they are ideal agents positioned for change (Redman, 2013). Lastly, it is critical that teachers possess intrinsic motivation to grasp relevant knowledge to prepare their lessons for transformative change.

5.5.4.2 Teaching of Learning for Sustainability (LFS)

Valderrama-Hernandez et al. (2020) note that teachers are responsible for preparing future generations to face the challenges precipitated by current unsustainable developments. Vijay elaborates:

> **Vijay:** *We need to upgrade ourselves so that we can embed this knowledge in the young ones who are the adults of tomorrow. This knowledge should be modelled by the teachers at school so that learners are motivated to ingrain them.*

Ritika who stated that after the ARC one, she explored strategies she could apply to teach her class innovatively. She surfed the internet on how to teach LFS topics effectively. This affords teachers the opportunities to improve their teaching skills regarding LFS by learning new skills and knowledge to enhance their lesson presentations. Ritika articulated the following:

> **Ritika:** *After the first class, I felt that I needed more knowledge on LFS, and about ways to inculcate good habits in my learners. I wanted my learners to be good citizens*

of tomorrow. After I conducted the first class on LFS, I kept surfing the internet looking for information related to teaching strategies on sustainability issues, and general ways to teach my learners much better.

Ritika who screened a film on *honesty*, kept on referring to aspects of the movie from time-to-time. At the beginning of the lesson, she asked the Grade 2 learners the following:

Ritika: *What is honesty?*
Ritika: *What do you understand by the term honesty?*
[No response…..then after some time a learner responded]
Learner: *We must speak the truth.*

The teacher (Ritika) lectured to her learners on honesty, and the advantages of being honest. She also lectured on climate change but the class was not interactive as shown in the following extract:

Ritika: *Climate change impacts positively or negatively on the world?*
Ritika: *How does climate change impact on the world?*
[No responses were received from the learners]

Ritika: *Ok, make an effort please!*

The findings revealed that there was a limited understanding of the teaching of sustainability concepts in education, and that the participants lacked content, pedagogical knowledge, and experience in this area (Shah et al., 2022; Walter et al., 2020). Moreover, the teaching was not relevant to the 21st century education system as traditional teaching methods were mainly favoured. Out of the six participants, no one could accurately list the different teaching strategies to teach sustainability concepts. Thus, they were not able to address LFS efficiently. Ferguson et al. (2021) corroborate this finding when they claim that teachers try to implement LFS during lessons, but are not able to teach sustainability concepts to the learners. Shah et al. (2022) opines that teachers are to some extent unable to address LFS. Natkin (2016) also found that teachers lacking knowledge of sustainability issues are unable to address such issues in their classrooms, and thus recommend appropriate teacher-training for the teachers. With this

type of static learning, learners could not grasp LFS knowledge and concepts which could act as a game-changer for a sustainable future. According to the data generated, teachers' perceived knowledge was quite limited on LFS, and was not much stated in the prescribed schoolbooks. There is a dire need to mainstream LFS at all levels in the school, in addition to upgrading teachers' content knowledge so that they could better enhance teaching LFS in their classrooms.

5.5.4.3 Teacher-engagement and enhancement of Learning for Sustainability (LFS)

It was deduced from gathered evidence and analysis, especially pertaining to the semi-structured interviews that Sandia and Nirma consented to participate in this research because they could not refuse me. Their journals reflected their fear of not contributing positively to the progress of the ARS. The following is Sandia's response:

> **Sandia:** *Oh! Really …* [laughs]*… No, but I thought I was not covering the topic directly when I was preparing the lesson plan for the action step for the learners.*

According to Ritika, the reflective journal helped her very much to plan a full lesson for her first cycle action step. She was able to situate herself within the research's process. She pointed out that the reflective practice was something very interesting, as it was important for her to develop her own understanding of LFS. Regarding Komal, who was not at all confident about the way the reflective journal had to be updated and written, she expressed her concern that she might be off the track with the points she was writing down, but she could help me (researcher) gain an insight into what the actual situation was during the planning step. In contrast, Vijay was confident and ready for the start of the research as stated in his following comments:

> **Vijay:** *I am ready to be part of the project where I can find myself upgrading my knowledge and understanding of LFS in context of the AR study…. will be able to develop my enhancement due to my new understanding of LFS…benefit my learners.*

All the participants reflected along the same lines as they realised that eventually their learners would benefit from the project. They were unaware that this was an objective of the research which was to reflect on participants' understanding and enhancement of LFS. Although it was evident that all the teachers were dedicated to their profession, their level of enhancement of

LFS was very limited. As perceived by the teachers, LFS being a 'hidden' component in the curriculum, was sometimes 'marginalised' and not highlighted as a priority. Vijay's comment follows:

> **Vijay:** *LFS should be a subject where all the concepts and facts should be taught directly. Learners must be able to know what their learning objectives are.*

Three out of six teachers were engaged in teaching LFS even though all the teachers were aware and concerned with sustainability issues in the world. They knew that the children should be sensitised and motivated about global issues to engage in meaningful actions, and that 'sustainable' behaviour should be instilled in them from the beginning of their schooling. Because of the lack of content, pedagogical knowledge, and relevant skills to enhance their teaching in LFS, Ritika stated the following:

> **Ritika:** *I know I don't have enough knowledge in LFS to be able to inculcate it in my learners, but I do my best when I teach them. I do a lot of research to find out how I can conduct my lessons better so that my learners can gain maximum out of it.*

Rudilla, Sandia and Vijay were able to some extent enhance LFS in their lessons, but they claimed that during subsequent classes they would be able to further enhance their newly constructed knowledge gained during cycle one. The other three participants, through their surface learning approaches and traditional methods, unfortunately did not enhance LFS to the extent that learners were not responding to their lessons' aims and objectives. The data revealed tha the teachers were engaged in their teaching of LFS, and tried their best in enhancing their understanding, but they could not do it successfully because of the sparse content, knowledge, and teaching skills regarding LFS. Some of them were in their latter years of teaching so they were not keen to learn new strategies to implement in their classrooms (Shah et al., 2022). Gamage et al. (2022) agree that different models for learning and teaching must be applied to foster learners' interest, and enhance their skills and capacities in critical-thinking. Similarly, Natkin (2017) proposes that teachers should reflect on their teaching instructions and transform them to deliver better and interesting lessons to the children.

5.5.4.4 Synthesis of theme

This section highlighted the different perceptions of teachers regarding LFS, and the extent of their engagement regarding sustainability. It comprises of data obtained from initial teachers' preparation, their teaching of LFS, and teacher engagement and enhancement of their understanding of LFS. It was found that experienced teachers could engage themselves and enhance their understanding of LFS in their teachings to some extent, while novice teachers who lacked teaching experience were not aware of LFS and thus could not engage fully in it. Moreover, if a teacher is not fully engaged in teaching an aspect of LFS, it has detrimental effects on the learners. Also, applying traditional teaching approaches in the 21st century to teach LFS, is unproductive as learners become bored. As life continues evolving, teachers should also evolve to become lifelong learners and transform their teaching styles to adapt to the requirements of 21st century learners. Pompeii et al. (2019) suggest that teachers should identify and reflect on their shortcomings, and overcome them accordingly. Lastly, once teachers have positive perceptions of LFS, they would start engaging themselves willingly in LFS endeavours.

5.6 CONCLUSION

In this chapter (5), insights into participants' understanding and enhancement of LFS were interpreted in line with the different themes that were identified in data analysis processes. The data analysed facilitated in answering the first research question: *What is the teacher's understanding and enhancement of LFS in Mauritian Primary Schools?* The chapter also described the different phases of the AR where data from semi-structured interviews, meetings during pre-lesson planning, classroom monitoring, documents perusal, and post-lesson meetings was analysed. This established teachers' understanding, and how they attempted to enhance their understanding of LFS. Further, the reflective journals were analysed and discussed prior to the commencement of planning the next ARC.

Additionally, the reflective journals were invaluable tools to measure participants' thoughts in ARC one. However, not all participants were able to keep up-to-date reflective journals, while some had written summarised versions of all the important aspects regarding AR. Most of them had written the salient features and details of their plan during our semi-structure interviews and pre-lesson meetings. Teachers reflected that during the semi-structured interviews they gained deeper insights of LFS, including new trends in research and development concerning

SD and ESD. A perusal of the different themes which emerged during cycle one, resulted in concluding that teachers had superficial perceptions of what LFS entails. Later (in cycle one of the AR), that they had to change their their mindsets and acquire deep knowledge of LFS. Some teachers displayed sincere interest in the study but at different levels of understanding LFS. They were willing to experience the next cycle where the emergent themes and sub-themes that explored how teachers' understanding shaped their enhancement of LFS. The next chapter (6) presented the findings, interpretations, and discussion related to cycle two of AR.

CHAPTER SIX

FINDINGS, INTERPRETATION, AND DISCUSSION: CYCLE TWO

6.1 INTRODUCTION

In chapter five, teachers' understanding of LFS was established during cycle one of the AR through different data generation methods. It presented the research findings from the data sets, followed by the discussion of themes. These themes emerged as responses to the first research question: *What is the teacher's understanding of LFS in Mauritian primary schools?*

This chapter (6) reviewed cycle two of the AR which was executed by teachers after having upgraded their knowledge and experiences from cycle one. In cycle two of the intervention phase, action and observation steps were involved (as mentioned in chapter four). The pre-intervention meetings were conducted across the planning and action steps to discuss the implementation of the lesson plans prepared by the teachers for cycle two (same as presented and discussed in chapter five).

Meetings between the teachers and myself were organised during the planning step to prepare for the action steps of the intervention phase. It was noted that teachers were able to express their reflections on the intervention phase and the post-intervention between each cycle. The findings were discussed according to the type of research tool or strategy used. In this cycle, teachers were much more organised to be able to plan their lessons more effectively. They used different strategies such as the deep approach to learning, holistic learning, problem-based learning, experiential learning, and action and transformational learning to deliver their lessons. Document analysis, reflective journals, interview and observation schedules, and meeting outcomes throughout the planning-action-observation-reflection steps were relevant in responding to the second research question: *How does teachers' understanding of LFS shape their enhancement in Mauritian Primary Schools?* These processes also assisted (partly) in answering the third research question: *Why do teachers enhance LFS the way they do?*

6.2 ACTION RESEARCH: CYCLE TWO

Cycle two of the action research was similar to that of cycle one where teachers prepared their lesson plans. The pre-lesson meetings were held during the planning steps prior to the

commencement of cycle two. The teachers' reflective journals revealed that all of them were unanimous in that they needed to engage in another cycle of the action research. They underscored the need to utilise different teaching approaches and methods to enhance their teaching of LFS. Accordingly, these were adopted (and adapted) in their second cycle lesson plans. This revision of constructed meanings and understandings of LFS implied that the plan for cycle two overlapped with that of cycle one.

6.3 FINDINGS, INTERPRETATION, AND DISCUSSION OF CYCLE TWO

After the conclusion of cycle two, all participants were interviewed again individually. The intention of the interview was twofold: firstly, to understand the experiences and challenges they faced during the action research study; and secondly, how their understanding shaped their enhancement of LFS. My role during the final interview was as a researcher sharing and probing relevant issues. During the interview, I asked each of the participants to share their experiences, especially what they liked and disliked about the research. They had to peruse their reflective journals to share their experiences with me. Table 6.1 below indicates the different themes that emerged from the thematic analysis in ARC two.

Table 6.1: Thematic analysis in Cycle Two

Thematic Analysis: Cycle Two			
Data generation	**Coding (Sub-themes)**	**Theme**	**Outcome after Cycle Two**
• Semi-structured interviews • Document analysis • Classroom observation	• Teachers' knowledge of LFS • Teachers' attending to LFS in classroom activities regarding LFS • Participation in LFS	Theme Five: Understanding LFS	How do teachers construct their understanding of LFS?

• Pre- and post-lesson meetings Reflective journals	• Deep Approach to Learning • Holistic Learning Approach • Experiential Learning • Problem-based Learning • Action/Transformational Learning	Theme Six: Innovative Approaches to LFS	How do Teachers engender change to shape their understanding of LFS in their lessons?
	• Situational/Institutional Assistance and Support • Enhanced Educational System • Need for Management Support • Mainstreaming LFS in Teacher-training	Theme Seven: Strategies to address LFS	In what way do teachers shape their enhancement of LFS?
	• Initial Teacher-preparation of LFS • Teaching of LFS • Teacher-engagement and Enhancement of LFS	Theme Eight: Teachers' Perception and Engagement regarding LFS	Why do teachers shape their enhancement the way they do?

6.3.1 Theme Five: Understanding Learning for Sustainability (LFS)

In the previous cycle, it was revealed that the participants possessed limited understanding of LFS, while some had never heard or read of the term *LFS,* and some did not pay attention to LFS before. As teachers' understanding of the concept sustainability impacts on their way of engagement and enhancement in the classroom (Svenkerud et al., 2020), teachers need to upgrade their knowledge of LFS to enable learners to adopt wise decisions for future sustainability. In cycle two, teachers inquired about LFS and researched ways to teach LFS

effectively. This knowledge of concepts and strategies assisted in conducting another lesson to demonstrate teachers' new understanding and enhancement of LFS.

6.3.1.1 Teachers' perceived knowledge of Learning for Sustainability (LFS)

The pedagogical content knowledge of sustainability and LFS are inseparable as they influence our daily existence. Primary school teachers comprehend that LFS concerns are complicated, intangible, and require appropriate teaching and pedagogical techniques to teach (Taylor et al., 2015). Knowledge is an intrinsic tool in understanding LFS. During the semi-structured interviews, teachers were asked what their knowledge about LFS was, to which three out of six affirmed having heard about LFS from various sources. Teachers had acquired relevant knowledge of LFS after the action research study, as witnessed in their reflections. At first, they felt that LFS was not directly related to their field of teaching as half the number of them indicated that they had never heard of LFS. They felt that it was a challenge to implement sustainability issues and topics within the school environment (Green & Somerville, 2015). One of the participants voiced the following:

> **Sandia:** *I never thought that LFS could exist in cross-curricular ways and therefore could be taught across the curriculum in any subject. Now, after some research on LFS, I can see how ignorant I was.*

It is not surprising that LFS relies heavily on how teachers teach as it is not included directly in their curriculum. Teachers' knowledge was greatly developed during the action research study as they could easily include various teaching methods and strategies such as transformative learning, active learning, critical questioning, participatory learning, and place-based learning, amongst others. In so doing, learners will be more responsive to sustainability challenges. This became noticeable at the school where I teach as I observed that there was a lack of sustainability culture, one of the components of the whole-school approach. For example, learners continue littering the schoolyard and playgrounds even if bins were provided at convenient locations within the school campus.

Additionally, the findings also revealed that teachers were initially not interested in the practice of teaching sustainability (Manasia et al., 2019). However, after cycle one was concluded, they were more confident and amenable to integrate sustainability components into their lessons. Nirma's understanding of LFS was concerns about what she could do during her daily routines

to help protect the environment, to live and work in cleaner spaces where there is no pollution, and to secure a better future for generations to come. She articulated the following:

> **Nirma:** *We give learners examples such as we must not cut down trees as they give out oxygen, embellish our environment, and they serve as habitats for many types of animals. We also tell them that we must continue to make effort to protect our environment, and to maintain the cleanliness of our surroundings.*

After the completion of the two cycles, teachers pledged their enthusiasm and commitment to teach LFS more effectively as they felt more empowered to enact sustainability in the school environment. The data revealed that in cycle two, teachers were more acquainted with the term *sustainability* and were able to relate and integrate it in all the subjects they taught. They also became more engaged in the teaching and learning processes. According to Dash and Mohan (2017), teachers' inability to merge the practical aspects of sustainability with their theoretical knowledge was a major factor obstructing sustainability teaching-learning at school. In support, Agirreazkuenaga (2019) confirms the dire need for proper knowledge and training on the use of relevant teaching methodologies and strategies to engage learners based on their level of understanding concepts of sustainability. Svenkerud et al. (2020) concur that teachers' understanding of concepts of sustainability influences the way they teach so that they promote meaningful living in a healthy society. This may result in improving behaviour and attitude, while acting as a vehicle for positive transformation such that learners realise the value of survival in a sustainable world.

6.3.1.2 Teachers attending to Learning for Sustainability (LFS)

In consideration of Rudilla's vision that addressing LFS is essential, and that LFS should be included in the mainstream curriculum, and not executed cross-curricularly as is the present case. Rudilla emphasised that teachers should try their best to incorporate LFS in their lessons. The frequency at which LFS themes were addressed in class was heartening, but this depended on the topic that was being taught. For example, if a topic was directly related to LFS, like *taking care of myself* or *counting*, this would infuse concepts related to LFS in a way that learners could relate to. Rudilla also suggested practical hands-on approaches such as active class discussions or taking learners outside to discover the world by themselves. Further, Rudilla criticised lecturing to young learners who would become boring; combining the lessons

with practical and contextual work outside the classroom would generate a deeper understanding. This was demonstrated when she engaged learners in practical sessions where active learning occurred.

Komal claimed that she taught sustainability but without realising it. According to her, she taught sustainability in Grade 1 during virtually every lesson, and upgraded it to a higher level in Grade 2. When she taught values and ethics in Grade 2, she was also inadvertently and simultaneously teaching LFS where learners learnt to live harmoniously among themselves and society. Komal further claimed that healthy eating habits and a balanced meal formed part of LFS. During these lessons, learners were taught to eat nutritious food to stay in good health by avoiding eating oily, sugary and junk food for a sustainable living. The teacher also mentioned that learners would be exposed to such good habits at school and, in turn, they themselves raised awareness at home which eventually advantaged society at large. Komal also mentioned that most of what is taught in the curriculum currently contains components of LFS. She pointed out that when learners learnt mathematics, they also learnt about aspects of LFS.

Sandia was involved in an NGO aquaponics project at school. Her exposure to the project provided her with an opportunity to adapt her lessons by incorporating LFS elements across her lessons. She liked the concept very much and used it regularly in her lessons to promote environmental sustainability and healthier lifestyles. She elaborated:

> **Sandia:** *I teach them that using the compost bottle to grow our own crops can help us to improve our health. We should eat healthily. We can also get fresh vegetables uncontaminated by pesticides. I also teach children that we can use plastic bottles at home to grow our own vegetables, and at the same time we are reducing plastic pollution.*

The above evidence established that Sandia instilled in her learners ownership and responsibilty concerning nature and the environment by demonstarting that all of us can contribute to LFS. Her understanding of LFS and the use of resources motivated us to use use fewer resources in our daily lives without putting pressure on our environment, and thereby reduce our ecological footprint (Hacking et al., 2010; Wals & Benavot, 2017).

As far as Vijay's contribution in addressing LFS was concerned, almost every Friday afternoon, his learners went out to the playground where they performed activities and discussed sustainability. Vijay would then let them play a little to relax after being a whole week at school. Other methods Vijay used to raise awareness of sustainability issues and LFS concepts follow:

> **Vijay:** *To raise awareness we have the media, and we have photos and images from the web which I download and show to the learners. Almost every day, I talk to learners about aspects of LFS … I get feedback from them, and sometimes they give me some information concerning sustainability.*

Nirma advocated other methods that coul be engaged to determine if learners have understood the lesson: brainstorming and activity-based research where learners surf the the internet and read books; they come back to clas and report on information gleaned from such sources. Nirma boasted that she had many opportunities to talk about LFS in class; for example, the recent Wakashio shipwreck, which many children knew about because they saw it on the news, and heard about it on the radio. The children learnt about many challenges concerning the impact of a shipwreck on the environment, especially how it severely damaged the ecosystem.

Consequently, it was revealed that teachers were better able to address LFS in their classrooms in cycle two. They attended to the concepts in such a way that learners were able to provide an understanding of them at the end of the lesson. This finding set to rest the notion that teachers had only a partial or fragmented view of sustainability. I assert that teachers must update their knowledge via research, interaction with knowledgeable others (KOs), social media, and experimentation to be able to address LFS successfully.

6.3.1.3 Classroom activities in Learning for Sustainability (LFS)

According to Kuzich (2019), teachers use different strategies to convey knowledge about sustainability issues in primary schools. However, during cycle one, teachers were unable to design concrete classroom activities or outdoor activities regarding LFS, as they had time-constraints and faced red tape. Nirma added the following at the interview:

> **Nirma:** *A lot of classroom activities can be used to teach environment and sustainability issues.*

The above response by Nirma is ironical as classroom activities related to sustainability were not visible in her lesson-delivery as she continuously used the lecturing style of teaching.

According to Rudilla, often while conducting class activities the message may not conveyed to all the learners in the same way. Some understood it, whereas others did not. When she saw a learner coming from outside drenched in water, Rudilla knew that the learner had wasted water. If a child threw litter onto the floor, the others admonished him/her or even picked it up themselves. For them, it was through these small actions that they learnt about sustainability. Rudilla could not determine exactly if learners had understood LFS, but it was visible in small actions such as not wasting water. She was hopeful that change would occur gradually. Rudilla elaborated:

> **Rudilla:** *Every day I tell learners to go outside to dry themselves when they come drenched into class. Little by little, they will be sensitised as this cannot be learnt immediately. When they grow up, they will eventually understand it through practice.*

During the interview, Komal claimed that correct eating habits also formed a significant part of LFS, which comprise of topics such as *eating* and *health*. If a population is not in good health, then there will be no development occurring - development should occur so that life and the economy could thrive. Komal elaborated:

> **Komal:** *An educated population will help in the development of the country, and if we do not motivate our learners to go for further studies like tertiary education, then there will be no development which will negatively impact the economy.*

The feedback that Komal received from the learners proved that the message had been conveyed to them. Komal added:

> **Komal:** *Learners tell us their ambitions, what they want to achieve, and what they want to be like. I tell them that that even being a labourer is important as it forms part of the economy, but we also aim higher. Learners say that they like big houses and big cars, so I tell them that they will not get them easily. They should work hard for these luxuries, so they become motivated by this. Through this motivation, learners see an improvement in their studies.*

So, when delivering these lessons, learners get inspired towards achieving their goals. Komal continues:

> **Komal:** *LFS is easy, I can do activities where I can involve parents at school, and talk on these topics, and link them with the education of the learner. It can also be brought up within society by talking about it, raising awareness, and informing people. With the approval of the government teachers can go outside the school and inform people about LFS and sustainability in general.*

In Vijay's opinion, the school is doing its best to meet the requirements of LFS by providing resources to achieve sustainability objectives. He elaborated:

> **Vijay:** *Teachers already have access to the internet, but I think that the control is very strict, and we cannot run certain programmes that are important. I am not saying there should not be any control, but if it would have been a little more accessible, it would have been a little better. For example, YouTube contains a lot of educational videos, but teachers cannot use YouTube at school, and besides internet, I do not see any more resources that the school can give us.*

Ritika discovered that while conducting and engaging herself in LFS in classes, she was improving herself and learning new things at the same time. She stated:

> **Ritika:** *Educators are improving despite being a teacher and an adult as our level of perception is different, but we have learnt something important which how a child sees life. Sometimes we think we have a reason for our way of perceiving, and our way of teaching, but it is also from children that teachers learn sometimes. It is not one -sided teaching, it is reciprocal.*

The above means that when Ritika was teaching LFS, she understood its content but went on to learn new things that she perhaps did not grasp before. She stated:

> **Ritika:** *Yes, I learnt new things while performing activities in class such as role-playing, using photos and videos on the projector, and through games that I have learnt at the MIE. I have guided activities where learners learn how to clean their*

environment. I also address LFS through comprehension passages in English and French, but mainly in Science and History/Geography. For example, I teach climate change, sustainability itself, and many more topics. Learners also view films using media via the projector, or they can even engage in some outdoor activities. For classes like Science and History/Geography the class goes out into the schoolyard for observations.

Nirma lamented that the school lacked management support and resources to conduct classroom activities in LFS. For instance, outside, in the hallway there was a bin only for plastic waste. She wanted to know why there were no other separate bins - one for waste papers, another for for waste metals. This would enable the learners themselves to do the sorting of waste materials. This implied that there was no concept of waste-sorting, as recycling of waste materials such as paper and metals were not evident. It was also disappointing to notice the lack of a garden corner where children could grow plants by themselves such that they could have their own taste of nature. Nirma commented:

Nirma: *No…unless a teacher is doing it in class and gives special attention to sustainability, the learners will not be motivated to do it by themselves.*

Disappointingly, there was no initiative from teachers or learners to initiate a project to protect the environment. Although data revealed that the participants learnt about strategies to teach LFS more appropriately to be able to design classroom activities to foster transformation in the behaviour of the learners, this finding was inconsistent with what was observed. Watson (2017) emphasised that principles taught about LFS should be expanded beyond the classroom and whiteboards, and that active learning should be promoted to improve learners' development of critical-thinking skills. Similarly, Zibell (2013) also pointed out that outdoor lessons will be more appropriate to teach LFS, while Svenkerud et al. (2020) criticised teachers who have limited content knowledge as they would not be able to enhance their teaching of LFS (Evans et al., 2012).

6.3.1.4 Participation in Learning for Sustainability (LFS)

Teachers' participation in LFS demonstrated their care and interest in their learners' lives. According to Komal, learning occurs in a reciprocal way as teachers also learn from their learners. Komal concluded that experience was bringing change in her teaching approaches,

and that she was discovering innovations to enhance her own teaching of sustainability aspects. She stated:

> **Komal:** *Yes, I am upgrading my knowledge. When I was in primary school, I learnt about multiplication, but I understood multiplication when I started to teach multiplication. When I learnt about LFS, at that time, I did not really understand it, but now I can finally teach it through experience.*

When Sandia was asked about how she can contribute to LFS advancement and enhance her teaching, she responded as follows:

> **Sandia:** *Oh yes! The class can come in front of the school assembly to talk on issues such as keeping our schoolyard clean. That's really an enjoyable activity. I can also take my class to regularly visit the school yard to teach them about good habits to practise in their homes and to share the knowledge with their parents. I can also use the same notion of composting or compost-bottle-gardening to share with learners who in turn will share this knowledge with their families. It gives learners a good feeling that they are sharing things at home which they have learnt from school through lessons in their classrooms.*

The above new understanding was used to enhance lessons so that the learners benefited from them. Hence, thorough and innovative lesson-planning as well as the appropriate utilisation of available teaching aids, tools, and resources were used to conduct the lessons. Notably, Sandia also learned from the learners' experiences. Her comments follow:

> **Sandia:** *Activities can be organised to go outside for observations, as teachers do not really have much access to media as videos cannot be projected in schools to show the learners, which is a big downside. I tell the learners to go and look something up on the internet, but I cannot be sure if learners are really doing it. There should be talks about the matter and specialists should come to the school frequently to raise awareness about sustainable development to everyone. They should come and do presentations on the subject.*

When asked if learners grasped the new concepts of LFS during lessons, Sandia responded:

> **Sandia:** *Yes, sometimes by their response while I am questioning them. But if they do not respond or if the class is silent, then I can reach the conclusion that my learners and I need to revisit the topic. At the end of the lesson there should be learning that should have taken place.*

At this stage, the participants became more comfortable to conduct their lessons, while the learners seemed motivated by the teachers' participation in LFS activities. The data revealed that teachers used new knowledge from their own experiences to promote livelier and more responsive learners which interested the learners during their lessons. This finding is consistent with Watson's (2017) who points out that the active engagement of teachers and the learners is crucial in LFS. Suarez-Lopez and Eugenio-Gozalbo (2021) also conclude that teachers' participation motivates learners in many ways. Evans et al. (2012) posit that teachers who upgrade their content knowledge on sustainability participate fully in the class activities to motivate learners to become more engaged in lessons.

6.3.1.5 Synthesis of Theme

This section summarised teachers' understanding of LFS. Compared to cycle one, the teachers could now elaborate on LFS, and explain how they conduct their lessons using different classroom activities. Watson (2017) advises that learners should be taught by using active teaching-learning strategies combined with the teacher's incisive understanding of LFS which is crucial.

Teachers' engagement and active participation in class activities are critical in the education of learners (Grove, 2019). This can only happen when the teachers have an appropriate and accurate understanding of LFS. Since there is no appropriate training given to teachers on LFS, it becomes difficult for them to integrate sustainability in their lessons (Shah et al., 2022). When teachers possess accurate content knowledge, they become confident in their teaching - then no one can challenge them for not imparting the relevant knowledge adequately (Evans et al., 2012). Svenkerud et al. (2020) affirm that LFS is not a novel phenomenon but an innovative way of thinking that all teachers need to implement in their daily teachings. Hence, teachers should upgrade their knowledge of sustainability by themselves, or training sessions can be

arranged by the Ministry for teachers to strengthen their knowledge of LFS to achieve the goals of sustainability.

6.3.2 Theme Six: Innovative Approaches to Learning For sustainability (LFS)

Pahnke et al. (2019) recommend that teachers should be encouraged to apply inquiry-based learning and scientific thinking among learners. Pahnke et al. (2019) favour interactive teaching which encourages exploratory, reflective, action-oriented, and transformative approaches for teaching sustainability. Watson (2017) and Kuzich (2019) confirm that it is the best way to inculcate LFS values and skills in learners. Teachers were advised to transform their teaching methods to effectively address LFS in their classrooms; consequently, the participants applied innovative techniques in their lesson presentations which turned out to be very rewarding, according to them.

6.3.2.1 Deep Approach to learning

After the first presentation of lessons in cycle one, the teachers were convinced that they needed to enhance their LFS content knowledge to be able to make their future lessons interesting, interactive, and successful. Consequently, before the commencement of cycle two, intensive research was executed as articles were reviewed and suggestions from experienced teachers were appreciated by the participants. All participants attempted to demonstrate their understanding of LFS in the second cycle. Various learning strategies such as groupwork, role-play, and discovery-learning, among others, were applied to teach LFS. Aharony (2006) describes the deep approach as the capacity to correlate the new and previous knowledge to obtain a holistic picture to look for meaning and connections.

Through observation during action cycle one, I noticed that Rudilla used the deep approach to learning. She remained very enthusiastic while teaching her learners, even if she was not thoroughly familiar with her topic. The learners were enjoying the lesson while interacting freely. All the learners were showing great interest in the lesson. While conducting the lesson on the topic of *keeping the environment clean*, the learners deduced for themselves that throwing rubbish around was not a responsible and hygienic habit. Rudilla's lesson proceeded as follows:

> **Rudilla:** *Ok, learners! When you like your playground, your classroom, how do you keep them?*

Learner: *Clean.*

Rudilla: *When I sharpen my pencil, do I throw the dust on the floor of our classroom?*

Learner: *No, no, no… our classroom will become dirty.*

Rudilla: *So, where do we go to sharpen our pencils?*

Learner: *At the dustbin.*

Rudilla requested the learners to observe the schoolyard, where they made inferences and deduced for themselves that the schoolyard was beautiful when kept clean. Ritika took the learners outside the classroom to demonstatre how hot it was which enabled learners to realise the rise in temperature which related to an aspect of global warming. Nirma was also instrumental in describing the concept of LFS in her French language class. This led to the writing of a short narrative on oil pollution of the sea. Sandia optimism is expressed below:

Sandia: *It's amazing! Hands-on activities regarding LFS helps a lot in grasping the necessary concepts and understandings. It is not like in the class, where teachers must explain a lot so that the learners grasp the message conveyed to them through the different concepts. Sometimes teachers do not even realise what is being taught. By taking learners outside, they were able to express their concern at littering, and began picking up the plastic bottles which caused pollution.*

Also, Vijay applied the deep approach in his class while teaching. He taught learners how distinguish between an object and a material. It was clear that Vijay was very fond of teaching his learners and he thoroughly knew the subject matter. The lesson on the environment and materials was conducted by using the questioning method which indulged the learners in critical-thinking to find solutions. Vijay articulated the following:

Vijay: *What do you understand by the term environment?*

Learner 1: *The surroundings where we live…*

Vijay: *Give a description of the environment.*

Learner 2: *All things around us.*

Vijay: *So, everything that we all can see around us forms part of our environment. Now when I speak of materials, what does that mean?*

Learner 3: *Things we need to build something.*

Learner 2: *Building a house.*

Learner 3: *We need concrete stones, blocks, bricks, cement, and steel.*

The participant-teachers who conducted thorough research on the topics to be taught, grasped the content knowledge fully during this second ARC. This was also visible in their lesson plans. There was a deliberate transition from cycle one in the teachers' approach of conducting their lessons, and how they enhanced LFS. They were apparently thoroughly prepared, and appeared to know much more about LFS having gathered ideas from the first cycle experiences. They achieved their lesson objectives, while the learners were responsive and actively engaged during lessons. Assisted by the deep learning approach, participants could now conduct their lessons meaningfully and successfully. This finding is consistent with Pahnke et al. (2019) and Tularam and Machisella (2018) who suggest that teachers should adhere to innovative strategies to successfully teach LFS. Watson (2017) confirms that active learning and the deep learning approach in LFS fosters the development of critical-thinking in learners.

6.3.2.2 Holistic Approach to learning

Johnson (2012) describes holistic learning as a philosophy that attempts to investigate the question of fragmentation and compartmentalisation. It aims at learners seeing things in terms of the whole instead of discrete parts. UNESCO (2015) reports that holistic learning activates the learner's emotions, imaginations, intellect, and body for more an efficient and comprehensive learning. Consequently, according to my observation, Rudilla, Sandia and Vijay were able to successfully teach lessons through the holistic learning approach. They successfully activated the intellect and emotions of the learners such that the class activities became very interesting. For instance, Rudilla asked learners to pick up litter in the class, as learners realised the value of a clean environment. Rudilla's class activity follows:

Rudilla: *Is it right that these bits of papers and pencil dust are on the floor like this?*

Learner 1: *No, teacher.*

Rudilla: *What should we do?*

Learner 2: *We must not throw rubbish in the classroom.*

Rudilla: *All right, who will pick them up?*

Learner 3: *Me, me, me…*

Sandia, while conscientising learners about the importance of natural resources, asked learners to make their own compost bottles to create their own gardens. They gathered leaves, vegetables, and fruit peels to grow their own crops. The class discussion followed:

> **Sandia:** *How can we make compost?*
>
> **Learner 1**: *Cut the bottle, put in some soil from our yard, then place kitchen leafy waste in it, add some water and finally add some more soil.*
>
> **Sandia:** *Very good learners - you got it right. This is how we can make our own compost bottles. Now learners, what are you going to do with the compost bottles?*
>
> **Learner 2**: *I will grow my own crops! Plants will be very happy to grow.*
>
> **Sandia:** *What is a garden?*
>
> **Learner 3**: *Where we grow vegetables. We get vegetables to eat from the garden.*

The participant-teachers followed participatory and collaborative teaching techniques to inculcate sound behaviour among the learners. The data revealed that teachers were au fait with applying the holistic approach to successfully integrate LFS concepts into their lessons. This is consistent with Johnson's (2012) recommendation of the holistic learning approach for sustainability. Watson (2017) also suggests that holistic learning is necessary for learners to develop necessary skills to manage future sustainability issues. According to the United Nations Economic Commission for Europe (UNECE, 2013), teachers need to be empowered to ensure a sustainable future; hence, these holistic pedagogies have to be implemented to foster sustainability capabilities. As such, to be able comprehend LFS, one must think holistically about sustainability relationships and their interconnectedness.

6.3.2.3 Experiential Learning

Experiential learning is the technique of learning by doing. As mentioned in the literature review in chapter three, Kolb (1976) states that people learn through observation, reflection and concrete experience (c.f. 3.10.2) adding that without reflection, learners are not able to connect theories and knowledge learned to real-world situations.

In my observation, Rudilla, being a novice teacher was able to achieve the objectives framing her lesson as evidenced in her lesson-preparation. The different teaching strategies such as class discussion, observation, and reflection on the topics taught, facilitated the attaining of the set objectives of the lesson. These strategies were in line with experiential learning that occurred.

Due to their concrete experience, observation and reflection, learners were able to answer to the questions posed by their teacher as evidenced in the following excerpt:

Rudilla: *Right learners, tell me the places we visited?*

Learner 1: *Classroom.*

Rudilla: *Where are we? What do we call this place?*

Learner 2: *Classroom.*

Rudilla: *Where do I tell you to drop off the register? What is the place known as?*

Learner 3: *Office*

Rudilla: *Outside, near our classroom, what do we call it?*

Learner 4: *Playground.*

Rudilla: *Is it the playground? No… Where is the playground?*

Learner 5: *At the back of our school.*

Rudilla: *What do we call the place in front of the school?*

Learner 6: *Schoolyard.*

During a role-play class-activity, learners acted in two different ways: one of them threw his pencil dust onto the floor, and the other threw his litter into the dustbin in the corner of the classroom. While observing, learners reflected on both actions, and could distinguish that using the dustbin kept their classroom neat and tidy. Additionally, an analysis of documents entailed interpreting learners' drawings or sketches which revealed that discrete, hygienic actions are necessary to keep the environment neat and tidy. An example from a learner's copybook showing the use of the dustbin is depicted in Figure 6.1 below.

Figure 6.1: Sketch from learner's copybook displaying the use of the dustbin in the classroom

Sandia was able to apply experiential learning in her lesson topic on *compost bottle making*. Learners brought empty plastic bottles and kitchen waste to the class. While carrying out the experiment in class, learners observed their teacher on how she transformed the plastic bottles into compost containers. Learners then participated in preparing of the compost bottles with directions from their teacher. Their understanding of the experiment converged with concrete reality. Sandia demonstrated how to cut the bottles a quarter of the way from the top and fill them with a mixture of soil and kitchen waste such as vegetable peels and food leftovers. She also used some leafy wastes mixed with some water in the bottles, then helped learners to cut as many bottles as possible to start the practical part of the lesson. Learners then started filling their bottles with soil brought from the schoolyard and waste brought by learners from their homes. The activity is encapsulated in the following excerpt:

> **Sandia:** *Very good learners – this is how you make your own compost bottles. Now learners, what are you going to do with the compost bottles?*
>
> **Learner 1**: *I will grow my own garden.*
>
> **Sandia:** *I will grow my own garden. What is a garden?*
>
> **Learner 2**: *Where we grow vegetables.*
>
> **Sandia:** *Good, that means during your school holiday you can easily grow your own vegetables at home. In this way, in a month you will grow so many vegetables to eat at home.*
>
> **Learner 3**: *We can also ask our parents for vegetable seeds to grow in our compost bottles.*
>
> **Sandia:** *Yes, of course, children.*

Sandia recapitulated the lesson by reviewing the procedures for learners to create their own compost bottles, and how to grow their own vegetables and flowers at home. The intention was to ensure that people reduced littering the environment, and recycled waste by putting it into 'compost' bottles for growing healthy plants. In this way, plastic bottle pollution could be reduced. Learners were told that during their next leson they would visit their schoolyard or garden to look for a compost bin.

Evidently, experiential learning seemed a positive and productive way to teach LFS. The data which revealed that the participants used experiential learning to conduct their lessons on sustainability, yielded profitable outcomes while preserving the environment. Kim (2016) and Shah et al. (2022) concur that experiential learning is the most effective way of teaching LFS

to learners as they could easily relate to simple actions demonstrated during their lesson to perform future actions of benefit at home and in their communities. This action-oriented learning process allows them to experience, reflect, and modify how they view their position in their respective environments. Baldwick (2020) concludes that experiential learning activities result in learners being more likely to accept responsibilities to ensure a sustainable future.

6.3.2.4 Action and transformational learning

In cycle two, action and transformational learning were apparent during lesson observation. The participants recognised that during cycle one of the study, they were not able to actively address LFS. So, as evidenced in their reflective journals, they conducted considerable research and asked for guidance from other senior colleagues on innovative methodologies to conduct their lessons before the commencement of AR cycle two. Most of the teachers took their learners outside the classrooms and used experiential and participatory learning strategies to inculcate environmentally friendly attitudes and values towards LFS such as enacting sustainability and becoming environmentally responsible. Learners were very excited while learning new things outside the classroom which made them eager for acquiring more knowledge on LFS. Rudilla, who took the learners outside the classroom to observe the schoolyard, demonstrated part of her lesson in the extract below:

> **Rudilla:** *Walk, walk everybody and at the same time observe the schoolyard around you. Here, is it clean?*
>
> **Learner 1**: *No, no…*
>
> **Rudilla:** *What is the problem?*
>
> **Learner 2**: *Sweet…*
>
> **Rudilla:** *Sweet wrappers … yes*
> **Rudilla:** *Is it plastic? Tell me who threw this here?*
>
> **Learner 3**: *Other children, Miss*

When the learners took a quick short walk to observe the schoolyard, they had a brief discussion on the state of cleanliness and what was needed to be done. Learners unanimously agreed that they must clean up the schoolyard as it was untidy. Eventually, with the assistance of the

caretakers, learners picked up most of the litter discarded during recess. In so doing, the learners understood that the schoolyard must always be kept clean to beautify their premises.

Similarly, Komal used an action/transformational learning method to conduct her lesson on *how to save water*, especially during seasons prone to water shortages. She discussed water supply problems that the entire school community were facing. Every morning learners had difficulties to brush their teeth because of water cuts. Learners moved outside the classroom during their break time to observe other learners' behaviour concerning water wastage at the school taps. All the learners unanimously agreed that a much precious water was being wasted at the taps especially when learners washed their hands. They pledged that they must conserve water to compensate for the drought periods.

Likewise, Sandia went outside the classroom to clean the yard by collecting plastic bottles for the learners to use to prepare their own compost bottles in class. Learners had fun picking up the litter from their own schoolyard while learning through self-discovery. Sandhia's lesson, in part, follows in the excerpt below:

> **Sandia:** *learners, now tell me, can you make compost bottles at home?*
>
> **Learner 1:** *Yes, Miss.*
>
> **Sandia:** *Tell your parents not to throw plastic bottles anywhere, but collect them to make compost bottles. Who can tell me why we must do this?*
>
> **Learner 2:** *To grow your own fruits and vegetables such as strawberries and carrots.*
>
> **Learner 3:** *To grow salads items such as …*
>
> **Learner 4:** *To make our own garden.*

In another scenario, Ritika asked her learners to feel and experience the temperature outside in the school playground during their recess time. When recess was over, learners distinguished the difference between temperature in the playground, and the temperature inside their classroom. The lesson was very interesting for both Ritika and the learners since it was an interactive one where learners were asking questions and responding appropriately in line with the objectives set for the lesson. In so doing, the lesson on *climate change* was well understood by the learners, thus Ritika successfully integrated LFS concepts into her lesson.

The above scenario makes it clear that learners were learning via new methodologies that their teachers were using to conduct their lessons. Teaching and learning were visibly happening.

The data revealed that the participant-teacher (Ritika) used action and transformational learning in her lessons. This finding corroborates with Watson's (2017) and Seatter and Ceulemans' (2017) studies which recommended transformational learning, but criticised traditional teaching which does not prepare learners for change. Learners need to ask critical questions and think critically to be able to change their behaviour in favour of LFS principles.

6.3.2.5 Problem-based Learning (PBL)

According to Bholah (2017), PBL is based upon actual situations where learning is a product of working towards the understanding or resolution of an issue (c.f. 3.10.5). During the interview, the participants related that LFS is a big concept, and that it should be taught using various teaching strategies to facilitate learning. However, during classroom observations, not all the teachers used these approaches. Rudilla made learners realise that the classroom and schoolyard looked dirty as the learners littered everywhere. So, they were encouraged to find a solution to the issue themselves, and through picking up litter, the learners learnt that they must not litter but should keep the environment clean.

Sandia used a problem-based learning technique during her lesson presentation on making compost bottles by collecting bottles thrown in the schoolyard and bringing them into the classroom, thus showing learners that it was not good to litter. At the same time, Sandia taught learners how to utilise used plastic bottles by re-using and recycling them. This convinced them about how to solve the plastic litter problem by re-using the thrown-away plastic bottles. The following is the verbatim conversation between Sandia and her learners on the usefulness of plastic bottles to make compost bottles:

> **Sandia:** *Ok, learners. You see, all these bottles were found here and there in the school yard. Is it good to throw them in the yard?*
>
> **Learner 1:** *No teacher!*
>
> **Sandia:** *What can we do with these bottles?*
>
> **Sandia:** *We can do composting with them. What type of bottles do we use to make compost?*
>
> **Learner 2:** *Plastic. Why?*
>
> **Learner 3:** *It does not break.*

Sandia: *So we will use the collected bottles wisely, and make them useful to us. We are going to save and protect our planet.*

Vijay also presented a lesson in cycle two by adopting a problem-based learning approach where learners discovered that their school premises was contaminated by waste pollution during a class visit to the schoolyard. Vijay explained that waste management can be done through reduction, re-using, and recycling waste that we produce at home, in schools, and in industries. The actions involving the problem-based learning approach will lead to the maintenance of sustainability in our environment by developing sound habits and an environmentally friendly attitude by using objects which reduce environmental pollution.

A class activity by Vijay was conducted where learners were able to recognise different types of waste that were brought into the classroom from the schoolyard. Learners were asked to separate waste into categories, and and then drop the waste into their respective recycling bins which were placed in front of the classroom. Figure 6.2 illustrates the segregation executed by Vijay's learners.

Figure 6.2: Separation of waste materials in the classroom

Through PBL, the concept of waste separation by using separate bins for different types of waste was shared with the learners in which they learned to separate plastic, paper, metal and glass to be able to correctly manage waste for re-using and recycling.

Nirma advocated that taking a little more time to prepare lessons thoroughly and appropriately regarding LFS could yield excellent results such that learners can learn effectively through

different teaching strategies such as experiential and PBL methodologies. Nirma articulated her view:

> **Nirma:** *… but it takes time because compared to last time when I worked in a Grade 6 class, it is different now as I have learnt a lot of new things. For instance, there are certain mistakes that I no longer do now as I devote much time in preparing lessons appropriately.*

Nirma utilised PBL to facilitate a French composition writing exercise on *Oil spill from ships at sea.* She portrayed images of a recent shipwreck near the coast of Mauritius using the overhead projector and a video clip on the threats at sea due to oil spills. The video clip and images were based on the Wakashio Shipwreck which caused serious damage to the marine ecosystem in Mauritius some time back. Learners witnessed how the marine environment and the water ecosystem were affected during the spill. They could see millions of dead fish, mutilated coral reefs, and kilometres of seashore blackened by tons of heavy tanker oil. The learners were overwhelmed with sadness and could easily deduce that we must always ensure that we keep our country clean and safe from such disasters.

The lesson revealed that learners were able to relate to the topics covered as they depicted real-life situations and contemporary issues where they recognised an ecological problem, and proposed solutions through essay-writing. The findings from AR cycle two revealed that teachers used problem-based learning (PBL) to teach LFS in their lessons. While finding solutions to the problems, learners were able to understand the objectives of the lessons. These findings confirmed the suggestion of Bholah (2017) and Wyness and Dalton (2018) that teachers must use various real-life situations to discover solutions to environmental problems. Similarly, Ryan and Cotton (2011) reiterate that pedagogies for teaching sustainability need to be real-world based involving critical-thinking. Moreover, Wyness and Dalton (2018) find PBL as a vehicle for LFS which opens opportunities to encounter scenarios involving learners to solve global problems.

6.3.2.6 Synthesis of Theme

It was observed in this second AR cycle that there was a distinctive enhancement in the teachers' approaches to learning. They had sufficient content knowledge of LFS and were able to express themselves coherently on their understanding of LFS. Also, there was a considerable

upgrading in the teachers' lessons which were more interactive such that learners were excited to participate in the teaching-learning activities. As stated by Seatter and Ceulemans (2017), LFS cannot be taught using traditional teaching approaches; transformative and innovative activities should be designed by the teacher to motivate learners to change their mindsets to promote the preservation of the earth in the 21st century, lest we be doomed to successive disasters caused through global warming.

Additionally, Natkin (2016) confirms that LFS should be taught using a variety of teaching practices and assessment strategies. Teachers must take learners out of the classrooms to let them experience the vast outdoors and the beauty of nature for themselves (Watson 2017). Through learning actively, they will be able to discover for themselves and develop skills necessary to achieve and maintain sustainability in the future. It is imperative that these innovative strategies be implemented by teachers through training and briefing sessions.

6.3.3 Theme Seven: Enablers for Learning for Sustainability (LFS)

Enablers assist in executing evidenced-based practices in LFS such that schoolteachers and administrators can identify strategies to implement LFS. This theme (7) elaborates on the different enablers of LFS which were mentioned by the participants at the semi-structured interviews, and also reflected in the journals. The participants proposed a few strategies and implemented them in lessons during the action research process to address LFS in primary schools.

6.3.3.1 Situational/Institutional assistance and support

During the interview sessions, the participants enumerated various strategies to deal with challenges hindering LFS. The most experienced teacher, Vijay, suggested the following:

> **Vijay:** *Parents and other stakeholders should be made aware of the importance of LFS for the future generation to become conscious citizens, and for a sustainable future. Parents and teachers should collaborate on this matter so that more fieldwork and participatory learning can be done. Parents may then consent to their children participating in LFS-related activity, and thus become more conscious of the state of the environment, society and the economy.*

Although it is highly recommended that enablers such as active management support, innovation, determination, and trust accelerate the implementation of sustainability education in schools (Evans et al., 2012), participants' unique school situation did not permit them to freely conduct LFS lessons. However, they were adamant that LFS is very important for the future of the learners, and that sustainabilty behaviours and skills should be included in the curriculum from early childhood education (ECE). Vijay confirmed this:

> **Vijay:** *I know LFS is crucial for the future of the learners, and that it is imperative now that we have to inculcate these skills in them so that they get used to them so it becomes their culture.*

Nirma, who noticed a change in the behaviour of the learners while implementing innovative and participatory learning strategies, stated the following:

> **Nirma:** *Learners are more active in class when they do hands-on activities and groupwork.*

In addition, the teachers recommended institutional assistance in the implementation of LFS, especially while adopting a whole-school approach. Benavot (2014) points out that sustainability and environmental education are treated as stand-alone subjects, and are not mainstreamed in the curriculum of primary and secondary schools. A consistent LFS dimension is lacking because of policy and institutional constraints. All the teachers and stakeholders should contribute to the smooth functioning of schools to ensure that appropriate measures are promote to effect LFS successfully. Moreover, a teacher requested that more materials should be provided by the school, in addition to better support from other teachers and school staff when teaching LFS aspects. Nirma commented that educators' efforts towards promoting sustainability endeavours are not acknowledged by the school; according to her, teachers' engagement and actions concerning LFS should be incentivised.

Further, teachers stated that they were not encouraged to practise LFS at school. Some of the teachers suggested that parents should collaborate with the school management to institute simple programmes such as clean-up campaigns, planting of trees, helping poor people, and fundraising for needy learners and indigent people. The data revealed that teachers were not supported by parents and their institution while conducting their lessons on pertaining to LFS. Teachers also complained that they lacked resources needed to attain their lesson's objectives,

and proposed better assistance from parents and the institution so that efficient learning can occur. This finding is consistent with Parry and Metzger (2021) and Evans et al. (2019) who agree that teachers encounter mny challenges at school while teaching LFS.

6.3.3.2 Enhanced education system

In AR cycle two, teachers were now more aware of the relevant content knowledge and the strategies to teach LFS. Consequently, they were able to confidently and critically relate their opinions about the education system which had morphed; for instance, traditional teachers evolved to becoming action and transformational learning teachers. Vijay's point of view is in line with the above statement when he stated the following:

> **Vijay:** *The exams should not be based on testing how well a learner is able to memorise what was taught, rather they must be tested how well they understood a topic, new knowledge, and relevant concepts. Exams, where learners are assessed on rote-learning without understanding, should be replaced by a better system of assessment.*

Importantly, Vijay proposed a review of the education system to include LFS for the betterment of humanity, rather than prioritising learners' academic prowess through memorisation without having any actual knowledge of existing social, economic and environmental challenges. Although ESD is included in the cross-curricular areas of the curriculum as stated by the NCF (2016) of the MoETEST, where several themes are integrated to conscientise learners of sustainability, it is contained in the informal part of the curriculum which teachers find difficult to implement in primary school. Emanating from the findings, teachers recognised the need for an enhanced education system that could transform the conduct and attitude of learners to promoote a sustainable future. Vijay explained the following:

> **Vijay:** *Examinations and the rat-race competition in primary schools to secure learner-placement in the best secondary schools, is the only priority that parents have. Teaching has become too exam-oriented. Hence, teachers must produce results at the end of the school year.*

Moreover, other teachers also postulated that the implementation of LFS at primary school level can be effective if the time allotted for core subjects can be reduced by downsizing the

congested syllabus, in addition to reviewing the exam structure. Alarmingly, the findings revealed that the education system was not suited to teaching LFS in primary schools. It therefore should be enhanced to engender the required transformation in learners and their communities. This finding is in accordance with Green and Somerville (2015) and Taylor et al. (2015) who affirm that teachers consider LFS as an additional burden. Effectively implementing LFS at school can be possible if it becomes a compulsory part of the job-description for teachers to persuade them to promote sustainability issues. Further, the MoETEST can also recruit qualified specialist teachers to teach LFS and ESD in primary schools at all levels as our common but precarious future depends on effecting sustainability measures.

6.3.3.3 Need for management support

There are several constraining factors for LFS, including the lack of management support. School administrators lack confidence in taking responsibility for transformation; they are reluctant to challenge the status quo, and are seldom proactive in support of LFS activities. According to the participants, there is an urgency in the need for management support to facilitate LFS by adopting a whole-school approach as suggested by the UNESCO Agenda 2030. Vijay stated the following:

> **Vijay:** *Teaching LFS is time-consuming as teachers must perform activity-based lessons, take learners outside to make them experience the content, and perform hands-on activities to be able to address the objectives. On top of that, teachers must maintain discipline in and outside the classroom. Management can give a helping hand to class teachers, so that we can conduct these kinds of lessons frequently.*

Nirma elaborated:

> **Nirma:** *Participatory and activity-based learning need appropriate resources so that learners can have real-life experiences of LFS. Management must be agreeable and ready to motivate teachers to conduct their classes successfully.*

Moreover, according to the participants, school management should make LFS part of the prevailing school culture as it is an important component for the whole-school approach, where learners become acquainted with the values, behaviours and principles of LFS. Thus, they

would apply them at school, at home and everywhere else. The findings revealed that teachers urgently need appropriate management support for implementing LFS, and to overcome red tape. This finding is consistent with that of Kadji et al. (2012) and Miedijensky and Abramovich (2018) who state that management should be able to take risks in supporting change. This will motivate such teachers to teach LFS effectively in their classrooms knowing that they have management's support.

An important aspect related to LFS is the initiation of the whole-school approach through school management and senior staff who value the need for appropriate capacity-building regarding LFS. The whole-school approach creates opportunities for emotional and personal connections to nature when children experience lived and hands-on engagement with the community and the environment. The school management, through the whole-school approach, could structure a school calendar of activities with appropriate resources that could support teachers in promoting LFS through formal education and extra-curricular activities. This implies re-focusing school management's role towards environmental concerns including energy and water conservation, healthy eating habits, reducing waste, adequate and appropriate pedagogy and learning, and community collaborations. If a proper whole-school approach is implemented, it can improve the school ethos, teaching and learning of LFS, and reduce our ecological footprint (Hacking et al., 2010; Wals & Benevot, 2017).

6.3.3.4 Mainstreaming Learning For Sustainability (LFS)

The majority of the participants suggested the need to mainstream LFS, so that teachers would know how to integrate it into their lessons. Sandia reflected:

> **Sandia:** *As LFS is part of the hidden curriculum, it is very difficult for primary school teachers who have limited content knowledge of LFS and SD to integrate it into other subjects.*

Similar to Sandia's reflection during the interview on the knowledge and understanding of LFS, Nirma expressed the need for more exposure of LFS at school level through various talks and mini-projects to sensitise teachers and learners about the subject areas. Nirma stated:

> *… as I was saying there is a lack of resources and learners themselves will not initiate a new topic? … to share that they read in front of the classroom. We never have that*

response from them. Us, as teachers are the ones who are delivering everything, and they just listen and if they learn, they learn, if they do not, they do not. The school, the government and ministries are not guiding learners towards sustainability that much. Everything that is present in the book we are doing it but the concept of LFS is truly little…Activities can be organised to go outside for observation, and we do not really have much access to media such as videos cannot be projected in schools to show the learners which is a big downside and I tell the learners to go check something out on the internet, but we cannot be sure if they are really checking it or not.

Nirma believed that special resource persons should be delegated to the school or from the MoETEST to deliver speeches on topics related to LFS at schools. She iterated:

Nirma: *There should be speeches about the matter, and resource persons should come to the school frequently to raise awareness about sustainable development to everyone. They should come and make presentations on the matter.*

During cycle one, when the participants were asked about their knowledge of LFS, some of them acknowledged that they had a limited understanding of the subject. In fact, they had little content knowledge, which was understandable since they claimed that they had never been exposed to the subject matter during their pre- and in-service training. If LFS became mainstreamed, teachers or specialist resource teachers could be adequately trained to teach school learners. Rudilla added:

Rudilla: *Although we have bins in our school, we have a lot of litter because learners are not practising what they were taught in class.*

Vijay added that he was not able to devote much time to LFS when conducting lessons during teaching core subjects such as English and French languages. Consequently, LFS and sustainability education were marginalised to focus on core subjects. Vijay elucidated:

Vijay: *The syllabus is too bulky and there are a lot of things to do. Last week I was doing a comprehension passage on 'cleanliness' where I talked about cleanliness at home, at school, and in society minimally, as I had to priotise the answering of the*

comprehension questions rather than delving into the content knowledge of cleanliness.

Teachers suggested mainstreaming LFS for the proper acquisition of values, behaviour, and skills concerning sustainability. This finding is consistent with Agbedahin and Lotz- Sisitka (2019) and Togo and Lotz-Sisitka (2013) assertion that LFS should be included at all levels of education. The United Nations Sustainable Development Goal 4.7 also suggsests that Education for Sustainable Development should be mainstreamed. Learning about sustainability and concepts related to LFS integration in subjects other than Science and History/Geography, does not do justice to LFS in schools. Teachers mainly focus on the content of core subjects that will help learners to pass examinations with distinction.

6.3.3.5 Synthesis of theme

This section elaborated on the enablers of LFS where teachers proposed strategies to overcome the barriers to the implementation of LFS. An awareness of the barriers and a desire to eradicate them can promote in the effective implementation of LFS in classrooms and in the school. The participants proposed some enablers of LFS which should accordingly be used and modified at schools. Firstly, teachers should introduce new approaches to teaching such as innovative learning styles and transformational learning. Watson (2017) states that it crucial to use innovative strategies to create change in learners' behaviour through LFS principles. Secondly, the education system should be enhanced by situational and institutional support to enable the smooth running of LFS in schools. Lastly, overcoming the barriers can result in a better understanding of LFS for both teachers and learners.

6.3.4 Theme Eight: Teachers' Perceptions of, and Engagement in LFS

According to Malandrakis (2018), teachers' perceptions of their own understanding of ESD aspects and how they perceive their ability to teach this subject, influences the quality of their lessons. This theme elaborated on the teachers' new perceptions and enhancement towards LFS in AR cycle two. The findings revealed a remarkable change in teachers' perspectives and engagement towards LFS. They demonstrated a significant improvement in the way they conducted their lessons, and how they enhanced their understanding of LFS to meet the needs of sustaining a better future. Armed with a better knowledge and understanding of LFS content,

teachers were better equipped to conduct their lessons which were interactive such that teaching and learning occurred effectively and efficiently.

6.3.4.1 Initial teacher-preparation for Learning for Sustainability (LFS)

Rudilla's entries in her reflective journal indicated that more exploration on the understanding of LFS was required to enhance the acquisition of knowledge to teach LFS effectively. According to my observation schedule, Rudilla demonstrated a clear understanding of the topic taught but needed a practical slant to it. Thus, during the AR cycle two meeting, she wanted to improve her understanding of LFS as she felt that it was incomplete. During the preparation of the second lesson plan, the same topic was presented, but she adapted the first lesson by organising a class visit to the schoolyard, in addition to other relevant activities. For example, learners were asked to draw and colour in their favourite areas, thus indirectly raising awareness on keeping the environment clean.

Komal expressed concern about LFS when she selected her next topic, *Conservation of water* for AR cycle two. According to her reflective journal, she noted that learners were more enthusiastic in watching the short film and listening to the story on honesty such that they expressed distress about the challenges which became more apparent via verbal and visual presentations. In fact, the choice of the topic for AR cycle one served as a learning curve for Komal who was at this stage not aware that LFS does cover social equity and social justice aspects where honesty is critical in shaping children's mindsets towards sustainability.

Sandia consolidated the lesson already presented during cycle AR one by going a step further by creating awareness of the use of compost for growing plants (vegetables and flowers). During the first AR cycle, both the teacher and the learners demonstrated avid enthusiasm for participating in interactive lesson activities. Thus, the implementation of new knowledge gathered in a previous practical session was the next logical step of integration in a lesson in AR cycle two. Unanimously, active learning was favoured for the presentation of the second lesson where learners benefited through participation.

Additionally, emanating from the data generated during document analysis, Vijay chose a topic related to sustainability which focused on the harmful consequences of environmental pollution. It was emphasised that we produce tons of waste which end up in landfills thus causing land pollution. The fact that waste harbours the possibility of the spread of harmful diseases, was prioritised in the lesson which taught learners how to preserve our environment.

Ritika also expanded on her first topic by focusing on LFS and climate change. As stated in her journal, Ritika was unsure that her understanding of LFS had developed, and that her understanding of LFS had enhanced her teaching. During our planning meeting for AR cycle two, Ritika expressed the intention to participate in another cycle of the AR to consolidate her understanding and enhancement of LFS. Ritika's objectives were articulated below:

> **Ritika:** *To relate the increase in global temperature to climate change, to explore the causes of climate change, and to find ways to reduce global warming and climate change.*

For the second AR cycle lesson plan, Nirma used a descriptive method, which was observed during document analysis, to encourage learners to participate in class discussions. Nirma used the class-activity of writing a descriptive participatory composition in French language studies. The topic was not provided directly, but instead images and a video clip were projected via an overhead projector to stimulate learners' thinking. They had to write a composition with the aid of the images, the video clip, words, and expressions given to them. The picture depicted a shipwreck on the coral reef which caused a disastrous oil spill on a public beach some time back in Mauritius. The 'collage' provided included:

- family outing at the seaside;
- ship sinking on a coral reef;
- oil spill on the beach;
- aquatic animals covered with thick black oil; and
- setting up of buoys to prevent oil spillage and being assisted by the public.

While observing the images and watching the video clip through the innovative teaching strategy, learners were enthusiastic to interact during the lesson. Findings revealed (French composition) that learners were able to unearth solutions to problematic situations that they had identified with the oil spill in the lagoon.

The data revealed that teachers prepared their lessons effectively and presented them successfully such that learners were able to grasp knowledge for everyday practice. In support, Maidou et al. (2019) and Evans et al. (2012) confirm that if teachers are committed in selecting

different methods of teaching to cater for different learning styles when teaching LFS, they will become change agents of sustainable development.

6.3.4.2 Teacher-upgrading for LFS

The teachers' experiences from AR cycle one exposed the need for an improvement and change in their methods of teaching, upgrading of their knowledge on LFS, and a consolidation of their understanding of LFS. I observed that compared to AR cycle one, the teachers improved their knowledge and understanding of LFS as they learnt about innovative ways to teach LFS. It was encouraging that transformation was observed in the teachers' presentations of their lessons.

It was also observed that the teachers could relate to LFS issues more confidently, and were able to devise activities to motivate learners to participate and engage in LFS activities. Sandia added:

> **Sandia:** *I did some research on teaching composting, and I got the idea to make learners go outside to pick up the plastic bottles, thus cleaning the yard at the same time. We made compost bottles for growing of flowers and vegetables for the nature corner of the classroom.*

Vijay also took his learners outside into the schoolyard and the playground to collect materials from the environment. He stated that:

> **Vijay: …** *to make learners learn about materials in the environment, I took learners outside to pick up materials in the school yard. They, themselves, brought the materials to the class and they segregated them according to … plastic, metal, glass and paper to be recycled and re-used, and thus reduce environmental pollution.*

This change of behaviour among the teachers was appreciated. Being lifelong learners, teachers managed to improve their understanding of LFS. The data revealed that teachers were able to enhance themselves through self-learning and engaging in research. This finding is consistent with that of Maidou et al. (2019) and Ferguson et al. (2021) who agree on the upgrading of the teacher's knowledge and understanding to enhance LFS among learners. Likewise, Calvaro (2015) shares the view that teachers needed to maximise their knowledge, and follow the advice by Delors et al. (1996) that learning to learn, learning to do, learning to live, working together, and learning to be professional teachers is basic to the profession. Tolstikova et al. (2021)

recommend that teachers improve themselves to adapt to the 21st century demand as traditional teaching cannot meet the requirements of LFS.

6.3.4.3 Enhanced teacher-engagement

According to scholars like Kimanen et al. (2019), how teachers teach their learners influences their worldviews. This statement emphasises how important LFS is in the classroom. During the final interview, all the teacher-participants realised that they were key agents in the promotion of sustainability values to accelerate the required change in attitude and engagement regarding LFS (Cebrian & Junyient, 2015; Lasen et al., 2017).

In the cycles of the AR, it was evident that teachers considered learners' existing knowledge into their lessons during cycle two. Rudilla covered theme six by adapting her lesson in cycle one to present in cycle two by exploiting learners' prior knowledge (acquired from the lesson on *"Keeping the classroom neat and tidy)*. In this way, Rudilla demonstrated how her understanding of LFS was enhanced through the amending of the first lesson.

Similarly, Sandia also used her learners' prior knowledge built from the first lesson to do a follow-up into her second class in cycle two. She relied on the understanding of how to prepare a plastic compost bottle to grow crops and flowers. Sandia enhanced her understanding of LFS so that learners could prepare plastic compost bottles at home to grow vegetables and fruit which were healthy for them to consume. Flowers could also be planted via composting plastic bottles to beautify the home environment. Hence, the concept of re-using plastic bottles was favoured, which was in line with the strategies that must be developed to reduce the plastic pollution of our environment.

The activities that were used to arouse learners' interest regarding environmental preservation also overflowed into health concerns such as consuming healthy food like vegetables growing in their compost bottles in their gardens. Sandia's response below reflected her excitement:

> **Sandia:** *I am myself amazed that I could conduct the lesson so satisfactorily. I was wondering if this time I could enhance LFS in my class…but I am satisfied. My learners were able to learn in an enhanced manner, and I am sure that they will implement what thet were taught in class.*

Similarly, Vijay demonstrated how LFS concepts were intrgrated into Science lessons where the topic was not directly linked to LFS. When discussing materials in the environment, Vijay

applied his understanding to demonstrate how to preserve the environment by reducing the number of resources that we use. In this way, Vijay better understood the lesson through his introspection, modification, and appreciation regarding LFS as stated in the theme, *innovative approaches to learning.* Vijay dug into his experience in teaching Science, and indicated that there were some improvements in learners' performance in the teaching-learning of LFS. Vijay reiterates:

> **Vijay:** *Well, I should say that my experience in teaching Science has helped since I can see improvements in myself as well as in my learners' performance.*

The data generated from the participants indicated that their engagement in LFS improved. Vijay's statement that follows also concurs with his other collegues:

> **Vijay**: *I could see that, as a reflection, most of the learners are able to interact in class discussions, and are able to participate actively during lessons. They also respond positively to new concepts of LFS.*

Nirma indicated that teaching and engaging in LFS should be outside the formal curriculum. She believed that LFS must be applied in a more cross-curricular way, and should be accommodated and integrated in subjects such as French, English, and Oriental languages. She believed that LFS could also be taught without a textbook, which required teaching exactly what the learners are supposed to know by giving them elaborate background information on LFS concepts. Sandia concurred with Nirma by advocating that teaching LFS should not only be part of the textbook, but also for teaching outside of the class through talking about life, introducing Science and Technology, discussing observations, and promoting self-discovery. Sandia felt more knowledgeable, and consequently more confident to teach LFS.

The data revealed that the participants had enhanced their engagement with LFS. The finding corresponds to Burns et al. (2019) who confirm that teachers constantly search for information to empower themselves as new knowledge coupled with different learning strategies, helps to improve teaching-learning practice. In essence, LFS promotes broad social and structural transformation to facilitate sustainability (Leal Filho et al., 2018). Leal Filho et al. (2018) state

that this implies that it requires a new perspective requiring critical thought about the role, nature and potential of LFS as an agent of transformation.

6.3.4.4 Improved teachers' enhancement of Learning for Sustainability (LFS)

All the participants demonstrated that their improved understanding of LFS positively enhanced their teaching of LFS lessons. The data obtained during the observation step of the final cycle speaks for itself, and supports the above statement. Rudilla pointed out that when a learner litters the floor, others would reprimand the wrongdoer who would be advised to use the classroom bin to discard litter. In so doing, Rudilla also learned and understood that from this simple action occurring, it enhanced the understanding of LFS for the benefit of all concerned. Rudilla admitted that after the first cycle, she decided to enhance the understanding of LFS through an awareness of plastic pollution which degrades the environment, but through the recycling of plastic bottles, much was learnt on how to sustain our environment.

Based on her first interview, Komal noted that she was learning while simultaneously teaching the learners. While sharing experiences with other colleagues, Komal learnt new methods and strategies of teaching LFS which enhanced the quality of lessons. During the final interview after the action research cycles, Komal was convinced that her newly constructed understandings of LFS were beneficial during the presentation of lessons. She believed that LFS is no longer a new concept, and viewed learning as an ongoing process where new knowledge is obtained and transferred to develop learners in classrooms. Moreover, Sandia, who was not confident in her LFS abilities during the first interview, was now conscious of LFS being integrated in her lessons as noted in the following excerpt:

> **Sandia:** … *oh really*… [laughs]…*No, but I thought I was not covering the topic directly. Oh yes, really. I think you are correct, sir. I did not know that all of these are known as LFS as we only cover what is found directly in our textbooks.*

Previously, it was apparent that Sandia was not engaging in, and enhancing LFS in her lessons, but as the action research study progressed, she became more knowledgeable, and thus could enhance her LFS lessons (as indicated below):

> **Sandia:** *Yes, I think it is a better way to enhance the learning process in my lessons. It pays to come back to improve on the the same topic, or select a new topic or lesson*

to teach better. If a positive change is brought about when I learn and understand a new thing related to LFS, then I grow professionally. In the end, a better lesson is taught, and learning occurs.

Vijay explained that he selected the lessons, topics or themes from school life and related them to learners' home lives to encourage them to learn. When learners refrain from littering their houses and yards, then beneficial learning occurs which applies also to school and outside places. Vijay's understanding is articulated below:

Vijay: *I will use my new understanding to enhance my teaching, and at the end of the day my learners will benefit. I will apply better and appropriate lesson-planning techniques, use useful teaching aids, tools and resources available to me to conduct my lessons. Maybe as a teacher, I can also learn from my learners on things and from their experiences that I have not focused on. I can also learn something new that I don't know, and bring them together to enhance my teaching during my lessons.*

In response to a question on what extra teachers could do to enhance their teaching at class level, most of the participants agreed that it requires dedicating more time, space, and resources at school. They also agreed that there are moments when they must step out of the classroom context to delve on issues outside the subject area which enhances the understanding of LFS. **Sandia** reiterated:

It depends on time and availability of space as my learners are too young. Sometimes something can come up instantly which I think I can share with my learners. There are moments when I need to step out of my class context to talk on issues outside my topic while teaching. I think it is a good way to enhance my lessons further. As I said, it depends on topics that I am engaging in, at a specific time.

Teachers in the lower primary section found it interesting to incorporate new concepts of LFS into enhancing their lessons as there were many ideas to share with the class. These learners are young and they do not possess the capacity to understand aspects in the way adults do. So, teachers believed that it was their duty to explain these concepts to create awareness. In so doing, teachers thought that learners could acquire basic knowledge on LFS that they, as

teachers, had already grasped. Also, all the teachers reiterated that their enhancement of LFS in their classes engendered positive changes such that their learners shared their knowledge with their friends and parents. Hence, good habits were fostered in this way. Moreover, teachers also need to contribute actively towards enhancing LFS, and they believed that learners need more time and attention to adapt to understanding their lessons. The data revealed that all the teachers improved their enhancement of LFS in AR cycle two. This finding is consistent with findings by Shah et al. (2022) and Gamage et al. (2022) who state that teachers need to make this transformation a reality by reflecting on what they teach. New and adaptive learning strategies and processes proposed by teachers must be visible to prepare learners to be active and responsible citizens of tomorrow.

6.3.4.5 Synthesis of theme

Theme eight consisted of initial teacher-perceptions of LFS, teachers' knowledge, upgrading LFS performances, and improved teachers' enhancement of LFS. It was perceived that the teachers were able to learn and upgrade their knowledge and understanding of LFS. Through research work and feedback from peers, they used innovative strategies in their lessons to inculcate the values and skills necessary for LFS transformation in the learners. The teachers were convinced, based on the outcomes of their second AR cycle experiences, that they had improved and upgraded their understanding of LFS and enhanced them in their teachings. This led to a remarkable transformation of their lessons to the benefit of their learners. Through experiential and problem-based learning, learners were able to experience and reflect on scenarios and deduce by themselves how to start changing their attitudes towards LFS.

Furthermore, teachers had to change their perceptions so that they could engage themselves in LFS. Maidou et al. (2019) conclude in their research that teachers who lack content knowledge and strategies to teach LFS, need appropriate professional development training which can upgrade their ability to teach their learners. They believe that teachers could influence learners to become agents in solving sustainability issues.

6.4 CONCLUSION

This chapter provided insights on the different phases of cycle two of the AR where an explanation of the themes outlined in AR cycles one and two were presented. The different phases involved the planning-action-observation-reflection steps. These steps served to

respond fully to the first research question, *what are the teachers' understanding and enhancement of LFS?* The second research question was: *How does the teachers' understanding shape their enhancement of LFS?* The findings revealed that as the teachers submerged themselves in their second AR cycle of the action research, their understanding of LFS evolved and developed. However, teachers demonstrated the need for more resources and support from resource persons and the school management as evidenced in the findings. Also, as soon as they reached saturation point when their own knowledge of LFS was exhausted, they waned in terms of effectiveness. At the end of the second AR cycle, their new refined and reconstructed understanding of LFS shaped their enhancement towards LFS positively so that they could better the quality of teaching LFS concepts efficiently and effectively.

The teachers became more knowledgeable on the implementation of LFS during the second AR cycle by relating to their experiences while teaching LFS lessons. It was pointed out that several people were becoming sick due to food poisoning or consumption of vegetables with a high proportion of chemical content which could have been avoided by consuming uncontaminated vegetables from their own compost bottles. Thus, teachers found a new way of thinking to deliver their lessons following the enhancement of their understanding of LFS. The teachers' understanding was based on their actions in classrooms during the action research study, during their discussions of the planning and pre-lesson meetings, and how they included LFS in their practice throughout the action research study. However, neither what teachers did nor what they said completely represented their enhancement of LFS. Lessons that teachers presented for both AR cycles were not sufficiently rehearsed, but were part of the compulsory school curriculum. Within these limits, teachers' explanations and classroom actions portrayed their understanding and enhancement of LFS.

The ways how teachers' understanding and enhancement of LFS changed over the two cycles of the action research study reflected to some extent the quality of planning they developed for the cycles, and the changes that were effected. The actions displayed by participants indicated the expansion of conceptual understanding regarding implementing LFS, together with the development of practical know-how. These changes in implementing LFS in the school curriculum were promoted based on teachers' knowledge and interpretation of new concepts. This study promoted such changes, where teachers shaped their enhancement of LFS through the changes and improvements in their understanding. This chapter provided incisive insights

for fully answering fully the second research question. The next chapter (7) which addressed teachers' theoretical reflections during, and after the ARCs, answered the question, *why do the teachers enhance LFS the way they do?*

CHAPTER SEVEN

THEORETICAL REFLECTIONS AFTER ACTION RESEARCH AND BUILDING UP THE CASES

7.1 INTRODUCTION

This chapter explored the data generated during the post-intervention phase of the participant-designed action research. This was described through the reflection steps of the action research cycle (ARC) as described in chapter four. Also, this chapter examined teachers' understanding of LFS and why they enhanced LFS in the way they did - executed after teachers engaged themselves in the action steps of the ARCs. The teachers were the ones who planned, designed and implemented the lessons; therefore, they occupied a self-directed role in the study. Data from the post-lesson meeting, reflective journals, and the post intervention final interview which was conducted after the action research cycles were presented and analysed. From the analysis of the data generated from the post-intervention phase, the first research question, *What are teachers' understandings of LFS,* and the third research question, *Why do teachers enhance LFS the way they do* are fully addressed in this chapter by using the conceptual and theoretical framework as discussed in chapter two.

7.2 REFLECTION: TEACHERS'UNDERSTANDING OF ENHANCEMENT OF LFS

It was quite evident that some of the teachers had never heard of LFS or sustainability. Those working in upper primary classes were the ones who were most acquainted with the phenomenon under investigation. As a result of their exposure to the phenomenon during my brief meeting with them (participants), they gradually began to develop an understanding of LFS which was located within the context of the school environment. The exposure from the first cycle to the second cycle of the action research proved successful for teachers who constructed an understanding of LFS, in addition to being offered valuable insights into how the participants enhanced their understanding of LFS during their delivery of lessons in classrooms. The majority of them referred to the post-lesson interview where they utilised their new knowledge and meaning of LFS to enhance their teaching. It was interesting to note that teachers included specific concepts and notions of LFS in their second cycle of action research. This was corroborated with evidence extracted from participants' reflective journals.

At first, Sandia believed that she would not be capable of integrating LFS into her lesson. She asserted that her learners were too young and not mature enough to grasp LFS concepts. However, after the first action research cycle, she was convinced that she was able to incorporate LFS in all her teaching-learning areas and at all levels of schooling. This was possible as she understood more (regarding knowledge and skills) about LFS than the content subjects. Komal shared Sandia's opinion as she felt that LFS was not appropriate for Grade 2 learners, and that it should be a separate subject. Sandia believed that LFS was a science-related concept and could only be integrated in a science-specific learning area, but later conceded through journeying through this study, that LFS was also content-related.

After conducting the first action research cycle, Komal realised that while discussing the concept of *honesty* with her learners she was already covering the social aspect of sustainability. Komal stated that her understanding of LFS was limited to the content, and was related to new knowledge that was acquired during the first ARC. Nevertheless, after the first action research cycle, Komal was able to continue the second ARC with much conviction by using her newly constructed understanding to enhance the teaching of LFS. The insights of these teachers demonstrated how they viewed LFS as being subject-specific rather than learning-area-specific. Accordingly, Calavia et al. (2021) and Rosen et al. (2020) contend that teachers should first identify LFS in their learning areas before they apply them in their class lessons.

For Rudilla and the other teachers in the upper primary section, LFS was easier to integrate into their lessons, and therefore it was highly valued. According to teachers' lesson-planning of the pre-intervention phases of both action research cycles, many sustainability concepts were included, and it became more apparent during the second ARC pre-intervention phase that applying a range of innovative teaching methods was conducive for teaching LFS (Zohrabi et al., 2012).

7.3 REFLECTION ON LESSON-PLANNING: CYCLE ONE

Upon examining the six lesson plans for cycle one, it emerged that all the teachers were committed to including LFS during the AR. They were quite enthusiastic about how the study was going to unfold. In the pre-lesson interview, a pattern of questions was identified that were asked by participants, including how to prepare and what procedures to include while they were

preparing the lesson plans. The topics chosen were adequate and mainly covered the environmental aspects of LFS. The aims and objectives were succinct and unambiguous. Procedures were presented in steps, but in adequate detail by most of the teachers. Moreover, some teachers also included an evaluation section in their plans.

7.4 CROSS-REFLECTION ON ACTION RESEARCH: CYCLE ONE

Rudilla applied teaching strategies based on her lesson plan and topic considerations. She adhered to class discussions as a teaching strategy and method. She probed with questions that were related to the topic. The class was completely engaged and most of the learners participated in the different class activities. The drawing section of the class activity was mostly liked by the learners; the majority were six years old. The actions of learners who cared for their favourite places linked them directly to caring for the environment, the classroom, the schoolyard and the playground – which was the objective. They understood very well that they should clean their school if they wished to take care of it. The lesson covered contents related to LFS, but the teacher's lack of thorough understanding of LFS did not enhance her delivery of the lesson.

Komal screened a video on *honesty* as part of her lesson presentation. This topic was very interesting as it provided the social dimension of LFS. There was a meaningful message that was conveyed to the learners on how to help one another, especially those who are in need, in addition to exercising moral actions. Honesty engenders self-discipline and motivation to do even better which can result in intrinsic rewards. The objective of the topic was to understand that being honest will make the individual, the parents, and teachers proud, while role-modelling for other learners as well.

Sandia did her best to impress me as the researcher, by making me believe that she understood LFS very well. In fact, Sandia searched the internet on the topic that she would teach in class during the action research, but finally decided to make a compost bottle in class as her first lesson. She elaborated that reducing and re-using plastic bottles were environment-friendly acts. Beach and roadside pollution are now becoming a menace, hence it was high time to find effective solutions to decrease these kinds of pollution. One way of reducing them was through re-using used plastic bottles. During the lesson all the learners were attentive while observing the actions of the teacher.

Vijay managed to enliven his class compared to Komal and Sandia. Vijay used various types of visual aids including pictures, posters and other teaching materials. It was a Science class where he was able to demonstrate via a concrete example of LFS in a real-life situation. Materials such as paper, metal, and plastic which are obtained from nature, but over-exploitation of these materials can cause serious environmental problems. Hence, the teacher devised a lesson on preserving our natural environment so that our next generation can also make use of the things that we have now. One such measure which is of great importance is the use of bio-degradable bags made from jute, pandanus leaves, and bio-degradable plastics which reduce pollution and preserve our environment.

Ritika commenced a lesson on LFS by explaining climate change and its effects on our planet. However, her class discussion was not interactive as not all the learners participated fully. Her understanding of LFS was not as developed as Vijay's. Ritika was not able to express herself confidently to the learners. She dominated the lesson by imposing the the antiquated lecture method to explain the erratic and unpredictable global weather patterns. This was initiated to demonstrate that some places were receiving more rainfall and experiencing floods compared to places where there was no or little rainfall. Moreover, soaring global temperatures cause ice to melt and eventually sea levels rise. This submerges low-lying land areas and regions.

Similarly, Nirma commenced her lesson in class with a brainstorming session on *sustainability* to elicit what it meant. Nirma also used the lecture method to talk about the preservation of our environment and planet. She continued monotonously talking about the preservation of the environment for more than an hour. She emphasised that it was important to preserve the environment for the future generations who can live safely and healthily to enjoy the resources that we have.

7.5 REFLECTIONS ON LESSON PLANNING: CYCLE TWO

Reflecting on the lesson plan in cycle two, it was noted that most teachers were cautious in choosing their topics. Concerning Rudilla and Sandia, continuation from their first lesson was selected from action research in cycle one. In so doing, they wanted to establish a more comprehensive understanding of LFS during cycle two of the action research. In the case of Komal, it was clear that she intended to enhance her understanding of LFS through improving on her first lesson that she taught as it was not very effectively delivered. She improved on her

topic to include content directly related to LFS: *conservation of water*. Komal intended to make her class become more interactive, livelier, and responsive.

Vijay had a detailed lesson plan which included an outdoor activity in the schoolyard in order to apply discovery and problem-based learning as key strategies to teach Science and LFS-related topics (Calavia et al., 2012; Rosen et al., 2020). Komal and Ritika were not satisfied that their conducting of their first lessons were LFS-friendly, such that their enhancement of LFS was incomplete. Regarding the second lesson, Ritika applied a more active and participatory teaching style with more brainstorming activities while they were outside the classroom during recess which was in line with Janse van Rensburg's (2015) stance that active learning is associated with activity-based learning.

Regarding Nirma, there was an effort to do much better than the first lesson, thus she selected a French composition writing exercise with a theme related to marine pollution (e.g. oil spill). Learners viewed a video clip of a lagoon oil spill from a shipwreck, in addition to a canvas of pictures depicting ecological disasters, after which they were asked to write a short essay on what they felt about the theme of marine pollution.

7.6 CROSS-REFLECTIONS ON ACTION RESEARCH: CYCLE TWO

Rudilla recalled from teaching her previous lesson on *how to keep our environment neat and tidy*, that she could enhance her understanding of LFS by including innovative strategies in the second lesson in cycle two. Groupwork was favoured so that learners grasped concepts through discovery and observation techniques (Zorabi et al., 2012). Role-play was chosen as an appropriate strategy for learners to actively participate in the lesson such that the learners demonstrated great enthusiasm in participating in the various activities on how to keep their classroom clean. Discovery learning was also favoured where learners went outside the classroom to observe the schoolyard to observe and act on the state of their schoolyard. Learners were able to sum up the unsavoury situation, and take necessary actions to keep the schoolyard clean.

Komal wanted to select a topic very closely related to LFS as she wanted to take the opportunity during the study to teach LFS to her learners. *Water* as a topic for her second lesson was chosen. Komal was able to demonstrate and enhance her initial knowledge and understanding of LFS after her first lesson. Learners expressed clearly that water was essential for life, and that we

must preserve and avoid wasting it. After the conclusion of the lesson, learners were able express themselves through drawings.

Sandia clearly showed that she had to some extent enhanced her understanding of LFS from gaining 'new' knowledge on sustainability from her first lesson, and that she wanted to improve it further during the second cycle. She brought her learners outside the classroom to observe the state of their schoolyard. Children were able to understand that they should not throw waste everywhere as it made the schoolyard look very dirty and ugly to see. All the learners collectively helped other learners to clean a portion of the schoolyard under the supervision of the caretaker of the school. They also collected some plastic bottles for in-class activity which were later re-used as containers to make compost, and then to plant flowers in them for their classroom's green corner.

Vijay wanted to instil good manners and habits to preserve the environment among his learners who collected waste products from the schoolyard and displayed them in front of the classroom. He integrated LFS into a Science lesson by using materials from the environment which were later separated to be binned into categories (glass, paper, plastic, and metals) to recycle or for re-use. The class activity clearly demonstrated the teacher's enhancement of LFS in his lessons compared to his first lesson.

Ritika used her lunch-time recess period to observe learners to plot a topic for her second lesson. She observed that learners were profusely perspiring while playing during recess time as it was the summer month of March. However, the weather was changing annually, but this year the temperature was unexpectedly much higher. Such a rise in temperature was also noted in higher plains of the island. According to the Mauritius Meteorological Services, these changes were due to climate change. However, she could not establish that the rise in temperature is on a global scale, but she related that we were harming the fauna and flora by increasing pollution on our planet. Ritika pointed out that it was high time people changed their behaviour *vis-à-vis* the environment and that they must not destroy the natural habitats of plants and animals.

Lastly, Nirma integrated the concept of LFS into her French language lesson where she explained, via a short essay, pollution of the sea caused by an oil spill from a sinking ship. A class discussion was favoured when learners observed some pictures showing people taking safety precautions while removing oil from the beach. Learners viewed a video clip screened in class of what had happened and how it affected the marine ecosystem which had a drastic effect on the lives of fishermen. Moreover, people were not allowed access to the beach which

affected the tourism sector drastically. This situation affected the social, economic and political wellbeing of people residing in Mauritius.

7.7 THEORETICAL REFLECTIONS REGARDING BURN'S MODEL OF SUSTAINABILITY PEDAGOGY AND O'DONOGHUE'S ACTIVE LEARNING FRAMEWORK

According to Boden and Edmonds (2009), reflection leads to the identification of weaknesses and strengths of teachers' opinions and practices based on the phenomenon under investigation. These can be methodological and theoretical techniques that make teachers reflect on their lived-experiences, philosophies, and actions for engagement in a process of continuous learning and enhancement (Sweeney et al., 2017). Dewey (2007) claims that it is an important phase in human development where teachers analyse their practice to improve the planning and delivery of their lessons. This section analysed teachers' reflections after concluding cycle one and two to investigate whether they had understood, whether they were challenged, what they thought of AR, or what was their view of using Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework as theoretical lenses.

7.7.1 Content Knowledge and Focus Area of Learning for Sustainability (LFS)

Rudilla

During cycle one, Rudilla introduced the topic of *keeping the environment clean* for the first lesson. She preferred to go to places of relevancy and of practical interest to actively involve learners; these places included the classroom, playground, and staircases at the school. The lesson plan was designed so that learners would identify and describe their actions that pollute the environment. During the application stage of the lesson, learners were asked to devise strategies to keep the environment clean. According to her understanding, she had clear knowledge of the content of her lesson for keeping the environment clean. During the lesson, the teacher clarified that she introduced the places of interest to learners at school to demonstrate how to keep areas of the school clean and to maintain them. The following interaction with a learner confirmed this intention:

Rudilla: *When you value your playground and your classroom, how do you keep them?*

Learner: *Clean.*

During a picture demonstration activity, the participant used prior content knowledge and focused on how learners would develop their civic responsibility through practice in classroom activities. The learners demonstrated that using the classroom bin effectively renders the classroom neat and tidy as opposed to throwing pencil shavings onto the floor. The teacher also focused on introducing the green bin found in the schoolyard which is used for the purpose of collecting plastic bottles to be recycled. The teacher's understanding of the grouping of waste materials was showcased so that learners could learn certain established practices to save the environment from degradation; for example, only plastic bottles are to be put into the green bin for recycling.

By the end of the lesson, learners had a sound perspective of plastic pollution which affects the water system. Pictures showing plastic pollution in the sea were thought-provoking for the learners as they could see that irresponsible actions cause serious environmental disasters which harm humans, and aquatic life, among others. Also, the lesson was content-related as the focus area was LFS such that different concepts were brought to the fore. However, Rudilla admitted that her understanding of LFS was limited to content that covered only the classroom. So, according to her understanding, she opted for a new cycle in which she used her prior content knowledge and understanding to enhance LFS teaching.

In cycle two, Rudilla wanted to demonstrate her understanding of LFS optimally to enhance LFS when delivering the second lesson. She wanted to utilise content knowledge as proposed in the Burn's Model of Sustainability Pedagogy to enhance her understanding of LFS by moving outside the classroom to extend class activities. While observing the schoolyard, learners perceived the state of ('un')cleanliness at school. She emphasised to the learners that all the litter that they saw strewn in the yard were of their own doing. The playground was also full of plastics, and she recalled mentioning from the previous lesson that if the plastic wrappers went into the sea, they would cause the death of many marine creatures. This focus area was acknowledged by the learners. Learners realised that they had to stop littering the schoolyard and that necessary action was crucial to keep the schoolyard and the classrooms clean. After cycle two, Rudilla was convinced that her understanding of LFS had in fact enhanced her teaching during the ARS.

Komal

In the first cycle, Komal discussed during her lesson presentation how people should help others who are in need. The lesson was introduced by the screening of a short film. The introductory session also involved explaining the meaning of *honesty* by providing some examples. She did not have clear content knowledge of the sustainability issue.

She also used Burns' Model of Sustainability Pedagogy, without knowing it, to effectively re-orient her lesson to incorporate sustainability content. She already had some knowledge of sustainability but later expanded her knowledge on LSF issues. She later screened the short film titled, *honesty is the best policy.* The film was paused intermittently to discuss its salient features that focused on areas that were relevant to sustainability principles. This activated the learners' critical-thinking skills that fostered a coherent and improved understanding of the conceptions related to LFS.

In so doing, the teacher enhanced her own understanding concerning the complexities of sustainability issues. Also, this lesson aroused learners' curiosity on being proactive if someone picked a purse; this was brainstormed to provide diverse forms of action from learners. According to Komal's reflective journal, she was pleasantly surprised that she herself did not expect such creative responses from her learners, as stated below:

> **Komal:** *I am surprised by the variety of answers my learners gave. I never thought that young Grade 2 learners can give such solutions coupled with so many emotions.*

The above statement proved that Komal further developed her understanding of LFS. In cycle two, she introduced the importance of water to her learners. She wanted to include the aspect of environmental stewardship by providing additional knowledge on saving water. Learners were very keen to answer short questions on water usage, and the importance of water in our everyday lives. The focus was on saving water at home and school. However, Komal was not able to demonstrate her content knowledge to focus on the multi-dimensional aspects of sustainability such as the different ways of demonstrating how to save water at school and at home. This could have been done by organising an activity outside the classroom where learners could role-play scenes pertaining to the importance of saving water.

Furthermore, the teacher could also have adapted her content knowledge to focus on incorporating sustainability aspects using a participatory strategy to inculcate good habits such as closing the tap while brushing one's teeth or while washing one's hands. This active learning activity process fosters the acquisition of new knowledge such that the previous understanding of LFS becomes consolidated, as claimed by Buil-Fabrega et al. (2019) who state that this reinforcement commits learners to better understand LFS concepts. After delivering the lesson in cycle two, Komal claimed that her understanding of LFS evolved which sensitised her to sustainability issues thus enhancing the quality of future lessons by activating her newly constructed knowledge to promote sustainability content.

Sandia

During the first lesson, Sandia introduced the composting of kitchen waste to produce fertile conditions to grow crops. As mentioned in her pre-lesson interview and in her reflective journal, Sandia had never heard about LFS. At the commencement of the AR process, her content knowledge of LFS was nil, and she was not sure of which aspects of sustainability to include in her lesson. Sandia claimed that learners were too young to understand complex issues of LFS. After some research, reported in her reflective journal, she decided to introduce the topic, *making your own compost bottle*. Nevertheless, during her lesson, she claimed that new content knowledge emerged from her class discussion regarding the harmful effects of plastic bottles on environmental pollution. This new content knowledge enhanced her own understanding of LFS. Later, she was able to activate this content knowledge by discussing various aspects of LFS in her lesson. She talked about the dangerous consequences of throwing plastic bottles in environmental spaces, especially the blocking of drains and rivers which could cause flooding and diseases. Re-using plastic bottles by making compost bottles was one solution to reduce pollution.

She also talked about the benefits of producing vegetables from compost bottles for health living. During her lesson, sustainability content was understood by referring to real-life experiences of learners. The learners could fill their compost bottles by using organic waste and kitchen leftovers (e.g. pieces of bread). Hence, the process of multidimensional content knowledge-building was favoured such that both the learners and the teacher constructed new meanings of sustainability issues. After the cycle one lesson was concluded, Sandia was much

more confident and enthusiastic to continue with cycle two to strengthen and demonstrate her knowledge-construction.

In AR cycle two, Sandia reinforced the lesson from the first cycle by choosing a topic similar to the first one. It demonstrated sound content knowledge by using an observation of the schoolyard during the school-break. Learners were surprised to observe how dirty the schoolyard and the playground were – littered by learners themselves. They collected some plastic bottles from the schoolyard for classroom activity during lesson-time. According to learners' own observations, they were more sensitised about the effects of throwing waste in the schoolyard as they recognised it as an irresponsible action. They also cleaned the school yard and acquired new knowledge – that is, if they did not throw waste onto the ground, the schoolyard would be clean, and that they would not need to spend energy and time in cleaning it.

During her class activity, Sandia demonstrated her constructed content knowledge by focusing on the procedures on how to prepare compost bottles, and to transplant new seedlings of flowers and vegetables that she bought to the market. In so doing, learners were more aware of useful actions which protect the environment and the planet since reusing plastic bottles for composting reduces pollution. In this way, it was now evident that Sandia and her learners had a clear understanding of LFS content knowledge. From this position, Sandia could enhance the quality of her future lessons by increasing her understanding of local contexts, sustainability practices, and precautionary alternatives to solve imminent environmental challenges. At the end of the cycle two lesson, Sandia was convinced that LFS can be integrated into every aspect of her future lessons thus promoting multidimensionality and cross-curricular components in lesson-planning to improve the quality of the presentation of lessons; and aspects of combating sustainability challenges.

Vijay

As the only male teacher, Vijay, who had excellent classroom management skills, claimed to have a higher content knowledge of LFS as observed in his reflective journal. That could be attributed to his long experience in working with upper primary learners. In cycle one, he wanted to integrate his content knowledge and focus area on LFS into his Science lesson topic, *materials in the environment.* He thus consolidated the previous lesson on the topic by integrating sustainability content into it. The first part of his lesson was based on scientific

principles where he discussed the different materials that are found in the environment, and then in the second part of the lesson shifted to focus on LFS content. He commenced with a class discussion by applying questioning techniques to source information on where we get paper from. The following extract pertains to Vijay's lesson introduction:

> **Vijay:** *… paper… good. Ok! Paper is obtained from where?*
> **Learner 1:** *From trees.*
> **Vijay:** *You know, nowadays, to preserve plants and trees, it is said that we should not use a lot of paper.*

The teacher executed a sound strategy to incorporate LFS into his lesson, as he thoroughly developed his understanding of LFS, and enhanced it during lesson-presentation. Vijay further introduced content on environment pollution, by referring to using biodegradable plastics instead of conventional plastics which causes serious environmental hazards. In cycle one, Vijay integrated and consolidated his lesson by relating LFS issues such as pollution of the sea and its effects on aquatic plants and animals.

During the cycle two, Vijay demonstrated his content knowledge by focusing on the effects of land pollution. The lesson commenced by learners picking up some waste materials from the schoolyard and bringing them into the classroom. Learners observed them carefully, and were able to name some of them. Vijay consolidated prior content knowledge as he talked about how the environment around us looks dirty with bad odours, which adversely affects the health of people, animals, and plants. He further focused on waste management such that learners developed an understanding that throwing away waste materials directly harms our lives. From this area of focus, learners were able to explore and critically analyse their observations by identifying key actions and issues of concern to address by applying their content knowledge, experience, and background to find solutions. Vijay, thus developed his understanding of LFS from class discussions and introduced the 3 Rs; namely, to reduce, re-use, and recycle. Composting of organic waste, such as kitchen waste, was also discussed. While performing a class activity, learners could now compartmentalise waste into three (3) categories: paper, plastic, and metal prior, for recycling and re-using. Thus, Vijay could effectively enhance the quality of his lessons by focusing on the content knowledge related to LFS.

Ritika

At first, Ritika was critical about the implementation of a lesson as attested in her reflective journal where she claimed that she doubted whether climate change formed part of LFS. During the pre-lesson interview, Ritika could integrate her topic into LFS principles for lesson cycle one, although she possessed limited content and prior knowledge of sustainability. Ritika commenced the lesson by utilising a questioning method on the topic of climate *change,* but most of the learners were unable to answer the questions correctly. To avoid being embarrassed in front of me, the teacher answered the questions herself. However, learners indicated that climate change impacted negatively on the planet, but could not say how. Ritika continued her lesson by giving answers from her own content research knowledge on LFS. No attempt was made to prompt learners to find the answers themselves.

During cycle two, the Ritika again chose a topic on global warming, of which she had little content knowledge. Ritika claimed that global warming was responsible for carbon dioxide pollution, which was not true as the rise in carbon dioxide pollution was responsible for global warming. Furthermore, Ritika dominated the lesson by lecturing to the learners who sometimes answered questions posed from their prior content knowledge of LFS. The following question prompted a response from learners' prior knowledge:

> **Ritika:** *What happens when the icebergs melt?*

Some of them answered correctly saying that the sea level will rise as the excess water goes into the sea. Then the lesson progressed with the imparting of new content knowledge on LFS which included details about various damaging climactic phenomena such as droughts, floods, cyclones, and hurricanes. It was emphasised that droughts can cause loss of human life, including that of animals and plants. Lastly, the lesson concluded by describing the different strategies on how to avoid adverse climactic conditions including a reduction in the burning of fossil fuels, controlling pollution through regular servicing of engines, using electric vehicles and utilising renewable sources of energy. Ritika was satisfied with the lessons she delivered during both cycles her newly because she developed a greater understanding of LFS as compared to her initial content knowledge. Her methods of teaching had changed regarding LFS, and this enhanced her understanding of LFS which she practised to enhance the quality of her lesson.

Nirma

Nirma introduced her lesson during cycle one on sustainability through a brainstorming session on the topic. Learners participated in the class discussion by deliberating about their own points of view gained from content knowledge extracted from research and previous experiences. Learners were able to determine that sustainability is all about protecting our world. Nirma helped the learners to gain knowledge by prompting them on matters of preserving of our natural resources for future generations. *Keeping our planet clean* was the slogan frequently bandied around. Learners also provided answers to Nirma's 'stereotyped' questions related to sustainability. Below is an extract from the conversation between Nirma and the learners:

> **Nirma:** *Is our planet really clean? What do you observe?*
>
> **Learner 1***: No, there are wastes everywhere.*
>
> **Nirma:** *Which types of wastes?*
>
> **Learner 2:** *Land pollution, other pollution.*
>
> **Nirma:** *What types of pollution?*
>
> **Learner 3:** *Land, air, water, sea, and noise.*

Learners were prompted to answer questions as they were not responding spontaneously. They claimed that people were not using bins to throw away rubbish. Instead, they were throwing it into rivers, canals, and roadsides. Various types of air pollution were also discussed such as the increased use of fossil fuel that causes global warming and climate change. The new knowledge developed from the class discussion allowed the teacher to move to a new understanding of LFS. The teacher enhanced her understanding in her lesson by providing learners with mitigating strategies to deal with the pollution of the environment. In cycle two, Nirma applied her content knowledge to focus on sea pollution by exposing the oil spillage incident. Observation of a picture related to the pollution, and the screening of a video clip were instruments utilised to arouse learners' interest which led to them writing a short composition on the topic in French. Here, the content knowledge of the phenomenon regarding sustainability content issues was integrated into a French language composition writing exercise to demonstrate and promote the sustainability theme. This fulfilled the first goal of Burns' Model of Sustainability Pedagogy.

7.7.2 Perspectives and Information-seeking on Learning for Sustainability (LFS)

Rudilla

During the lesson, Rudilla favoured the critical-thinking strategy pertaining to the different aspects of cleanliness when learners were shown different pictures on the overhead projector. Learners were able to discover that pictures depicted places of interest in their schools - some were dirty due to irresponsible actions. They found out through information-seeking and enquiry methods that the learner who threw his pencil dust on the floor was not committing a responsible action as it made the classroom dirty and untidy. This discovery learning through observation provided many perspectives to interpret the information, and this was in line with to the problem-solving abilities of learners. In doing so, they were able to understand that when they use the dustbin, their classroom would always remain clean.

During the second lesson activity in cycle one, learners realised that throwing away plastic materials can cause a serious threat to the environment. They could seek information and dissect pictures depicting a dirty sea with lots of plastic floating on the water. They deduced that this action may cause food poisoning when we eat fish that had consumed plastics. In this instance, the teacher possessed astute information-seeking skills via visual stimuli.

When Rudilla migrated to cycle two, she proposed to conduct a class activity outside the classroom. Learners observed the schoolyard which was dirty after break-time. From this information-seeking activity of the schoolyard, learners and the teacher noted that keeping the yard dirty was not sustainable. Thus, it was the duty of everyone in school to maintain cleanliness. To this end, observing, questioning, and examining learners' attitudes and behaviours, led to the realisation that their irresponsible actions encouraged unsustainability and harmful practices that needed to be interrogated. Rudilla also criticised learners' throwing of plastic everywhere, and labelled it as a barbarous practice which must be cease at once. She incorporated the notion of recycling plastic bottles for gardening purposes which created a value-added product to be re-used in different forms.

Komal

Komal, in the first cycle lesson, introduced the concept *honesty* for learners to define or describe. She gave them the opportunity to think critically to respond appropriately to the scenario of *dropping a purse*. Learners provided answers extracted from their different

perspectives which was difficult for them. Hence, some gave answers like they need to find out the person's name within the purse, and one said that he needed to take the purse to the police. In so doing, the learners looked at different avenues to effectively react to the issue. By using the information provided by the learners during their class discussion, the teacher identified what needed to be done to remedy the problem. That was achieved during the critical-thinking and questioning session. This led to the perception that when performing an admirable act, one is respected by everyone which makes one's family proud. The same scenario was viewed in a film where the boy opted for a moral decision instead of stealing the money and telling lies.

During the second cycle, the teacher introduced the topic, *saving water for later use*. Admirably, the teacher discussed the topic from different perspectives that provided multiple dynamics of understanding sustainability. Accordingly, Komal adopted various techniques such as questioning which elicited divergent views on saving water. Learners became conscientised that wasting water was not sustainability-friendly, and that they should change their habits, attitudes, and behaviour to comply with sustainability principles in order to preserve the environment.

Sandia

When Sandia chose her topic for the first cycle lesson, she was not aware of the different methodological possibilities to apply to enhance the quality of the lesson. During the pre-lesson meeting, Sandia became more conscientised of the sustainability issue that could be incorporated into her lesson-planning. This information-seeking and enquiry encounters helped her to design her lesson in line with the understanding and enhancement of LFS. Prior to the commencement of the study, sandia embarked on an information-seeking exercise advocated by O' Donoghue's Active Learning Framework to maximise her content knowledge on the topic, *making your compost bottle*. Sandia could find information by accessing resources and experts' knowledge on the sustainability topic. During the lesson, the teacher considered different perspectives of informing her learners on what could be done to reduce plastic bottle pollution; one was making compost bottles and reducing waste (organic) through composting which produced nutritious vegetables that could decrease the risk of diseases and contamination.

At the end of cycle one, she was not convinced that her understanding of LFS was complete, hence she requested for another cycle so that she could enhance her newly developed understanding of LFS for the benefit of her learners. This time she looked at applying different

perspectives of addressing pollution problems. Sandia took her class outside in the schoolyard and playground for observation. In so doing, she was able to impart new knowledge of how it looked like when learners keep their schoolyard and playground dirty. So, keeping the environment neat and tidy was a way to reduce waste disposal by re-using and recycling plastic bottles to make compost bottles to grow crops, vegetables, and flowers.

Vijay

Before Vijay could prepare his lesson in cycle one, he wanted to introduce new and different perspectives of understanding the sustainability issue of pollution, and caring for the environment. He introduced different materials found in the environment, and later looked at them from different perspectives to understand how their misuse could harm the environment. He used the example of paper which is a product processed from trees. Information-seeking and enquiry encounters through critical-thinking and questioning techniques were advanced; namely, if we cut down many trees to manufacture paper, then this would lead to unsustainability which will affect the planet. Therefore, Vijay examined this challenge incisively by focusing on saving the planet from pollution as trees act as carbon sinks.

Additionally, new perspectives were discussed and critically analysed by the teacher and the learners on other materials such as plastic which can cause environmental pollution. The use of biodegradable materials such as potatoes, pandanus leaves, paper, clothes and jute from plants could also be used to decrease environmental pollution. During cycle two, Vijay talked about waste management in correlation with the 3 Rs; that is, to reduce, re-use, and recycle. Here too, he introduced new perspectives of looking at sustainability issues of waste disposal to reduce environmental pollution. Vijay conducted a class activity where learners picked up waste materials from the schoolyard after recess, and separated them into three different boxes for re-using and recycling purposes. Furthermore, he emphasised reducing the use of different waste materials (e.g. through composting at home) to inculcate citizenship responsibilities by advocating sound habits and values to reduce the use of materials which produce harmful substances.

Ritika

While conducting the lesson during AR cycle one, Ritika struggled to incorporate ideas on sustainability from different perspectives. Ritika was not well-prepared to discuss the different aspects of *climate change* from different perspectives, and was only guided by the limited

content knowledge provided in the Grade 5 textbook. It was apparent from the classroom observation that the class was not engaged in critical-thinking as classroom discussions were limited. Information-seeking and enquiry encounters were present but to a minimum, since the only information the teacher could gather was extracted from the Grade 5 textbook. When Ritika asked her learners questions, only a few of them managed to provide answers which were vague, and without deep thinking. They kept on hesitating, so the teacher had to come to their rescue by giving the correct answers herself. While observing the lesson, it became obvious that information-seeking and integrating sustainability concepts were lacking. After the conclusion of the lesson, Ritika readily accepted that her understanding of LFS was limited to the textbooks, and that her understanding did not enhance LFS during the first cycle lesson.

The next AR cycle lesson was planned and executed on the topic, *global warming*. New perspectives emerged through which Ritika presented her lesson by using critical-thinking and reflective practice. Much content on sustainability gained through information-seeking and enquiry encounters were incorporated in her lesson. Entries in her reflective journal inferred that she had effectively enhanced her understanding of LFS during her lesson, and that it would empower her enormously to prepare lessons in the future.

Nirma

While conducting the lesson in cycle one, Nirma was unsure of how to intrgrate sustainability content into her lesson activity. She could not propose new or different perspectives through which she could conduct her lesson. Critical-thinking and reflection were hardly evident. When learners were asked about what they understood by the term *sustainability*, answers were limited to what was covered during the geography lessons, and from textbooks. Information-seeking by the teacher was also limited to the learners' textbook. As far as new knowledge construction was concerned, the teacher could not ascertain that her understanding of LFS was improved, and that this understanding could enhance her lesson. The class was similar to a question and answer session during a revision lesson.

When conducting her second cycle lesson, Nirma preferred to base her topic that related to a picture depicting a shipwreck that harmed the marine ecosystem. Though the lesson was transdisciplinary and cross-curricular, new knowledge-construction and understanding were limited to what was seen in the picture. Hence, Nirma could not enhance her understanding of

LFS in a productive manner. She was able to provide only a descriptive summary of what was observed by the learners on the sustainability theme. Lastly, only a quick overview by referring to the picture was provided as Nirma focused on sentence-building but with minimal class discussion.

7.7.3 Active Participation Process and Enquiry Encounters regarding Learning for Sustainability (LFS)

Rudilla

Rudilla achieved the third goal of Burns' Model of Sustainability Pedagogy by enhancing her learners' civic duty and their intent to work towards LFS through active participation (Hedden et al., 2017) and visual learning (picture and video shows) conducted in her lesson during cycle one. Interestingly, the teacher improvised by having some learners throw pencil shavings and bits of paper directly onto the classroom floor, while others used the classroom bin to dispose of litter. Hence, learners saw the difference between the two actions. Later, learners participated in the sustainability process when they took necessary action by cleaning their classrooms themselves so that cleanliness could prevail. This was evident through learners' drawings depicting the judicious use of dustbins in the classroom. Furthermore, the notion of a green bin for recycling plastic bottles introduced a new concept of re-use. Re-using plastic bottles is a means to reduce plastic pollution of land, river, and sea. During the class discussion, the teacher explained the harmful effects of the unscrupulous actions of people depicted in the pictures. It was heartening that learners participated actively in proposing different solutions to reduce or stop pollution, one being the re-use of plastic bottles. Other learners proposed a clean-up programme organised by their own class to keep their school environment clean.

During cycle two, learners observed the state of their schoolyard and playground where they deduced through enquiry encounters, that littering everywhere was not a good civic action that degraded the environment. Rudilla was able to guide her learners to take note of this worrisome scene and its effects on the environment. Meaningful proactiveness by learners led to cleaning the schoolyard by picking up all litter and placing them into a covered bin. This called for action through participatory learning to empower learners to build capacity to confront sustainability problems. Accordingly, learners must engage themselves fully in civic responsibility towards improving the condition of places of interests. This active participation process is an invaluable

dimension of Burns' Model of Sustainability Pedagogy which promotes learners' skills regarding healthy relationships, knowledge, values and skills.

Komal

While conducting the first lesson of cycle one, the Komal was not aware of what sustainability content she would need to include in her lesson. While preparing her lesson plan, and during discussion sessions at the pre-lesson meeting, Komal chose the topic *honesty* which has a social angle to LFS. Through her lesson presentation, it was noticed that she was unable to make her learners actively participate in the class discussion on the sustainability theme of *honesty*. What could be observed from her lesson were straight-forward responses to questions. The following interaction is proof of this:

> **Komal:** *If we pick up a purse on the road, what should we do?*
>
> **Learner***: Return it to that person.*

Komal was unable to encourage the learners to actively participate through different perspectives of the issue by probing and allowing them to think critically on the consequences of each of their option. While the film was on pause mode, questions were posed about the action that the boy took, but the class was not always engaged in the lesson. During our pre-lesson meeting for cycle two, Komal admitted that her understanding of LFS was superficial. So, she intended to include a sustainability topic where she could elicit active participation from her learners so that they could embark on a transformational learning process.

While conducting the cycle two lesson, learners were more actively participating in class discussions by presenting their points of view on the LFS theme. They answered that they should not waste water and promote sustainable water use. They also described different water-saving strategies at home and at school. When the lesson concluded, the teacher was quite confident that her understanding of LFS had enhanced the teaching of her lesson.

Sandia

In Sandia's case, she failed to evoke the active participation of her learners in her first lesson in cycle one. She briefly explained the use of plastic bottles as compost bottles. Learners demonstrated through class discussions that plastic bottles were appropriate to be used to make

compost bottles as they were readily available and do not break easily. However, during the class activity, learners were not actively engaged in the procedures as spelled out by their teacher, thus learning was not proceeding smoothly. They did not indicate that the best way for them to reduce and re-use plastic bottles was a solution to avoid plastic littering and pollution of the environment. Hence, learners' active participation was not evident. Lastly, Sandia prepared the compost bottles by filling them with soil (from the school garden) and organic waste (bio-degradable) which learners brought from home. Sandia was dissatisfied with the outcome of her lesson but was ready to involve herself in cycle two of the ARS to enhance her understanding of LFS actively.

During the second AR cycle of her lesson, Sandia chose to continue with the sme topic from the first lesson. She organised a class visit to the schoolyard and playground after recess. Learners actively participated in the observation of the schoolyard and playground. They were enthusiastic in engaging themselves in group discussions along with their teacher indicating that the state of the schoolyard and playground were very dirty, and that they needed to actively participate in the cleaning process. Learners picked the waste (bio-degradable) and plastic bottles and thereafter prepared compost bottles to plant flowers to beautify their classroom green corner. Post-lesson, Sandia noted a clear development in her understanding of LFS through the AR which enhanced her lesson.

Vijay

During his lesson in AR cycle one, Vijay wanted to integrate the element of sustainability in his Science class. While covering his science topic, *materials in the environment*, he intended to inspire learners to participate actively through the new knowledge construction of LFS. During his lesson, learners actively engaged in the class discussion regarding different materials that are found in the environment so that they could utilise them for beneficially. Moreover, the concept of environment pollution was discussed in line with bio-degradable plastic waste so as not to pollute the environment. The use of alternative materials obtained from plants was also discussed.

In cycle two, learners were encouraged to apply discovery learning as a technique to actively participate through the observation of the schoolyard and playground. Waste disposal was a serious environmental threat, as proposed by the learners, and necessary actions needed to be taken to remedy the situation. Waste management was discussed to find solutions for better

waste disposal methods. Learners were able to separate waste that they collected from the schoolyard and playground for recycling. There was also discussion on the notion of separating organic wastes for composting since a large proportion of municipal waste comprised of organic and bio-degradable components. After the conclusion of the lesson, Vijay was convinced that new knowledge construction had was achieved, and that he had effectively enhanced his understanding of LFS during lesson presentation.

Ritika

During Ritika's lesson presentation in cycle one, she was not convincing in implementing workable strategies to achieve the lesson's objectives. The element of active participation of her learners was missing as they were unable to express their points of view. It was a lecturing, traditional, one-way type of teaching approach. Learners were not encouraged to give answers nor to engage in active participation, hence class discussions were not evident. Burns' Model of Sustainability Pedagogy's third goal states that the teacher should enhance the learners' civic responsibility and intentions to work actively towards sustainability pedagogy. By the end of her lesson, Ritika attributed the children's disinterestedness in the lesson due to my (the researcher) presence as they felt inhibited.

During her second cycle, Ritika devised a lesson plan where she included teaching and learning strategies convenient for active participation and class discussion. She purposely conducted the lesson after recess when learners usually enter the classroom after playing in the sun. While playing, learners were perspiring due to the hot summer season. They performed a comparative observation between the morning temperature and after recess (how hot or cold). Learners participated actively in the discussion as learners deduced that there was a change in the temperature pattern as compared to the same time the previous year. Through discovery learning, the learners knew that it was the effect of global warming. Consequently, the class was able to actively participate in constructing new knowledge with assistance of the teacher who was quite happy to recognise that she also enhanced her understanding of LFS during the lesson.

Nirma

During the lesson in cycle one, Nirma asked a series of questions (and probing) that activated critical-thinking. This technique did not prove to be beneficial to the teacher and the class. Learners were unable to indulge in active class discussions and answers were limited to what had been taught from textbooks. The emergence of new knowledge during the lesson was limited, and understanding of LFS was mediocre.

During AR cycle two, Nirma devised new strategies to elicit active participation from the learners. According to O' Donoghue's Active Learning Framework, Nirma was able to deduce through her reflection that sustainability issues were not being addressed and experienced during her teaching in contrast to the principles of Nousheen et al. (2020). Cycle one of the AR proposed feedback about how the lesson was conducted through the teacher's reflective journal; Nirma expressed her desire to participate in another cycle to enhance her understanding of LFS. She chose to conduct a French composition writing exercise on the topic, *sea pollution due to a shipwreck on the coral reefs*. The learners participated actively by studying the pictures to glean information to write a composition on the topic. They were able to discuss the event using words and expressions presented at the bottom end of each picture which fostered an interactive class discussion.

The harmful effects of sea pollution were discussed and focused upon. Learners related to the event that happened some months back when a ship was wrecked off the coral reefs in the south of Mauritius causing serious damage to marine life. The lives of people living along the coast were also affected, especially those of fishermen who could not fish in the lagoon for a few months and thus had to face social and economic hardships due to the environmental disaster caused by the shipwreck. During post-lesson reflection, Nirma was convinced that she enhanced her learning and understanding of LFS in her second lesson. This would benefit her to design better lessons closely involving sustainability themes and contents.

7.7.4 Contextual Engagement towards Learning for Sustainability

Rudilla

As evident in Burns' Model of Sustainability Pedagogy, engagement occurs when effective sustainable pedagogy is rooted in the location where learning happens. The classroom context played an important role as this is where learning should happen. When Rudilla conducted a

picture presentation and video clip screening during the lesson in the first cycle, learners' active participation was limited. The process of active learning took place when learners themselves deduced that throwing waste onto the classroom floor was irresponsible, and that they needed to take necessary action to remedy the situation. The pictures and video clip were instruments that promoted a conscious and informed visual description to teach learners how to instil cleanliness in their classroom. Learners understood that using a dustbin kept the classroom neat and tidy, and that this practice needed to be maintained.

Furthermore, learners also responded to the pictures by indicating their abhorrence at polluting the environment, and that urgent cleaning-up needed to be undertaken to remedy the situation. The teacher's understanding of LFS catered for introducing the notion of recycling and re-using plastic bottles, and that the appropriate action was to collect and place them into the green bins. Hence, learners also realised that throwing plastic waste away could cause hazardous sea and river pollution which could lead to toxicity in fish and other marine and riverine life. In this case, the action required was to stop throwing plastic waste into rivers and the sea – this objective was achieved via Rudilla's lesson.

During AR cycle two, Rudilla wanted to further enhance her understanding of LFS in AR to better expose her learners on the action-taking step of the process. Rudilla and her learners deliberately conducted observation which produced action outside the classroom. In so doing, learners could differentiate between the condition of the schoolyard in the morning to that of the midday recess. The natural response from learners was to take necessary action to clean the schoolyard and playground. Learners helped the school cleaners by collecting all the litter and placing it into a covered dustbin. The teacher enhanced this understanding of LFS by teaching learners that they should always use the bin found around the schoolyard and playground to throw their waste. This action would certainly render their schoolyard and playground clean beautiful.

Komal

According to the lesson in cycle one, Komal screened a short film called *Honesty is the best policy* where she introduced the concept *honesty* to her learners. Through the lens of the fourth goal of the Burns' Model of Sustainability Pedagogy which proposes to increase learners' understanding of and connection with the location where learning is happening, I deduced that

Komal used the short film as a tool to create awareness relating to the boy's actions in the film. Learners thought about what they could have done if they had been in the same situation as the boy in the film. This is proposed by O'Donoghue's Active Learning Framework where involvement through action-taking stimulates and increases the learners' and teachers' knowledge of sustainability to unpack insights about the '*what can we do'* question (O'Donoghue's, 2001). During each step, Komal paused the film at specific points and asked learners what they would have done, thus arousing their curiosity on the action that they would take. Komal also related the story of a girl who was dishonest while saying that she completed her homework alone at home when it was not true. Thus, she portrayed place-based learning to strengthen her lesson.

When presenting her lesson during cycle two, Komal proposed the topic, *preservation of water.* The lesson commenced with the aspect of the importance of water in learners' daily lives, so Komal asked them what would happen if they did not have enough fresh water at school or at home. Hence, she motivated her learners to think critically from their different perspectives about a place without water. That exercise was a success as learners proposed a multitude of answers which revealed that understanding was evident. When the lesson concluded, Komal was quite impressed with her learners, and was confident that she had enhanced her understanding of LFS during her lessons.

Sandia

The whole lesson was presented in class. Learners brought materials as requested by Sandia (teaching) to utilse during the lesson. During the first cycle, Sandia's lesson was based on composting using plastic bottles. She introduced place-based learning when she asked her learners "What do you do with your waste when you go to the seaside?" To answer, her learners envisaged different scenarios about what they did with their waste. Some children said that they would leave it there, causing pollution, whilst others said that they would put all waste in a bin. At first, when the teacher asked the children to bring from home their waste such as plastic bottles and food leftovers, the children could not envision that this was beneficial. They were not aware they would use waste to make their own compost bottles to grow crops such as vegetables and flowers. In this way, environmental pollution caused by waste disposal could be reduced. By the end of the lesson, Sandia was keen to participate in cycle two as she believed that her understanding and enhancement of LFS was not complete.

In The second AR cycle, Sandia asked her learners to observe the schoolyard and playground just after recess, as she knew the extent of littering would be high. This connection with the geographical place invoked their curiosity in assessing the harm that they were causing to the environment. Immediately, they responded that it was a very bad practice which required immediate and urgent action for cleaning-up. As a result, a new understanding of LFS was developed by both the teacher and the learners which confirmed that place-based learning was important for change to occur in any sustainability context to get the best possible solution to the problem. When the lesson concluded, Sandia was more than convinced that she had positively enhanced her new understanding of LFS into her lesson.

Vijay

The fourth goal of the Burns' Model of Sustainability Pedagogy was not fully fulfilled during cycle one of Vijay's lesson one. He failed to relate his teaching to the outside geographical place where place-based learning could occur (Janse van Rensburg, 2015). When he projected some pictures of objects on the board, learners were able to relate them to specific materials they were made from. To some extent, learning through new understanding occurred, but was limited to the materials found in environment spaces. Later, he demonstrated that people using excessive amounts of paper would result in many trees being cut down. This causes environmental damage to the ecosystem as trees are carbon absorbers. As a result, he made his learners understand that reducing the amount of paper to be used would certainly decrease the number of trees to be cut. Using the same concept of place-based learning, the teacher proposed the use of biodegradable materials to produce plastic bags that would reduce plastic pollution in the environment. It was appreciated by his learners as they excitedly acknowledged it through a class discussion on the sustainability theme.

For cycle two, Vijay conducted a lesson on waste management by proposing that his learners observe the schoolyard and playground after recess. He wanted to arouse their curiosity on the state of these places. This strategy provided meaningful learning as they were exposed to the geographic place where learning was happening. Learners collected litter from the playground and the schoolyard and took it to their class to carry out a waste-separation activity. When the lesson concluded, Vijay indicated that his understanding of LFS had evolved positively as he had integrated LFS into his teaching.

Ritika

While conducting both lessons for cycle one and cycle two, Ritika was could not demonstrate that learning had effectively occurred in a place-based context. During her first lesson in cycle one, she conducted an activity based on the question-and-answer technique, similar to a revision session before an exam. Deep learning through place-based context methods did not occur. This was evident during observation as learners were not able to relate their understanding by using contextual dimensions. By only asking learners to visualise a situation, (e.g. the melting of icebergs), they could not foresee its environmental impact. That could have been possible if the teacher screened a video or presented pictures which would lead to the development of new knowledge of LFS.

Compared to the first lesson, the lesson in cycle two was better as Ritika included the effects of climate change. Learners related what they experienced during the recess regarding the high temperatures, and thus were able to interact positively resulting in knowledge development. In so doing, place-based learning was promoted (Hedden et al., 2017), and the fourth goal of Burns' Model of Sustainability Pedagogy was achieved. Following this experiment, the learners constructed new knowledge and their understanding of LFS was consolidated. When the lesson concluded, the teacher indicated in her reflective journal that through using the different techniques, learners were more active in class discussions and could participate actively during questioning. This proved to Ritika that any sustainability issue, through different lenses, would prove to be beneficial for herself and her learners. Through this experience her enhancement was fully achieved by using her new understanding of LFS.

Nirma

The teacher used a brainstorming session to commence her lesson on sustainability. Learners recalled information from background knowledge and revision classes to answer questions, but failed to participate actively in class discussion. The questioning session stimulated the learner's constructed knowledge to unpack their insights. Thus, the teacher acted on behalf of the learners to make a conscious and informed response on the sustainability issue during her lesson. She did not research ways of doing things differently as her understanding was not yet established. Learners were not able to relate the environmental situation to the geographical place-of-action taking to develop their understanding of LFS. Also, they could not deduce

possible variations of situations to the present situation. During multiple instances, Ritika applied traditional methods of learning, thus action-taking situations were limited.

After the first lesson, Ritika moved to her cycle two lesson where she connected her lesson to an environmental crisis - a shipwreck on the coral reef. Learners' interest was aroused when they observed the pictures related to the geographical situation involving a sustainability crisis. They were able to give plausible answers on what should be done, and how it should be done to reduce the environmental impact on the ecosystem. They were able to comprehend the consequences of lagoon pollution caused by the oil spillage from the sinking oil tanker. From this lesson, new knowledge was developed about how place-based learning promoted a constructive understanding of LFS. Nirma was convinced that learners were able to write simple sentences in their compositions which related to a crisis depicted in pictures presented in class.

7.7.5 Enhancement of LFS through Reporting and Transformative Learning

Rudilla

Using the fifth dimension of Burns' Model of Sustainability Pedagogy and the O'Donoghue's Active Learning Framework in cycle one, Rudilla planned her lesson by designing a class-activity where learners drew pictures of the good habits of keeping the classroom clean. Through this goal, learners were acquainted with the strategies of using the classroom bin for disposing of their waste regularly. Furthermore, they witnessed how they were empowered by working collaboratively which transformed their behaviours when new learning and understanding occurring. Rudilla also emphasised that throwing away plastic bottles was not ecologically sound, and that there needed to be a transformative learning experience of always keeping plastic bottles for re-use or recycling. Consequently, this conscientised learners to critically reflect on their past conduct and its consequences.

During AR cycle two, Rudilla wanted to enhance her understanding of LFS differently by allowing learners to experience the non-civic actions they engaged themselves in during recess time, and how their actions had affected the sustainability of their schoolyard. Through active learning, learners were more sensitised about cleanliness after being involved in cleaning the schoolyard themselves (Buil-Fabrega, 2015). They reported back collectively to their teacher that it was a hazard to continue littering the schoolyard and playground, and that now they have learnt how to keep spaces tidy. Rudilla further enhanced her lesson by telling the learners that

every single action towards sustainability reinforces their social and environmental contact with people (Calavia et al., 2021; Rosen et al., 2020). This content knowledge further enhanced the teacher's understanding of LFS as learners became more conscious of the harmful consequences of environmental degradation. Rudilla also pointed out that her learners' awareness towards sustainability could be practised in their homes and communities at large. This could create collective ecological principles to guide sustainable cultural and social practices.

Komal

The fifth objective of Burns' Model of Sustainability Pedagogy is a design process, incorporating all the other four goals which create a transforming learning experience for the learners regarding sustainability issues. According to the Komal's reflective journal, she mentioned that learners could not recall all the possible outcomes on how they could deal with sustainability situations, thus no practical solutions emerged. Komal did not witness critical-thinking evidence in her learners when they were exposed to the situation of the actor in the film. These types of reflection arose when they were further questioned by the teacher on the salient features of the film which stimulated evaluation, reflection and further information-seeking to discover the best possible solutions. Also, problem-solving skills among her learners were absent. Komal was dissatisfied with her enhancement regarding her understanding of LFS and opted to participate in cycle two of the AR.

In AR cycle two, Komal selected a topic on sustainability in which she could include strategies to stir full active participation of her learners in discussion and reporting to create a transformative learning experience. Saving water at school and at home put the learners in a position where they were able to converse with their teachers and their peers on practical ideas to address sustainability issues. Knowledge generated from the experiences created learning that influenced learners' attitudes and values to transform unsustainable behaviours to sustainable ones. After the conclusion of the lesson, Komal claimed that she had experienced a transformation in her understanding of LFS, and that her enhancement of LFS would be reflected during her future lesson presentations.

Sandia

During both cycles of the AR, Sandia was convinced that her understanding and enhancement of LFS had evolved during the period of this study. She now could confidently relate the different aspects of sustainability during lesson presentations, while at the same time arousing reflection processes in learners to come up with possible solutions to problems. As far as her first cycle lesson was concerned, learners were encouraged to report and share their reflections with the whole class regarding how to reduce plastic pollution by recycling into plastic compost bottles to grow vegetables at home. Through this design and reporting process, learners shared their achievements and challenges among themselves and the teacher, thus encouraging them to use problem-solving skills to practise sound habits. Hence, learners were empowered and transformed when learning occurred in an active and participatory way which was grounded in thematic, critical, and diverse perspectives. During post-lesson sessions, Sandia expressed her satisfaction that she had effectively enhanced her constructed knowledge of the understanding of LFS to become a better teacher.

Vijay

Vijay instilled transformative learning regarding LFS into the lives of learners evident in their change of behaviour towards sustainability issues. During his lesson presented in AR cycle one, he elicited responsive skills in learners when he talked about the sustainable use of paper at school and at home. Learners were able to report back and discuss the consequences of overuse of paper which led to the cutting down of more trees. The outcome from their discussions resulted in more transformative learning experiences such that learners were sensitised toward LFS. Further, Vijay discussed plastic pollution which causes tremendous environmental harm. Learners shared information as to how they could transform their ways of thinking and living to minimise the causes of plastic pollution. In so doing, learners devised possible solutions and discussed them with their teacher and peers.

During the lesson in AR cycle two, Vijay arranged for the learners to colaborate to separate the litter that they collected into different categories for re-use and recycling. Their understanding of the sustainability prompted them to come forward with plans and strategies to reduce waste production. After the two cycles, Vijay pointed out that his enhancement of LFS had improved due to his renewed understanding of LFS experiences emanating from his lessons.

Ritika

During the lesson in cycle one, learners were exposed to the term *climate change*. They were asked by the class teacher to describe what they understood by this term. Several answers were given by the learners. Then, Ritika had to clarify its proper description. As a result, the learners were not exposed to discussion, and were not given the opportunity to participate in knowledge construction. Little reporting back was encouraged which prevented learners from examining opportunities for critical reflection to achieve sustainability objectives.

In contrast, during the cycle two lesson (according to the reflective journal) Ritika promoted active learning strategies as proposed by Zorabi et al. (2012) and Buil-Fabrega et al. (2019) where learners were asked to reflect on what they did during recess time. Learners were enthusiastic in their responses and provided new knowledge to the discourse. Accordingly, learners were able to relate their activities to the lesson on *global warming.* The questioning technique by the teacher added the stimulating aspect of searching for the appropriate information regarding sustainability issues. This was done by adopting reporting as a technique to create opportunities for critical reflection on the topic being taught. In so doing, the teacher was further exposed to the emotions and feelings emanating from the learners concerning the social aspect LFS and the promotion of new knowledge-construction. Ideas were discussed and practical solutions were offered to address sustainability problems. Ritika was very happy with the outcomes of the cycle two lesson indicating that she had enhanced her understanding of LFS during her lesson presentations.

Nirma

Reporting and transformative learning experiences provided an opportunity for learners to transform their attitude, values and behaviour conducive to sustainability. During the lesson in cycle one, Nirma wanted learners to unpack the terms *sustainability* and *SD*. This theme aided in critically reflecting on the answers given by learners' peers. It could have stimulated dialogue between them and their teacher to report new ideas pertaining to LFS, but this was not the case. As a result, learners could not offer ideas on how they could deal with sustainability issues or how to address them. While conducting the lesson, various issues were raised by the teacher but her learners did not profer solutions. Learners could not relate their learning during class discussion to the expected outcomes by providing answers to problems that were raised. Such solutions were meant to sensitise learners to use bins to dispose of their waste, and to embrace sustainable behaviours in respecting the environment and society.

During her lesson in cycle two, Nirma demonstrated a greater understanding of new knowledge while conducting her lesson on marine pollution. Learners were able to provide varied answers to the questions she asked with added perspectives from different dimensions of sustainability. Learners suggested possible solutions on how they could tackle the devastating effects of oil spills through their past experiences and knowledge of a recent shipwreck in the south of the country. By the end of the lesson, the teacher expressed her satisfaction on how her enhancement of LFS was developed, which allowed her newly acquired knowledge and understanding of LFS, to be integrated in future lessons.

7.8 CONCLUSION

This chapter revealed the data generated during the action research regarding teachers' reflections in line with Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework. The findings contributed to providing an answer to my first research question; namely, *what is teachers' understanding of LFS in Mauritian primary schools?* Post-lesson interviews provided information which assisted in answering the third research question; namely, *why do teachers enhance LFS in Mauritian primary schools the way they do?* The findings from chapters five and six which represented the thematic interpretation of the data set, and chapter seven which represented the theoretical reflections, fully answered the first research question; namely, *what is the teachers' understanding of LFS in Mauritian primary schools?* in Chapter Eight. The final synthesis of these findings in relation to the research questions (also covered in the final chapter) drew on the main revelations in the previous chapters to answer the remaining research questions. The next and final chapter (8) provided the summary of findings and the study's contribution to knowledge.

CHAPTER EIGHT

SUMMARY OF FINDINGS, CONTRIBUTION TO KNOWLEDGE, LIMITATIONS, AND CONCLUSION

8.1 INTRODUCTION

Chapter seven presented the findings and the discussion of the study. In this chapter (8), the findings and main themes of the action research are discussed to offer more insight into the understanding of the phenomenon under study. This chapter also proposes a model for LFS implementation which focuses on the potential barriers that teachers who attempt to integrate LFS into their lessons encounter. The chapter concludes with the limitations of the participant-designed action research, and recommendations for future research.

8.2 OVERVIEW OF THE RESEARCH REPORT: SEEKING ANSWERS TO RESEARCH QUESTIONS

This study sought to investigate teachers' understanding and enhancement of LFS in Mauritian primary schools based on the research questions that follow:

- What is teachers' understanding of LFS in Mauritian primary schools?
- How does teachers' understanding of LFS shape their enhancement of LFS in Mauritian primary schools?
- Why do teachers enhance LFS in Mauritian primary schools the way they do?

In this participant-designed ARC of planning-action-observation-reflection, participants improved and developed their knowledge and skills of LFS. In so doing, it helped them in their progress and empowerment processes (Welby-Solomon, 2015). As proposed by Allen (2018), action research focuses on the action; that is, how to improve a situation - this research is a conscious effort to construct new knowledge, and adding theories of action from the information garnered from participants. Usually, people refine their knowledge through adapting their existing knowledge. Addressing the research questions directly involves the data analysis of findings (chapters five and six). The existing theoretical framework of Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework led the way to answer the research questions. The answering of the research questions provided

constructive teachers' understandings of LFS, in adition to how their enhancement of LFS plays a crucial role in their professional and personal development through knowledge-construction in the field of LFS teaching.

8.2.1 Teachers' Understandings of LFS

The first research question, *what is teachers' understanding of LFS in Mauritian primary schools* was answered during both research cycles. While answering this question, I referred to both the semi-structured interview and planning steps from the pre-intervention and the intervention phases mentioned in chapter four, included the reflection step during the post-intervention phase of the final post-lesson interview. Hence, the teachers' understanding of LFS is depicted by displaying professional progress that occurred between AR cycles.

The semi-structured interview in the pre-intervention phase served to unpack teachers' existing understanding of LFS. During the interview, half the number of the teachers (Komal, Sandia and Ritika) revealed that they had never heard about LFS before, and the rest (Rudilla, Vijay and Nirma) said that they had only heard about the term *sustainability*. Since LFS was an unfamiliar term to them, they could not connect the relationship between SD, ESD and LFS. Therefore, it could be deduced that teachers were not confident in addressing LFS during their lessons despite having clear NCF guidelines (Green & Somerville, 2015). Most of the educators had their own ideas of what LFS constituted, thus they applied their own understanding of LFS in their practice.

The reflection step during the post-lesson interview served to gauge teachers' understanding of LFS from the previous phases. Through the analysis of the reflection step, it was possible that all teachers could develop their understanding of LFS further throughout the process of the AR. It was noted from their participation that their understanding of LFS was much improved. However, the extent of understanding of LFS for each teacher varied as they demonstrated different but comparable understandings of LFS during the AR. Rudilla, Vijay and Sandia showed the high levels of knowledge development *vis-à-vis* their understanding of LFS, while Komal and Nirma displayed the mediocre levels of knowledge development. Rudilla displayed a relatively deeper understanding of the LFS in relation to society, the environment, and the economy, while Sandia, who was well-versed with biophysical aspects of the environment, provided detailed explanations for producing healthy fruit and vegetables by utilising compost bottles.

Teachers' understanding and enhancement of LFS were more pronounced by the end of the second cycle. It was apparent during their post-lesson meeting when they devised and applied new teaching and learning methodologies to incorporate LFS into their lessons. They had to also criss-cross into disciplines that were not directly linked to LFS issues. The findings also revealed that teachers presented lessons that promoted LFS and its relevance to the environmental facets of sustainability (Evans et al., 2017).

Nirma, who stated that LFS could be included in any learning context or subject area, was very pleased in realising that her new knowledge-construction assisted in her understanding of LFS. She was able to incorporate the topic on *oil pollution* into her French composition writing exercise. This was also evident with Vijay, who, besides delivering a lesson on materials in the environment, slanted his lesson in cycle two to talk about protecting trees through less use of paper. In Komal's case, she was not confident when she initially agreed to present a lesson on the theme, *honesty is the best policy* where the emphasis was on inculcating good social practices among learners. In the second cycle, she chose to implement a lesson on *how to save water* as she felt that she was implementing LFS principles. By the end of cycle two, she pointed out that she was at a loss at first regarding the choice of topic, but she finally saw the light that both lessons on *honesty* and *saving water* were actually LFS issues. Therefore, it was quite normal for a teacher to implement a combination of two topics during LFS.

In contrast to Sandia and Nirma, Ritika's understanding of LFS displayed evidence of new teaching and learning methodologies to accommodate and promote LFS concepts in different ways during cycle two of the AR. She displayed better enhancement of her understanding of LFS such that her class was livelier by following Burns' Model of Sustainability Pedagogy, compared to her first lesson in cycle one. So, there was a transformation from her initial understanding of LFS from action research cycle one, to cycle two which prepared her learners to apply critical-thinking skills to function sustainably. Sandia was also able to display the shift from her initial understanding of LFS throughout the two cycles. She was particularly engrossed in the active learning which occurred during her lesson presentation where learners were more enthusiastic in building their own compost bottles while learning about how this resulted in decreasing plastic pollution. Furthermore, she used her new knowledge in cycle two to deliver a lesson on composting bottles to grow healthy fruit and vegetables. This resulted in meaningful learning practices revealed in the findings which clearly showed that the teachers had gradually developed a better understanding of LFS such that they could confidently

integrate LFS into different subject areas over the course of time as proposed by Maidou et al. (2019).

8.2.2 How does the Teachers' Understanding Shape their Enhancement of LFS?

The second research question, *how does the teachers' understanding of LFS shape their enhancement of LFS in Mauritian primary schools* was answered in the findings in chapter six from the action and observation steps in cycle two of the AR. Different themes emerged from the action and observation steps of cycle two which developed teachers' understanding and shaped their enhancement regarding LFS. These features through which the research question was answered, are described in the following sub-sections:

8.2.2.1 The learning process for sustainability through different learning strategies/styles

Teachers adopted new and revised learning strategies and styles during the action research cycles. These involved groupwork such that Komal's learners were able to learn through discovery and observation. In addition, role-play was also adopted as an appropriate strategy for learners to participate in lessons. Discovery learning helped in the implementation of LFS when learners were taken outside the classroom to observe the condition of the schoolyard after the recess time. These action-taking and active learning processes aided the teachers to shape their enhancement of LFS (Burgener & Barth, 2018) which occurred when learners participated in the collection of waste from their schoolyard and playground. Through learners' collaboration and collective learning, they felt and experienced the importance of performing the action for the benefit of sustainability (Watson, 2017).

Vidyakala (2020) explains that one's learning style refers to the preferred way in which the one absorbs, processes, comprehends, and retains information. Different and innovative learning processes for sustainability must be exploited in lesson-presentation. Teachers must create conducive learning spaces which are flexible and dynamic to ensure that learners become part of the learning process (Pahnke et al., 2019). Incorporating visual materials as aids to teaching, makes lessons interesting for learners. This results in increased interaction among learners and teachers, thus crucial knowledge development is attained (Calavia et al., 2021).

The use of technology, according to Boorang et al. (2018), can promote all types of learning styles. Additionally, new types of teaching aids, tools and experimentation apparatus can also form part of new teaching and learning styles. Group projects on sustainability in conjuction

with collaborative learning in class presentations and classroom observations, create rich teaching and learning experiences (Ferdous & Karim, 2019). As a result, teachers in the study successfully incorporated sustainability themes into their lessons during ARC two. In this cycle, they had to avoid traditional learning methods to accommodate innovative and inclusive learning styles that enhanced their teaching.

8.2.2.2 Prior and background knowledge of LFS

Prior and background knowledge of LFS among learners and their teachers from ARC one were effectively implemented in ARC two lessons. It was evident from the data analysis that teachers shaped their understanding of LFS from what they had experienced during previous lesson delivery. In so doing, teachers built upon their understanding of LFS so that they were able to shape their enhancement of LFS for the effective implementation of lessons. Furthermore, local and indigenous knowledge also played an important part in LFS. Moreover, knowledge gathered through lived-experienced and from people in the school community influenced some teachers in shaping their understanding of LFS (Hlalele, 2012).

8.2.2.3 Cross-curricular approach to LFS

Teachers were able to clearly demonstrate the effective implementation of lessons by using a cross-curricular strategy throughout the ARC. Komal's lesson on *honesty* during her English language lesson was a cross-curricular implementation of LFS content in a language class. Since *honesty* is an important concept in LFS, language subjects better facilitate the imparting of LFS principles. Also, learners can demonstrate empathy and values that can make them change into better citizens (Seatter & Ceulemans, 2017). Further, Nirma also demonstrated how she had shaped cross-curricularly her enhancement of LFS from AR cycle one to AR cycle two by planning and implementing LFS content into a French language composition writing exercise.

8.2.2.4 Experiences from cycle one and interpretation of new understandings of LFS

Teachers noted in their reflective journals that at a certain time during their ARC one lessons, that they exhausted new techniques and teaching strategies which created a frustrating situation. Experiences from cycle one resulted in changes that they introduced in cycle two. To some extent, the remedying of challenges from cycle one resulted in changes in their practice based on their knowledge and interpretation of the new understanding of concepts. This proved to be

a critical aspect of AR, as the teachers shaped their enhancement of LFS through changes in their understanding of LFS (Hay et al., 2008).

Teachers' engagement during their own personal development resulted in the opportunity to further learn and reinforce their understanding of LFS in order to apply it to their school context (Gamage et al., 2022). The teachers now believed in their own practice and experience which they had acquired during the AR. Additionally, teachers expressed their views gleaned from their reflective journals, on how their pre-lesson meetings before each cycle changed their initial notions of LFS. It was at these reflective phase meetings that teachers could improve their understanding of LFS which shaped their enhancement of LFS.

Ritika was the most influenced participant who was amenable to changes when she realised that her implementation of her first cycle lesson was deficient in terms of learner-engagement. Her apprehension, she explained, was that her understanding of LFS was not sufficient and that she wanted to develop it further during her second cycle of the AR. This proved that teachers wanted their learners to become conscious of LFS issues via new ideas and teaching strategies in future lessons. This culminated in much enthusiasm for LFS from the teachers. In other words, teachers empowered themselves through their engagement in AR to develop their understanding of LFS by grasping opportunities to better themselves with the necessary sustainability skills and strategies for their professional development (Brandt et al., 2019). This provided sufficient insight on how teachers shaped their enhancement of LFS after the second cycle of the AR.

8.2.3 Why do Teachers Enhance LFS the Way they Do?

The answer to this research question was revealed through findings (chapter four) in the reflection step and post-lesson meeting during ARC two of the study. The answer emanated from teachers' own evidence of planning lessons that they chose to implement during their action research cycles. Evidence from their reflections proved that teachers initially did not have a structured plan for developing their understanding of LFS. Hence, they were not sure of how to begin developing LFS understandings. Firstly, the majority of the teachers admitted that after the initial semi-structured interview they were able to see the purpose of this participant-designed AR, and how they were going to develop themselves further during the AR cycles.

Secondly, the teachers decided to enhance LFS the way they did through the pre-lesson meetings that I conducted before each cycle. It was during this period that they were able to

develop an understanding of LFS, thus enhancing their teaching during the two cycles. There was also the consideration of what they understood from their initial prior context knowledge in the different stages of their knowledge- construction. This was evidenced by their decision to implement new and innovative teaching strategies, and newly developed skills in future lessons. As mentioned in the previous sections of this chapter, there was some teacher empowerment in their teaching because of their own intervention and experiences in the previous cycle. In so doing, teachers expressed their enthusiasm and desire to incorporate what they had learnt and experienced in order to plan their future lessons while implementing LFS content and concepts (Maidou et al., 2019).

The answer to the third research question provided sufficient insights into how teachers might further develop their understandings of LFS, and accordingly enhance them in their future lessons. This participant-designed AR provided important motivations for teachers in dealing with complex sustainability issues while working with school children. As a natural consequence of their exposure to the different meetings, teachers developed their understanding and enhancement of LFS and located them within the context of the school environment. Furthermore, the exposure during the first and second cycles of AR was appropriate in constructing their understanding and enhancement of LFS the way they did. Evidence originated from teachers' post-lesson meetings where they claimed that they applied their knowledge and meanings of LFS to enhance their teaching the way they did (Cebrian & Junyent, 2015).

Also, reflective practice played a major role regarding their choice of how to enhance LFS. According to Howell (2021), reflective practice is an important and reliable way of self-directed knowledge-building related to LFS in primary schools. It was evident from the study that teachers themselves chose and used what they knew to develop their new knowledge-building in LFS. It was clear from the above exposure that teachers utilised the steps of the ARC as a tool to progress towards knowledge-construction. Lastly, reflective practice and experience in advancing teachers' understanding and enhancement of LFS in primary schools, empowered them to confidently plan and effect better lessons in the future.

8.3 IMPLICATIONS OF ACTION RESEARCH

8.3.1 Teachers' Engagement in the Action Research Cycle

Data generation indicated that teacher-participants, especially Komal, Ritika and Nirma, failed to develop critical-thinking skills in learners as they were more inclined towards traditional approaches for teaching and learning. From observation, it was clear that during the first ARC, learners adopted a traditional learning approach which was characterised by passivity (Tularam & Machisella, 2018). Moreover, teachers were unable to incorporate new knowledge from outside the curriculum into their teaching, thus relying exclusively on the prescribed textbook as a means to deliver content knowledge (Shah et al., 2022). This was also true for Sandia who admitted that she never had to search for additional content knowledge regarding Science topics and LFS from outside of what was already contained in prescrobed textbooks.

This situation created lethargy in class where learners were demotivated to participate in class discussions thus depriving them of new knowledge development in the field of LFS. As a result, learners displayed disengagement in the learning process such that they could not relate LFS concepts to other subjects. These observations were noted by the teachers in their reflective journals where they, themselves, understood that their teaching strategies must change so that learners could actively participate in class activities and discussions. Fortunately, it persuaded teachers to plan their next ARC lesson in such a way to engender more engagement from learners and teachers.

8.3.2 Action Research as a Driving Force to Support Change

From the literature reviewed in chapter four, the five characteristics of AR mentioned by Greenwood and Levin (2007), are identified in this study. They are:

- an attempt to provide solutions to problems that existed within the ambit (LFS) of this study;
- a reflective inquiry which involved the participation of teachers;
- meaningful action-taking using diverse abilities and experiences gathered during action research cycles;
- meaningful knowledge-construction from teachers' understanding of LFS during the action research cycles; and
- developing teachers to change their practice to become versatile in problem-solvers.

During this AR, the six participants developed their understanding of LFS within their lessons. They were also able to use reflective practice from their understanding to enhance LFS during the AR cycles (Natkin, 2016). Furthermore, teachers were able to drive this understanding of LFS through their content knowledge and experiences gained from their teaching practice.

Regarding the fourth aspect of the AR, as proposed by Evans et al. (2012), Green and Somerville (2015) and Manasia et al. (2019), teachers displayed more confidence during their second action research cycle as they reflected positively on new methodologies and strategies to conduct their lessons. Moreover, the participants were all certain about their enhancement of LFS such that they addressed LFS adequately in their second ARC. They all expressed the feeling of correctly implementing LFS during the second ARC, and were motivated to investigate problematic situations regarding LFS in primary schools. All the participants were in favour of integrating LFS into future challenging situations in schools in order to fully enhance their understanding of LFS (Miedijensky, 2019). This stands true as a driving force for change for the betterment of all teachers to progress in their career paths.

However, change can only be successfully effected when teachers are willing to implement innovations, policies, and adaptation strategies in teaching-learning practices (Kuzmina et al., 2020). As informed by the NCF (2016) and the findings from this study, there are enablers which address LFS which include the syllabus, content, textbooks, and SDG components, but a lack of capacity-building can pose a serious drawback for teachers to confidently address the concepts of LFS in primary schools (Manasia et al., 2019).

8.3.3 Reflection on Teachers' Enhancement of LFS

There is no doubt that participants developed their knowledge based on LFS, and thus contributed towards knowledge-production regarding their understanding and enhancement of LFS. Although the teachers contributed to new knowledge-construction in the field of LFS in primary schools, they have only reached the first milestone in becoming LFS experts, as evidenced during the conclusion of AR cycle two.

The reflective journal was an important instrument for teachers to critically analyse events and construct their knowledge of LFS throughout the AR. It also provided important details on how and when to react to situations which prompted them to change or amend their teaching techniques and strategies (Natkin, 2016). Although, they considered writing in their reflective

journals a burden at first, they later realised the practical use of it. This reluctance of writing in their reflective journals can be understood - teachers, in their everyday work at school, are not accustomed to reflect in a written form regarding the nature of their experiences during their teaching hours. Nevertheless, they could verbalise their reflections rather than writing them to discuss when necessary. The little that the participants were able to write down in their reflective journals was adequate for me to critically analyse their thoughts during the AR.

Teachers who engage in writing reflections plan better and become action-oriented to achieve successful outcomes during lesson presentations (Mudaly & Ismail, 2016). However, those teachers, as I said earlier, who were not reflecting fully in writing their reflective journals, were by no means not engaging in deep reflective thought. This was evidenced by the level of engagement throughout the different cycles where they implemented LFS according to their understanding of LFS which they had developed. Sandia was a relevant and an appropriate example - she set out at first claiming that she was not at all familiar with LFS and she could therefore not implement LFS in her teachings, but later she transformed her attitude to achieve successful outcomes. Through reflection and pre- and post-lesson meetings, meaning-making emerged such that she evolved as a teacher. This encouraged her to change her understanding to conceptualise LFS in her teachings.

Reflections provided all the participants with an approach to professionalise. Teachers were more confident in engaging LFS as they demonstrated substantial change in aspects of methodology (among others) during their lesson presentation evidenced in their lively interactions with their learners.

8.4 RESEARCH CONTRIBUTIONS

In this section, I reflected on the contributions of this study in line with the theoretical framework and methodology used in this multiple case study.

8.4.1 Theoretical Contributions

My theoretical framework relied heavily on Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework. During this study, I regarded both theories as inter-related, with a shared objective of addressing the challenge of exploring teachers' understanding and enhancement of LFS in the primary school sector using a participant-

designed action intervention. Considering Tellings' (c.f. 2.6) explanation of theoretical integration, I used both theories and integrated them through reduction (Van der Klis & Tellings, 2020). Burns' Model of Sustainability Pedagogy can be applied in various activities to address the increasing emphasis on how teaching and learning can be re-oriented towards sustainability and LFS. Thus, teachers (through LFS pedagogy) can effectively be capacitated to address the increasing socio-cultural and environmental problems in our society.

Theoretical integration aims to transform teachers and learners to empower them to grasp sustainability content (Mogren et al., 2018; Vaughter et al., 2016; Silo & Ketlhoilwe, 2020). O'Donoghue's Active Learning Framework aims at engaging learners in action-taking activities to develop and transform their attitudes and skills towards sustainability (O'Donoghue et al., 2018). This theoretical framework can become an indispensable tool for teachers to understand and address sustainability problems by providing learner-centred teaching and learning. It provides opportunities for learners to participate in genuine decision-making that positively transforms their attitude and behaviour towards sustainable futures (Grindheim et al., 2019). In general, teachers can encourage independent learning and encourage learner-centred teaching and learning in other disciplines as well.

Both theories can further contribute towards inspiring, empowering, and transforming learners as well as teachers to address sustainability concerns in our society. Furthermore, through this multiple case study design with a framework of participant-designed action research methodology, it has the potential value to inform teachers, school administrators, and policymakers in developing a proper understanding of LFS, and how it can be enhanced in the education context to provide sustainable solutions to the ever-increasing global problems. This study provides a unique perspective for understanding LFS and addressing the lack of positive insights. Moreover, the enhancement of LFS engenders positive changes via adaptation strategies in teaching-learning practices. I contend that this study contributes by supporting and serving global pursuits in sustainability projects. In this regard, both Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework, with some amendments, can serve as powerful trajectories in designing lessons so that learners can benefit from the transformational and critical knowledge to do their bit to save this world from human-made catastrophes.

8.4.2 Methodological Contributions

This study's methodological contributions can be attributed to the multiple case study design nested in a qualitative approach within an interpretive paradigm encompassed by a framework of participant-designed action research methodology. According to Abutabenjeh and Jaradat (2018), research design approaches can be convergent or divergent. The methodological approaches were appropriate for this multiple case study design for data generation purposes to fulfil the objectives of the study. This research project makes a unique contribution to empowerment, transformation and adaptation strategies in teachers' practice. Frenzel (2010) acknowledges that the choice of participant-designed action research methodology within a case study can be proposed in light of major criticisms voiced against case studies, and with a view to best address the research objectives. Interestingly, Sales et al. (2021) also employed this unique design and methodology in Spain in a project framed as ...*an intrinsic case study of a school's educational improvement process based on participatory action research spirals.*

This participant-designed AR recognised that various strategies and approaches are executed at classroom level using research on class teachers, but not by class teachers. Although class teachers were not the pioneers of the participant designed AR, the study provided an opportunity to include them in the design and execution of their intervention. They planned, implemented, observed and reflected on their own understanding, development and enhancement of LFS. This function justified the claim that the teachers participated in this research to enhance their knowledge of LFS to construct new understandings (of LFS) that would benefit them in their teaching careers. Also, they will be able to transform themselves through their actions during the research process (Farrel & Weitman, 2007).

This study offers a unique perspective of addressing the research objectives by using a participant-designed action research with a view to generate and construct new knowledge in the field of LFS in an educational context. It also provides insights into how the research methodology can be a useful engagement tool in educational research that improves practice in teaching and learning.

8.4.3 Contribution to Practice

At the conclusion of the study, teachers described steps that they followed to shape their understanding and enhancement of LFS during their practice. Extracts from their interviews

provided proof of how their initial knowledge of LFS had developed and evolved. The level of change for each teacher was different, and apparent especially after the second ARC. Some teachers, especially Rudilla and Sandia, stated that the process of AR had equipped them better with new knowledge and understanding of LFS, which they were willing to employ to enhance their practice (Kuzich, 2019). The following are comments from some of the participants during the final semi-structured interview meetings:

Rudilla: *I thought if I knew and learnt more about LFS earlier, this could have helped me and my learners to adequately implement LFS in my classes.*

Ritika: *Through this study, I saw my teaching practice from another angle with regards to innovative teaching strategies to be adopted while addressing LFS. Also I gained via the utilisation of new teaching and learning skills.*

Komal: *I was able to learn from this study that what we learnt during our teacher-training and during the in-service course at the MIE do not provide all the necessary skills and competencies to address LFS in our classes. The action research has contributed to building and developing new knowledge, skills and teaching approaches to deal with LFS situations in my future classes.*

Nirma: *I can identify myself as having grown considerably from the experiences that I gained during the action research. This helped and persuaded me to adopt strategies gainedfrom LFS which I can adapt and incorporate into any subject or situation. At first, I was of the view that LFS could only be dealt with in Science or Geography lessons. That is true, I guess, since LFS can be perceived as cross-curricular and cross-boundary in nature.*

These extracts provide evidence of LFS's value. By the end of the study, their prior personal knowledge, worldviews, and experiences had shaped their enhancement of LFS. Through engaging in the participant-designed AR, they contributed to their knowledge-development, including their worldviews and their new practices for teaching LFS. Their justifications of their actions, especially during the intervention steps of the cycles, are proof of their newly

refined knowledge, skills in critical inquiry methodologies, and active learning processes. The level of confidence in engaging themselves in implementing LFS was higher, and so was their knowledge; hence, by reflecting and reacting differently led to shaping their enhancement of LFS. This study contributes practically by offering guidelines to teachers, curriculum and policymakers, and school administrators on the understanding and enhancement of LFS through reflective practice towards a sustainable future. Teachers can also be assisted to adopt a continuous multiple cycle participant designed action research as a method for self-learning to enhance knowledge and understanding of LFS, as well as for adopting relevant teaching approaches for application in teaching and learning processes within LFS. It can also be lauded as an effort by the researcher and the participants (as pioneers) in the emerging, yet quite unknown field of LFS in the Mauritian education system.

8.5 CRITICAL REFLECTION: MY PERSONAL LEARNING JOURNEY

According to Makovec (2018), teachers influence learners' development of values and worldviews. This action was considered as being important for LFS in the curriculum which seeks to broaden and structure environmental, social, and economic change towards sustainability. This has a direct implication on teaching LFS as a transformative tool towards a sustainable future. Emanating from this study, I deduced that teachers needed to explore *how* they teach their learners is as important as *what* they teach, so that they can develop learning strategies that assist school children to be active and responsible citizens by adopting LFS principles; hence, LFS is a value-oriented concept. Usually, one can observe that even if bins are present in strategic places in the schoolyard, school children still litter the grounds; this implies that there is a gap between the content being taught and learners' practices. The response to the challenges of implementing LFS at school level thus requires that there be some re-thinking on how teachers and school administration promote the teaching and learning of LFS.

From my personal experiences, this also entails that teachers must engage their learners to adapt to the innovative teaching and learning strategies encouraging them to employ constructive and constructed knowledge to modify their behaviour and transform their environment (Larsen et al., 2019). Moreover, the integration of global sustainability initiatives within the curriculum has been an important discourse at international sustainability summits and workshops. One of these was the EEASA (2021) where I got the opportunity to present my master's dissertation

which included some of my findings from this participant-designed AR. Since there is a dire lack of initiatives and projects which focus on re-orienting the curriculum for sustainability pedagogy through the provision of capacity-building for educators to engage their learners in active learning activities, Government must intervene at the highest level to remedy the situation (Mauritius Declaration, EEASA, 2021).

What I understood from the findings of this study, was that change towards sustainability entails more than merely reconsidering educational curricula which corroborates (Watson, 2017). This study's findings suggest that flooding the curriculum with sustainability themes will not produce the expected change towards LFS since it is already present at cross-curricular level. As I noted earlier in the findings, this was already supported by teachers during their conversations on whether they were addressing LFS in their school curriculum. The change towards LFS needs to come from the teachers' side, as well as from the school community - school management must actively promote sustainability projects at schools.

Given this scenario of needing to promote sustainability, this is where participant-designed AR will be useful to concientise teachers to take responsibility and pledge their commitment to develop new modes of teaching methodologies and innovative learning styles such as active learning, learner-centred learning, action learning and co-operative learning (Calavia et al., 2021). Teachers must be motivated to teach and inspire their learners to respect, not only themselves, but their possessions, their friends, their families, and the environment at large. Thus, this will make learners aware that all non-living and living entities are interdependent. I argue from my personal perspective and learning in the AR, that commitment towards LFS should embody values, principles, attitudes, and behaviours in tandem with social justice and equality for all.

8.6 LFS MODEL FOR PROMOTING CHANGE TOWARDS SUSTAINABILITY

Chapter two provided the lens through which I aimed to address the challenge of exploring teachers' understanding and enhancement of LFS in primary schools. I regarded both Burns' Model of Sustainability Pedagogy and O'Donoghue's Active Learning Framework as closely related to my aspirations as a researcher to dissect the phenomenon under study. In fact, the various phases and steps of AR have proved to me that integrating both theories contributed to addressing the research questions. This would engender the change expected to transform

teachers and school children to effectively address the increasing socio-cultural, economic, and environmental problems in our society (Watson, 2017).

While Burns' Model of Sustainability Pedagogy provided the necessary pedagogy that was incorporated in class activities which focused on teaching and learning, O'Donoghue's Active Learning Framework provided incentives for teachers to engage themselves in action-taking to develop necessary skills and knowledge for understanding LFS. O'Donoghue's Active Learning Framework also acted as a guide on what had to be done to address and understand LFS through active learning to improve teaching and learning. Out of studying and adopting both models for this research project, I have created a revised model of LFS adapted to learning situations in schools. This model provides incentives to develop a proper understanding of LFS and to address the lack of positive insights for teachers' enhancement by producing positive change and adaptation strategies in teacher learning and understanding practices. Through the research journey with the six participants, I propose the LFS model in Figure 8.1 below which illustrates the processes between the different parts of LFS, and its understanding and enhancement, and the setting of its implementation.

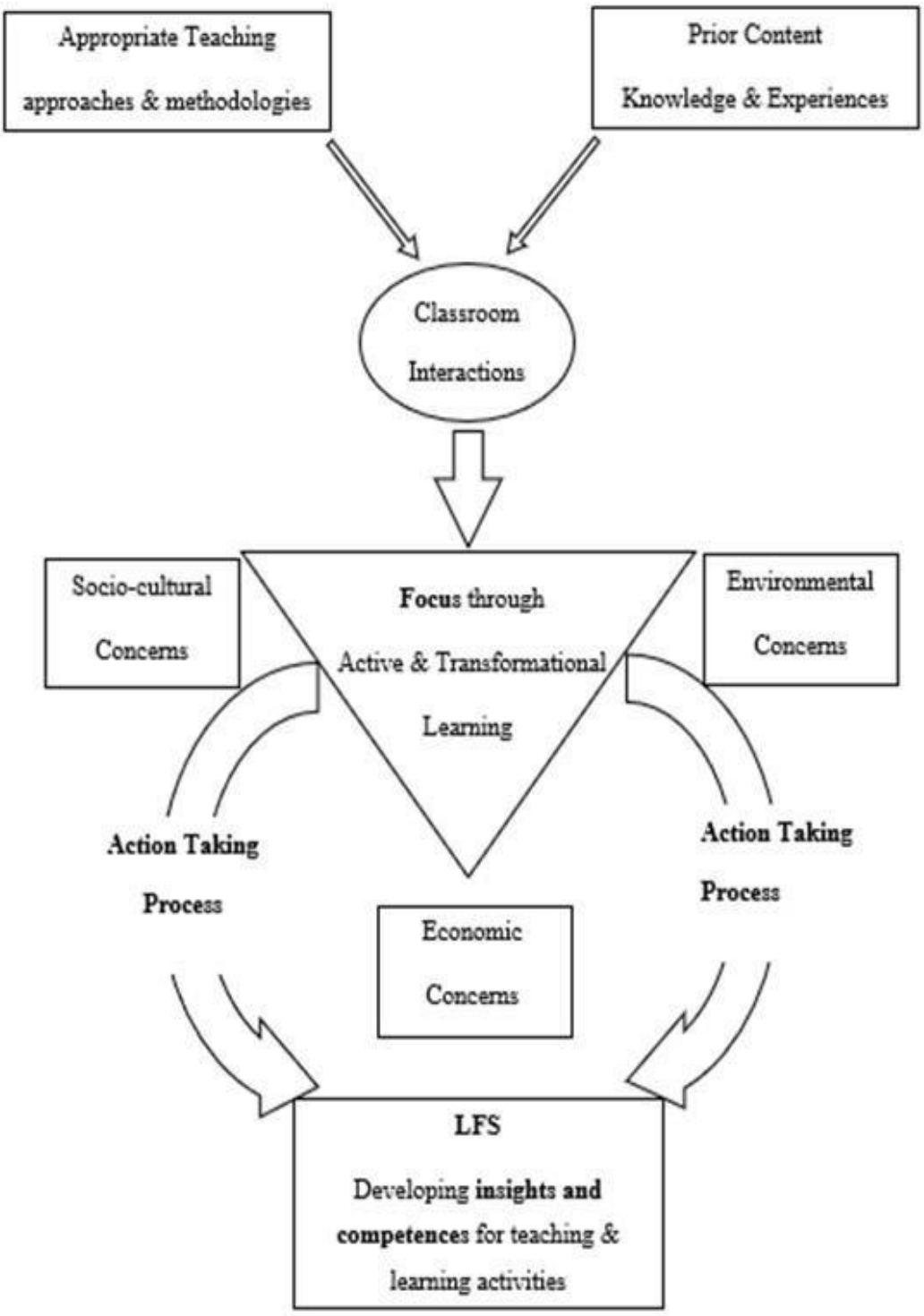

Figure 8.1: A LFS model for teaching and learning (by the researcher)

According to the model of LFS presented in Figure 8.1 above, classroom interactions which represent a classroom context/location/subject or topic dealing with sustainability issues are constructed through the injection of prior content knowledge and experiences of sustainability with appropriate teaching methodologies and approaches. In addition to classroom interactions,

the focus is on active and transformational learning which are driven by the inter-relatedness between environmental, socio-cultural, political (policy, governance, etc.), and economic concerns towards the focal point in the triangular structure. The focus thus drives the LFS through action-taking processes which enable the development of insights and competences through teaching and learning activities.

This model is adapted to foster necessary positive change and strategies in teaching and learning practices. It should be viewed as transdisciplinary and trans-perspective since it is not designed to include only a single discipline or been viewed from a single perspective. The LFS model that emerged from this AR should also be considered as cross-boundary in nature as it cannot be confined within the dominant structures and spaces that have shaped education systems for centuries. As such, LFS cannot be limited to only classrooms and schools. Learning in the context of sustainability requires hybridity and synergy between multiple actors in society (Rosen et al., 2020)

8.7 CHALLENGES OF IMPLEMENTING LFS

Teachers faced many challenges while they endeavoured to apply new teaching strategies to accommodate LFS concepts (Seatter & Ceulemans, 2017). Teachers responded that they could not perform groupwork regularly as classes became chaotic, thus favouring whole-class discussions to maintain control of the class. For the sake of the participant-designed AR, some of the teachers were able to conduct lesson activities outdoors, especially during cycle two, but most of the time they preferred to contain their learners inside their classrooms. Very often, disruptive learners purposely derailed outside-classroom lessons, thus teachers prefer to conduct lessons inside classrooms, which is opposed to Seatter and Ceulemans' (2017) contention that classroom teaching is too monotonous for the learners, and does not prepare them for a change.

Further, Chadha (2018) criticises teachers who solely rely on textbooks as it leaves little room for imagination and stimulation. Researchers like Westbrook (2013) advise that the recurrent use of learning resources over and above the textbook can promote enhanced learning opportunities for teachers. Alternative resources in LFS are *sine qua non* to proper knowledge-construction in sustainability. A lack of content knowledge and skills in LFS was observed through the data generation process where teachers were not motivated and inclined towards adopting new skills and teaching approaches that foster environmental and sustainability

stewardship in their learners. New knowledge and LFS skills engage learners in critical reflection about lifestyles to help them make informed decisions about their actions, and to work towards a more sustainable future. Teachers who are not well-versed in the use of innovative pedagogies in implementing sustainability content knowledge in their lessons, deprive learners of new developments in special skills including critical enquiry, systemic thinking, and problem-solving (Shah et al., 2022; Walter et al., 2020). The competencies needed for effective partnerships, participation, and action are also adversely affected. Hence, participant-designed AR can be used to develop and enhance these competencies.

Learners should be capable of exposing the foundations of sustainability issues and the values and assumptions that are dominant in society. As proposed by Calavia et al. (2021) and Rosen et al. (2020), teachers must be supported to develop participatory teaching and learning strategies and skills which are learner-centred, action-oriented, and in harmony with nature. Furthermore, using critical and reflective thinking, and engagement in real-life situations and contexts related to learners' lives, are also important aspects of teaching and LFS (Hedden et al., 2017). Teachers need to consolidate their pedagogical content knowledge with LFS vision to influence the effectiveness of sustainability at school level. This finding is consistent with a conclusion from another study which clearly mentions the need for teachers to be empowered to use innovative learner-centred teaching and learning strategies more frequently to reinforce the internalisation of ESD values among learners (MIE-UNESCO, 2011). They must modify textbook materials based on their teaching experiences to include themes related to LFS. These themes are particularly specific to the concepts being taught by the teachers who develop over time because of their teaching experiences.

When teachers develop a proper understanding of LFS, they are able to enhance their lessons to empower learners to be agents of change and sustainability ambassadors with a firm grasp of the content taught in class. Through the data generation and analysis processes, it was evident that teachers felt challenged in implementing sustainability measures in their lessons, thus they did not place much emphasis on content knowledge. What was lacking, and evident in the the findings, was that teachers were disinterested in the practicability of teaching sustainability during their first action research cycle, but due to their reflections, they were able to improve on their teaching and learning skills during their final cycle of the action research. This implied that they previously lacked the skills to integrate practical aspects of sustainability (Evans et

al., 2012) with the relevant teaching approaches required at each level; for example, the ability to introduce learners to processes of producing their own fruit and vegetables. This type of engagement is more likely to promote healthy living and sustainable consumption.

8.8 LIMITATIONS OF THE RESEARCH

A major limitation of this research was its time-frame. Since action research functions through its different steps of planning-action-observation-reflection, the participants conveyed their thoughts that it was only with the completion of the reflection steps at each cycle of action research that they started to realise what was expected from them. This statement confirmed that teachers felt motivated at the end of the cycle to implement innovative strategies in their lessons. It is therefore not surprising that I noted that longer or more cycles of the action research would provide greater insight into additional approaches that teachers could employ and develop over time. It could result in an authentic and appropriate reflection of their understanding and enhancement of LFS (Burgener & Barth, 2018).

As discussed earlier (c.f. 8.3.2), action research aims to provide a method to identify practitioners as designers and implementers of the change process. However, it must also give teachers the knowledge to identify the need to change or adapt some of their approaches. These changes must be motivated by teachers themselves, and not by the authorities. This participant-designed AR provided some innovative trajectories on how teachers may attempt to elicit change in their practice regarding LFS. As this research involved a qualitative multiple case study, the outcomes were limited in their scope, and therefore it cannot be generalised to the entire population. Moreover, considering the practicability and time-constraints, I consider that this study's scope is not broad enough. To gain a holistic and realistic view, it must include not only class teachers as participants, but also ICT, holistic and oriental language teachers across schools.

Lastly, this study was considered as being limited only to the social, economic, and environmental aspects of LFS that are being implemented at school level, and has not included additional aspects such as the political and Government policies which have an important influence in promoting LFS in education systems.

8.9 RECOMMENDATIONS FOR FURTHER RESEARCH

Firstly, I recommend that further research should be undertaken in more than two cycles in a similar study. This will contribute to invaluable insights and perspectives from teachers, policymakers, curriculum designers, and relevant authorities who are expected to embark upon LFS initiatives to develop a comprehensive understanding of LFSin all sectors of the popoulation. Further, it should become an ongoing engagement for teachers to address LFS in their practice as it would provide much-needed insights for self-directed professional development (Cheng, 2018). This participant-designed action research proposed the participants to design their own lessons which created a feeling that they were forced to develop and problematise issues in LFS. In fact, further research of this nature should not be a burden in itself for teachers, rather it should be regarded as a process of empowerment for the natural implementation of LFS in their practice.

This study addressed the lack of data by providing insights for future teachers' enhancement of LFS by engendering positive change and adaptation strategies in teachers' learning and understanding practices. Schools (teachers) should not only integrate sustainability models into current classes, but they should also encourage civil societies and school communities through PTAs for improving the situation. There should be an integration which requires proper knowledge and skills from teachers willing to implement LFS into the curriculum. As argued earlier, LFS cannot be taught through only one method but necessitates eclectism to include brainstorming, groupwork, inquiry, fieldwork, active, and place-based learning (Watson, 2017). There is evidence that learners need to develop ties with communities and places where they are rooted, and not only with nature (Hacking et al., 2017). This is possible by envisaging the need for the education system to revisit proper whole-school approaches to implement concepts of LFS where all the four components (school curriculum, school campus (environment), school culture, and school community) are taken into consideration.

Moreover, there is a need to change to lifestyles that foster sustainability practices holistically for attaining a sustainable future (Seatter & Ceulemans, 2017). As argued by Abson et al. (2017), there are many endeavours to pursue focus and research towards science and environmental sustainability, but development towards society, politics, and humanity remain elusive. Findings from this study noted that social, political, and humanitarian aspects of LFS lack consideration in schools and education systems. Future research should be focused through

system-thinking to consider transformational sustainability interventions that can connect learners to nature and to society.

Lastly, I recommend that this type of research should complement research studies on the broader school community by including taking other stakeholders such as school management, parents, NGOs, civil society, and the local and central authorities. Findings originating from such studies would contribute greatly to the present discourse that informs the understanding of issues that have to be addressed in LFS in education systems, both in Mauritius and abroad.

8.10 CONCLUSION

This study aimed to explore teachers' understanding and enhancement of LFS.which included the main research question. It presented the main findings of AR regarding the research questions. The findings indicated that teachers mainly view LFS as educating about environmental aspects rather than considering its socio-cultural and economic aspects, and their inter-relationships. However, only one teacher (Komal) demonstrated an awareness of its socio-cultural aspect by conducting an English language lesson with *honesty* as a topic during the first cycle. However, an incisive understanding of the inter-relationship between the three aspects of sustainability was sadly lacking.

The findings confirmed that there are different and comparable understandings of LFS among primary school teachers, and that their understanding greatly influences their enhancement in their teaching practice. This is inconsistent with the various levels of knowledge about teachers' understanding and their enhancement of LFS. The study further found that enhancement of LFS improved teachers' practices and experiences by bringing new knowledge into their understanding of LFS. There are enablers like the NCF which really addresses LFS, but a lack of capacity-building and mainstreaming of LFS was observed which reflected teachers' inability to confidently address the concepts of LFS despite having a clear NCF. At the end of the investigation, teachers displayed an increased motivation through their understanding and enhancement for further implementation of LFS outlining that the action research process was valid. LFS must be considered as more than merely a knowledge-base. It must be viewed as unavoidably transdisciplinary and even trans-perspective in that it may not be applied only to a single discipline or from a single perspective. Hence, LFS must be considered cross-boundary as it cannot be confined within the prevailing spaces and structures that have manipulated

education over the past few centuries. Furthermore, LFS cannot be limited to only classrooms and schools; LFS requires a symbiosis between various sectors in society and the dismantling of the current education system (Abson et al., 2017).

REFERENCES

Abson, D. J., Fischer, J., Leventon, J., Newig, J., Schomerus, T., Vilsmaier, U., & Lang, D. J. (2017). Leverage points for sustainability transformation. *Ambio*, *46*(1), 30-39. https://doi.org/10.1007/s13280-016-0800-y

Abutabenjeh, S., & Jaradat, R. (2018). Clarification of research design, research methods and research methodology: A guide for public administration researchers and practitioners. *Teaching Public Administration*, *36*(3), 237-258. https://doi.org/10.1177/0144739418775787

Adams, R., Martin, S., & Boom, K. (2018). University culture and sustainability: Designing and implementing an enabling framework. *Journal of cleaner production*. Clean. Prod. 171, 434e445. https://doi.org/10.1016/j.jclepro.2017.10.032

Adawiah, R., & Esa, N. (2012). Teachers' knowledge of education for sustainable development. In *UMT 11th International Annual Symposium on Sustainability Science and Management*, 09th–11th July 2012, Terengganu, Malaysia. https://www.researchgate.net/profile/Rabiatul-Adawiah/publication/263011209_Teachers'_Knowledge_of_Education_for_Sustainable_Development/links/02e7e53990e2ddd478000000/Teachers-Knowledge-of-Education-for-Sustainable-Development.pdf

Adom, D., Hussein, E. K. & Agyem, J. A. (2018). Theoretical and conceptual framework: Mandatory ingredients of a quality research. *International Journal of Scientific Research*, 7(1):438-441. (PDF) THEORETICAL AND CONCEPTUAL FRAMEWORK: MANDATORY INGREDIENTS OF A QUALITY RESEARCH (researchgate.net)

Affifi, R. (2017). The metabolic core of environmental education. *Studies in Philosophy of Education*, 36, 315-332. https://doi.org/10.1007/s11217-016-9555-y

Agbedahin, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence and future. *Sustainable Development*, *27*(4), 669-680. https://doi.org/10.1002/sd.1931

Agbedahin, A. V., & Lotz-Sisitka, H. (2019). Mainstreaming education for sustainable development: elaborating the role of position-practice systems using seven laminations of scale. *Journal of Critical Realism*, *18*(2), 103-122. https://doi.org/10.1080/14767430.2019.1602975

Agirreazkuenaga, L. (2019). Embedding sustainable development goals in education. Teachers' perspective about education for sustainability in the Basque Autonomous Community. *Sustainability*, *11*(5), 1496. https://doi.org/10.3390/su11051496

Aharony, N. (2006). The use of deep and surface learning strategies among learners learning English as a foreign language in an Internet environment. *British Journal of Educational Psychology*, *76*(4), 851-866. https://doi.org/10.1348/000709905X79158

Ahmed, Z., Asghar, M. M., Malik, M. N., & Nawaz, K. (2020). Moving towards a sustainable environment: the dynamic linkage between natural resources, human capital, urbanization, economic growth and ecological footprint in China. *Resources Policy*, *67*, 101677. https://doi.org/10.1016/j.resourpol.2020.101677

Akinyode, B. F., & Khan, T. H. (2018). Step by step approach for qualitative data analysis. *International Journal of Built Environment and Sustainability*, *5*(3), 163-174. https://doi.org/10.11113/ijbes.v5.n3.267

Al-Ababneh, M. M. (2020). Linking ontology, epistemology and research methodology. *Science & Philosophy*, *8*(1), 75-91. https://ssrn.com/abstract=3708935

Alam, M. K. (2020). A systematic qualitative case study: questions, data collection, NVivo analysis and saturation. *Qualitative Research in Organizations and Management: An International Journal*, Vol. 16 No. 1, pp. 1-31. https://www.emerald.com/insight/content/doi/10.1108/QROM-09-2019-1825/full/html

Albareda-Tiana, S., Vidal-Ramentol, S., Pujol-Valls, M., & Fernandez-Morilla, M. (2018). Holistic approaches to develop sustainability and research competencies in pre-service teacher training. *Sustainability*, *10*(10), 3698. https://doi.org/10.3390/su10103698

Aleixo, A. M., Leal, S., & Azeiteiro, U. M. (2018). Conceptualization of sustainable higher education institutions, roles, barriers and challenges for sustainability: An exploratory study in Portugal. *Journal of cleaner production*, *172*, 1664-1673. https://doi.org/10.1016/j.jclepro.2016.11.010

Allan, G. (2020). Qualitative research. In *Handbook for research learners in the social sciences* (pp. 177-189). New York: Routledge. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Allan%2C+G.+%282020%29.+Qualitative+research.+In+Handbook+for+research+learners+in+the+social+sciences+%28pp.+177-189%29.+New+York%3A+Routledge.+&btnG=

Allen, H. (2021). Learning for the Future: Exploring Effective Characteristics of Sustainability Leadership Programs in Higher Education. *Canadian Journal for New Scholars in Education/Revue canadienne des jeunes chercheures et chercheurs en éducation*, *12*(2), 115125. https://journalhosting.ucalgary.ca/index.php/cjnse/article/view/72453

Almond, R. E. A., Grooten, M., & Petersen, T. (2021). Living planet report 2020-bending the curve of biodiversity loss. *Natural Resources & Environment*, *35*(3), 62-62. https://pure.iiasa.ac.at/id/eprint/16870/1/ENGLISH-FULL.pdf

Alsina, A., & Mula, I. (2019). Advancing towards a transformational professional competence model through reflective learning and sustainability: The case of mathematics teacher education. *Sustainability*, *11*(15), 4039. https://doi.org/10.3390/su11154039

Altrichter, H., Kemmis, S., McTaggart, R., & Zuber-Skerritt, O. (2021). Defining, confining, or refining action research? In *Action research for change and development* (pp. 3-9). New York, Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781003248491-2/defining-confining-refining-action-research-herbert-altrichter-stephen-kemmis-robin-mctaggart-ortrun-zuber-skerritt

Ames, H., Glenton, C., & Lewin, S. (2019). Purposive sampling in a qualitative evidence synthesis: A worked example from a synthesis on parental perceptions of vaccination communication. *BMC medical research methodology*, *19*(1), 1-9. https://doi.org/10.1186/s12874-019-0665-4

Antwi, S. K., & Hamza, K. (2015). Qualitative and quantitative research paradigms in business research: A philosophical reflection. *European journal of business and management*, *7*(3), 217-225. https://www.academia.edu/download/37731458/Research_Paradigms.pdf

Anyolo, E. O. (2015). Implementing Education for Sustainable Development in Nabibia: A case of three senior secondary schools. *Publication of the University of Eastern Findland*. https://erepo.uef.fi/bitstream/handle/123456789/16104/urn_isbn_978-952-61-1867-3.pdf?sequence=1

Ariss, J. J., Gerlach, A., Baker, J. B., Barry, K., Cooper, L., de Vries, T. L., ... & Lacroix, M. (2019). Community-based recreation therapy and mental health recovery: a mixed-media participatory action research study. *Progress in community health partnerships: research, education, and action*, *13*(2), 161-170. http://doi.org/10.1353/cpr.2019.0016

Asenahabi, B. M. (2019). Basics of research design: A guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, *6*(5), 76-89. http://ijcar.net/assets/pdf/Vol6-No5-May2019/07.-Basics-of-Research-Design-A-Guide-to-selecting-appropriate-research-design.pdf

Azungah, T. (2018). Qualitative research: deductive and inductive approaches to data analysis. *Qualitative research journal*, *18(4)*, *383-400*. https://www.emerald.com/insight/content/doi/10.1108/QRJ-D-18-00035/full/

Babbie, E. (2011). The Use of Formative Research in Entertainment-Education. *Using the Media to Achieve Reproductive Health and Gender Equity*, 39.

Babbie, E., & Rubin, A. (2010). Essential research methods for social work. Fourth Edition. Belmont, California.

Babbie, E., & Mouton, J. (2001). Qualitative data analysis. *The Practice of Social Research, South Africa Edition*, 489-516.

Bailey, A., Hutter, I., & Hennink, M. (2020). Qualitative research methods. *Qualitative Research Methods*, 1-376. http://digital.casalini.it/9781473944251

Baldwick, M. C. (2020). Experiential Learning and Education for Sustainable Development: Primary Schools in Hong Kong. Encyclopaedia of education for Sustainable Development. http://www.encyclopediaesd.com/blog-1/tag/ESD

Barrett, A., Kajamaa, A., & Johnston, J. (2020). How to be reflexive when conducting qualitative research. *The clinical teacher*, *17*(1), 9-12. https://doi.org/10.1111/tct.13133

Bartels, K. P., Greenwood, D. J., & Wittmayer, J. M. (2020). How action research can make deliberative policy analysis more transformative. *Policy Studies*, *41*(4), 392-410. https://doi.org/10.1080/01442872.2020.1724927

Barth, M. (2014). *Implementing sustainability in higher education: Learning in an age of transformation*. Routledge, New York. https://books.google.com/books?hl=en&lr=&id=IXjZBAAAQBAJ&oi=fnd&pg=PP1&dq=Barth,+M.+(2014).+Implementing+sustainability+in+higher+education:+Learning+in+an+age+of+transformation.+Routledge,+New+York.+&ots=RqQn4AvN8c&sig=vyfCH5Hf5VJ7n7fonj3VkxVmEFM

Baskerville, R., Baiyere, A., Gregor, S., Hevner, A., & Rossi, M. (2018). Design science research contributions: Finding a balance between artifact and theory. *Journal of the Association for Information Systems*, *19*(5), 3. Available at: https://aisel.aisnet.org/jais/vol19/iss5/3

Baste, I. A., & Watson, R. T. (2022). Tackling the climate, biodiversity, and pollution emergencies by making peace with nature 50 years after the Stockholm Conference. *Global Environmental Change*, *73*, 102466. https://doi.org/10.1016/j.gloenvcha.2022.102466

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, *13*(4), 544-559. http://www.nova.edu/ssss/QR/QR13-4/baxter.pdf

Baumgartner, L. M. (2019). Fostering Transformative Learning in Educational Settings. *Adult Literacy Education*, *1*(1), 69-74. *https://eric.ed.gov/?id=EJ1246050*

Beers, P. J., & Van Mierlo, B. (2017). Reflexivity and learning in system innovation processes. *Sociologia Ruralis*, *57*(3), 415-436. https://doi.org/10.1111/soru.12179

Belle, J. L. (2017). A critical review of the current education system of Mauritius and the learner discipline problem in Mauritian state secondary schools. *Journal of Education and Social Sciences*, *8*(1), 47-55. http://jesoc.com/wp-content/uploads/2017/11/JESOC8_211.pdf

Ben-Eliyahu, A. (2021). Sustainable learning in education. *Sustainability*, *13*(8), Pages 4250. https://doi.org/10.3390/su13084250

Bhardwaj, P. (2019). Types of sampling in research. *Journal of the Practice of Cardiovascular Sciences*, *5*(3), 157. https://www.j-pcs.org/text.asp?2019/5/3/157/273754

Bholah, R. (2017). Developing Problem-Based Learning Approaches to Water Education in Mauritius. In *Schooling for Sustainable Development in Africa* (pp. 119-127). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-319-45989-9_9

Biggs, J. B. (1987). *Student Approaches to Learning and Studying. Research Monograph*. Australian Council for Educational Research Ltd., Radford House, Frederick St., Hawthorn 3122, Australia. https://eric.ed.gov/?id=eD308201

Biggs, J. (1979). Individual differences in study processes and the quality of learning outcomes. *Higher education*, *8*(4), 381-394. https://doi.org/10.1007/BF01680526

Bleiker, J., Morgan-Trimmer, S., Knapp, K., & Hopkins, S. (2019). Navigating the maze: Qualitative research methodologies and their philosophical foundations. *Radiography*, *25*, S4-S8. https://doi.org/10.1016/j.radi.2019.06.008

Boden, M. A., & Edmonds, E. A. (2009). What is generative art? *Digital Creativity*, *20*(1-2), 21-46. https://doi.org/10.1080/14626260902867915

Boorang, M. A., Fard, H. S., Sharahi, B. Y., & Khodabandelou, R. (2018). A Phenomenological Study on Teachers' View and Perspectives on Using Technology in Teaching & Learning. *The Journal of Social Sciences Research*, 748-755. https://ideas.repec.org/a/arp/tjssrr/2018p748-755.html

Borchardt, A., & Gothlich, S. E. (2009). Gaining knowledge through case studies. In *Methodology of Empirical Research* (pp. 33-48). Gabler Verlag, Wiesbaden.

Borg, S. (2012). Current approaches to language teacher cognition research: A methodological analysis. In *Researching language teacher cognition and practice* (pp. 11-29). Multilingual Matters. https://doi.org/10.21832/9781847697912-003

Borowski, P. F., & Patuk, I. (2021). Environmental, social and economic factors in sustainable development with food, energy and eco-space aspect security. *Present Environment & Sustainable Development*, *15*(1). https://doi.org/10.15551/pesd2021151012

Boud, D. (2001). Using journal writing to enhance reflective practice. *New directions for adult and continuing education*, *2001*(90), 9-18. https://www.academia.edu/download/49881309/Using_journal_writing_to_enhance_reflect20161026-13085-19rpa58.pdf

Bourn, D., Hunt, F., Blum, N., & Lawson, H. (2016). Primary Education for Global learning and Sustainability. Cambridge Primary Review Trust: York, UK. https://discovery.ucl.ac.uk/id/eprint/1475170/

Bowen, R., & O'Doherty, T. (2014). Participant-driven action research (PDAR) with sex workers in Vancouver. *Negotiating sex work: Unintended consequences of policy and activism*, 53-74. https://www.academia.edu/download/48916688/Participant-Driven_Action_Research_PDA20160917-14123-l19m60.pdf

Bower, M., & Hedberg, J. G. (2010). A quantitative multimodal discourse analysis of teaching and learning in a web-conferencing environment–the efficacy of student-centred learning designs. *Computers & education*, *54*(2), 462-478. https://doi.org/10.1016/j.compedu.2009.08.030

Bowers, J. (2016). Developing sustainable tourism through ecomuseology: a case study in the Rupununi region of Guyana. *Journal of Sustainable Tourism*, *24*(5), 758-782. https://doi.org/10.1080/09669582.2015.1085867

Bradbury, H., Glenzer, K., Ku, B., KjellstrOm, S., Aragon, A. O., Warwick, R., ... & Gray, P. (2019). What is good action research: Quality choice points with a refreshed urgency. *Action Research*, *17*(1), 14-18. https://journals.sagepub.com/doi/full/10.1177/1476750319835607

Bradbury, H., Lewis, R., & Embury, D. C. (2019). Education action research. *The Wiley handbook of action research in education*, 7. https://doi.org/10.1002/9781119399490.ch1

Bralic, A., & Divjak, B. (2018). Integrating MOOCs in traditionally taught courses: achieving learning outcomes with blended learning. *International Journal of Educational Technology in Higher Education*, *15*(1), 1-16. https://doi.org/10.1186/s41239-017-0085-7

Brandt, J. O., Burgener, L., Barth, M., & Redman, A. (2019). Becoming a competent teacher in education for sustainable development: Learning outcomes and processes in teacher education. *International Journal of Sustainability in Higher Education*, 20(4), 630-653. https://doi.org/10.1108/IJSHE-10-2018-0183

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Briggs, A. R., Morrison, M., & Coleman, M. (2012). *Research methods in educational leadership and management*. Sage Publications, New York. https://doi.org/10.4135/9781473957695

Briller, S., Pruim, D. E., Kelley, T., Sohn, J. J., & Martinez, R. (2022). Understanding the Values of, and Institutional Barriers Toward, Transforming Undergraduate Learning in the Pursuit of Innovation. ASEE 2022 Annual Conference, Minnesota, June 26th -28th 2022. https://peer.asee.org/understanding-the-values-of-and-institutional-barriers-toward-transforming-undergraduate-learning-in-the-pursuit-of-innovation

Brinkmann, S., Denzin, N. K., & Lincoln, Y. S. (2018). The SAGE handbook of qualitative research. *NK e. Denzin & YS e. Lincoln (Eds.), Handbook of qualitative research*. The SAGE Handbook of Qualitative Research (daneshnamehicsa.ir)

Brook, C., & Pedler, M. (2020). Action learning in academic management education: A state of the field review. *The International Journal of Management Education*, *18*(3), 100415. https://doi.org/10.1016/j.ijme.2020.100415

Bryman, A. (2016). *Social research methods*. 5th Ed. Oxford university press, UK. social-research-methods-alan-bryman.pdf (kpi.ua)

Buckingham, D., & de Block, L. (2013). 8 Finding a global voice? *Young Citizens and New Media: Learning for Democratic Participation*, 147. https://www.academia.edu/2748449/8_New_media_new_childhoods

Buil-Fabrega, M., Martinez Casanovas, M., Ruiz-Munzon, N., & Leal Filho, W. L. (2019). Flipped classroom as an active learning methodology in sustainable development curricula. *Sustainability*, *11*(17), Pages 4577. https://doi.org/10.3390/su11174577

Bunwaree, S. (2018). Poverty eradication and social cohesion: *Right to decent housing*. Retrieved from: https://www.lemauricien.com/le-mauricien/poverty.

Burgener, L., & Barth, M. (2018). Sustainability competencies in teacher education: Making teacher education count in everyday school practice. *Journal of cleaner production*, *174*, 821-826. https://doi.org/10.1016/j.jclepro.2017.10.263

Burns, H. L., Kelley, S. S., & Spalding, H. E. (2019). Teaching sustainability: Recommendations for best pedagogical practices. *Journal of Sustainability Education*, Vol. 19. https://pdxscholar.library.pdx.edu/elp_fac/59/

Burns, H. L. (2018). Thematic analysis: Transformative sustainability education. *Journal of Transformative Education*, *16*(4), 277-279. https://doi.org/10.1177/1541344620932310

Burns, H. L. (2016a). Self-care as a way of being: Fostering inner work in a graduate sustainability leadership course. *Ecopsychology*, *8*(4), 250-256. https://doi.org/10.1089/eco.2016.0006

Burns, H. L. (2016b). Learning sustainability leadership: An action research study of a graduate leadership course. *International Journal for the Scholarship of Teaching and Learning, 10*(2), 1-11. https://doi.org/10.20429/ijsotl.2016.100208

Burns, H., Diamond-Vaught, H., & Bauman, C. (2015). Leadership for sustainability: Theoretical foundations and pedagogical practices that foster change. *International Journal of Leadership Studies,* 9(1), 88-100. https://pdxscholar.library.pdx.edu/elp_fac?utm_source=pdxscholar.library.pdx.edu%2Felp_fac%2F45&utm_medium=PDF&utm_campaign=PDFCoverPages

Burns, H. L. (2015). Transformative sustainability pedagogy: Learning from ecological systems and indigenous wisdom. *Journal of Transformative Education*, *13*(3), 259-276. https://doi.org/10.1177/1541344615584683

Burns, H. (2013). Meaningful sustainability learning: A research study of sustainability pedagogy in two university courses. International Journal of Teaching and Learning in Higher Education, 25(2), 166-175. https://eric.ed.gov/?id=EJ1016542

Burns, H. (2011). Teaching for transformation:(Re) Designing sustainability courses based on ecological principles. *Journal of Sustainability Education*, 2. https://pdxscholar.library.pdx.edu/elp_fac/20/

Burns, H. (2009). *Education as sustainability: An action research study of the Burns model of sustainability pedagogy*. Portland State University. https://doi.org/10.15760/etd.942

Burns, R. (1995). The Adult Learner at Work Business and Professional Publishing. Sydney. Adult Learner at Work: The challenges of lifelong education in the new (routledge.com)

Burns, S. (1995). Rapid changes require enhancement of adult learning. *HR Monthly*, 16-17. Solved Burns, S. 1995 'Rapid changes require enhancement of | Chegg.com

Calavia, M. B., Blanco, T., & Casas, R. (2021). Fostering creativity as a problem-solving competence through design: Think-Create-Learn, a tool for teachers. *Thinking skills and creativity*, *39*, 100761. https://doi.org/10.1016/j.tsc.2020.100761

Cano, F. (2005). Epistemological beliefs and approaches to learning: Their change through secondary school and their influence on academic performance. *British journal of educational psychology*, *75*(2), 203-221. https://doi.org/10.1348/000709904X22683

Capra, F., & Luisi, P. L. (2014). *The systems view of life: A unifying vision*. Cambridge University Press.https://www.igiglobal.com/pdf.aspx?tid%3D123443%26ptid%3D119047%26ctid%3D

17%26t%3Dthe+systems+view+of+life%3A+a+unifying+vision%26isxn%3D9781466680791

Carlin, A. P., & Kim, Y. H. (2019). Teaching qualitative research: Versions of grounded theory. *Grounded Theory Review*, *18*(1). https://repository.um.edu.mo/handle/10692/107159

Casinader, N. (2021). What makes environmental and sustainability education transformative: A ReAppraisal of the Conceptual Parameters. *Sustainability*, *13*(9), 5100. https://doi.org/10.3390/su13095100

Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The qualitative report*, *21*(5), 811-831. http://nsuworks.nova.edu/tqr/vol21/iss5/

Cebrian, G., Junyent, M., & Mula, I. (2020). Competencies in education for sustainable development: Emerging teaching and research developments. *Sustainability*, *12*(2), 579. https://doi.org/10.3390/su12020579

Cebrian, G., & Junyent, M. (2015). Competencies in education for sustainable development: Exploring the student teachers' views. *Sustainability*, *7*(3), 2768-2786. https://doi.org/10.3390/su7032768

Chadha, A. (2018). Personalized Online Reflective Deliberations: No Significant Differences across Institution Type. *Journal of Instructional Research*, *7*, 60-74. https://eric.ed.gov/?id=EJ1188328

Chamberlain-Salaun, J., Mills, J., & Usher, K. (2013). Linking symbolic interactionism and grounded theory methods in a research design: From Corbin and Strauss' assumptions to action. *Sage Open*, *3*(3), 2158244013505757. https://journals.sagepub.com/doi/abs/10.1177/2158244013505757

Chambers, R. (2018). Us and them: finding a new paradigm for professionals in sustainable development. In *Community and sustainable development* (pp. 117-147). Routledge, New York. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315071190-7/us-finding-new-paradigm-professionals-sustainable-development-robert-chambers

Chandra, Y., & Shang, L. (2019). Qualitative research: an overview. *Qualitative research using R: A systematic approach*, 1-19. https://link.springer.com/content/pdf/10.1007/978-981-13-3170-1.pdf

Chen, W., & Reeves, T. C. (2020). Twelve tips for conducting educational design research in medical education. *Medical Teacher*, *42*(9), 980-986. https://doi.org/10.1080/0142159X.2019.1657231

Cheng, L., Ritzhaupt, A. D., & Antonenko, P. (2019). Effects of the flipped classroom instructional strategy on learners' learning outcomes: A meta-analysis. *Educational Technology Research and Development*, *67*(4), 793-824. https://doi.org/10.1007/s11423-018-9633-7

Cheng, V. M. (2018). Views on creativity, environmental sustainability and their integrated development. *Creative Education*, *9*(05), 719. http://www.scirp.org/journal/PaperInformation.aspx?PaperID=83965&#abstract

Chin, C., & Brown, D. E. (2000). Learning in science: A comparison of deep and surface approaches. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *37*(2), 109-138. https://doi.org/10.1002/(SICI)1098-2736(200002)37:2%3C109::AID-TEA3%3E3.0.CO;2-7

Chowdhury, A., & Shil, N. C. (2021). Thinking 'Qualitative'Through a Case Study: Homework for a Researcher. *American Journal of Qualitative Research*, *5*(2), 190-210. https://doi.org/10.29333/ajqr/11280

Chowdhury, M. S., Ahmmed, F., & Hossain, I. (2020). Methodological dilemma in microfinance research: Applicability of a qualitative case study design. *The Qualitative Report*, *25*(2), 271290. https://nsuworks.nova.edu/tqr/vol25/iss2/1?utm_source=nsuworks.nova.edu%2Ftqr%2Fvol25%2Fiss2%2F1&utm_medium=PDF&utm_campaign=PDFCoverPages

Christiansen, I., Bertram, C., & Land, S. (2010). Understanding Research: An introduction to reading research. *Durban: University of KwaZulu-Natal*. https://www.academia.edu/download/61057969/Understanding_Research_2_FULL_COVER20191029-44698-azdju.pdf

Christie, B., & Higgins, P. (2020). The educational outcomes of learning for sustainability: A brief review of literature. A Report for the Scottish Government Learning Directorate, Edinburgh. https://www.research.ed.ac.uk/en/publications/educational-outcomes-of-learning-for-sustainability-a-brief-revie

Claro, P.B. and Esteves, N.R. (2021), "Teaching sustainability-oriented capabilities using active learning approach". *International Journal of Sustainability in Higher Education*, (22) 6, 12461265. https://doi.org/10.1108/IJSHE-07-2020-0263

Cloud, J., & Jackson, M. (2016). Education for a sustainable future: Benchmarks for individual and social learning. *Journal of Sustainability Education*, *14*, 1-29. Microsoft Word - Benchmarks Draft Final 5.docx (susted.com)

Clough, P., & Nutbrown, C. (2012). *A Student' s Guide to Methodology*. Sage, New York. https://books.google.com/books?hl=en&lr=&id=jKUBy_v-KPsC&oi=fnd&pg=PP2&dq=Clough,+P.,+%26+Nutbrown,+C.+(2012).+A+Student%E2%80%B2+s+Guide+to+Methodology.+Sage,+New+York.+&ots=fHGjpScAe8&sig=vjk4kQuPwnNWd--lVt_YhD-jdKY

Coghlan, D., & Brannick, T. (2003). Kurt Lewin: The "practical theorist" for the 21st century. *Irish Journal of Management*, *24*(2), 31. https://search.proquest.com/openview/9e63e11eaa1b45d943c46acf1d936052/1?pq-origsite=gscholar&cbl=10069

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). London: Routledge. https://doi.org/10.4324/9781315456539

Collado, S., & Evans, G. W. (2019). Outcome expectancy: A key factor to understanding childhood exposure to nature and children's pro-environmental behaviour. *Journal of Environmental Psychology*, *61*, 30-36. https://doi.org/10.1016/j.jenvp.2018.12.001

Collis, J., & Hussey, R. (2009). A practical guide for undergraduate and postgraduate learners. New York: Palgrave Macmillan. https://eprints.kingston.ac.uk/id/eprint/5216

Colomer, J., Serra, T., Cañabate, D., & Bubnys, R. (2020). Reflective learning in higher education: Active methodologies for transformative practices. *Sustainability*, *12*(9), 3827. https://doi.org/10.3390/su12093827

Connett, H. (2020). Action research to improve confidence in meeting diverse need and the quality of inclusive practice through lesson observations. *Support for Learning*, *35*(2), 178-191. https://doi.org/10.1111/1467-9604.12298

Cooksey, R., & McDonald, G. (2019). *Surviving and thriving in postgraduate research*. Singapore: Springer, Singapore. https://link.springer.com/content/pdf/10.1007/978-981-13-7747-1.pdf

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications, London. https://genderopen-develop.ub.hu-berlin.de/bitstream/handle/25595/12/whatsnew7.pdf?sequence=1

Cortese, A., Lau, H., & Kawato, M. (2020). Unconscious reinforcement learning of hidden brain states supported by confidence. *Nature communications*, *11*(1), 1-14. https://doi.org/10.1038/s41467-020-17828-8

Cortese, C. G. (2005). Learning through teaching. *Management Learning*, *36*(1), 87-115. https://doi.org/10.1177/1350507605049905

Crawford, R. (2019). Using interpretative phenomenological analysis in music education research: An authentic analysis system for investigating authentic learning and teaching practice.

International Journal of Music Education, *37*(3), 454-475. https://doi.org/10.1177/0255761419830151

Creswell, J. W., & Baez, J. C. (2020). *30 essential skills for the qualitative researcher*. London: Sage Publications. http://dx.doi.org/10.1177/15586898211028107

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th Ed). Los Angeles: Sage publications. Creswell.pdf (ucg.ac.me)

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches (5th Ed)*. Sage publications, Los Angeles, CA. cuali2.pdf (revistapsicologia.org)

Creswell, J. W. (2015). Qualitative Research & Research Design. *International Journal of Physiology*, *3*(1), 674. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (uns.ac.id)

Cunningham, K., Gorman, M., & Maher, J. (2020). The value of using classroom observations as part of a multi-methodological approach to evaluate student engagement in vocational agricultural education. *Educational Research and Evaluation*, *26*(1-2), 4-29. https://doi.org/10.1080/13803611.2021.1872390

Cuthbertson, L. M., Robb, Y. A., & Blair, S. (2020). Theory and application of research principles and philosophical underpinning for a study utilising interpretative phenomenological analysis. *Radiography*, *26*(2), e94-e102. https://doi.org/10.1016/j.radi.2019.11.092

Dancy, M., Henderson, C., & Turpen, C. (2016). How faculty learn about and implement research based instructional strategies: The case of peer instruction. *Physical Review Physics Education Research*, *12*(1), 010110. https://doi.org/10.1103/PhysRevPhysEducRes.12.010110

Dannels, S. A. (2018). Research design. In *The reviewer's guide to quantitative methods in the social sciences* (pp. 402-416). Routledge. https://doi.org/10.4324/9781315755649-30

Dash, G., & Mohan, A. K. (2017). Education for Sustainability: Perception of teachers and practices in urban primary schools of Mysore. *Gyanodaya: The Journal of Progressive Education*, *10*(2) 9-17. http://dx.doi.org/10.5958/2229-4422.2017.00010.X

Davies, P. (2018). 12 Doing qualitative. *Doing Criminological Research*, 271. http://ssrn.com/abstract=1084684.

Day, S. P., Scott-McKie, L., & Killen, A. (2019). Primary education learners' engagement with socioscientific discussion as an approach to learning for sustainability. *Scottish Educational Review*, *51*(1), 30-43. https://doi.org/10.1163/27730840-05101005

Deane, P. (2018). A guide for interdisciplinary researchers: Adding axiology alongside ontology and epistemology. *Integration and Implementation Insights*. A guide for interdisciplinary

researchers: Adding axiology alongside ontology and epistemology – Integration and Implementation Insights (i2insights.org)

Deenapanray, P. N. (2021). Increasing the ambition of mitigation action in small emitters: the case of Mauritius. *Climate Policy*, *21*(4), 514-528. https://doi.org/10.1080/14693062.2021.1886898

Dejene, W., Bishaw, A., & Dagnaw, A. (2018). Pre-service teachers' conceptions of teaching and learning and their teaching approach preference: Secondary teacher education in focus. *Bahir Dar Journal of Education*, *18*(2). https://doi.org/10.4314/bdje.v23i2.7

Delors, J., Amagi, I., Carneiro, R., Chung, F., Geremek, B., Gorham, W., ... & Suhr, M. W. (1996). Learning. *The treasure Within. Paris*. https://www.educationforallinindia.com/1996%20Delors%20Commission%20Report.pdf

Denzin, N. K., & Lincoln, Y. (2021). Conrad, CF and Serlin, RC (eds) (2011) The SAGE Handbook for Research in Education: Pursuing Ideas as the Keystone of Exemplary Inquiry, 2nd ed. Thousand Oaks, CA: Sage. This is a comprehensive text which identifies the different issues. *Research Methods and Methodologies in Education*, 20. The SAGE Handbook of Qualitative Research (daneshnamehicsa.ir)

Denzin, N. K., & Lincoln, Y. S. (2018). The Sage handbook of qualitative research (Fifth edit). https://doi. org/10.1007/s11229-017-1319-x

Dewey, M. (2007). English as a lingua franca and globalization: an interconnected perspective. *International Journal of Applied Linguistics*, *17*(3), 332. https://docs.ufpr.br/~clarissa/pdfs/ELF_Globalization_Dewey2007.pdf

Didham, R. J., & Ofei-Manu, P. (2015). Social Learning for Sustainability. In *Responsible living* (pp. 233-252). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-319-15305-6_15

Dixon, F. A., Yssel, N., McConnell, J. M., & Hardin, T. (2014). Differentiated instruction, professional development, and teacher efficacy. *Journal for the Education of the Gifted*, *37*(2), 111-127. https://doi.org/10.1177/0162353214529042

Dlouha, J., Heras, R., Mula, I., Salgado, F.P., & Henderson, L. (2019). Competences to address SDGs in higher education-a reflection on the equilibrium between systemic and personal approaches to achieve transformative action. *Sustainability*, 11, 3664. https://doi.org/10.3390/su11133664

Domegan, C., & Fleming, D. (2007). *Marketing research in Ireland: Theory and practice*. Gill & Macmillan. Marketing Research in Ireland, Theory and Practice, | Request PDF (researchgate.net)

Donald, G., Colucci-Gray, L., Donald, R., Kyriacou, A., & Wodah, D. (2019). From Oil to Soil. Learning for Sustainability and Transitions within the School Garden: a project of cultural and

social re-learning. *Scottish Educational Review* 51(1), 57-70. https://doi.org/10.1163/27730840-05101007

Doorga, J. R. S. (2022). Climate change and the fate of small islands: The case of Mauritius. *Environmental Science & Policy*, *136*, 282-290. https://doi.org/10.1016/j.envsci.2022.06.012

Dresner, M., & Blatner, J. S. (2006). Approaching civic responsibility using guided controversies about environmental issues. *College Teaching*, *54*(2), 213-220. https://doi.org/10.3200/CTCH.54.2.213-220

Dufour, I. F., & Richard, M. C. (2019). Theorizing from secondary qualitative data: A comparison of two data analysis methods. *Cogent Education*, *6*(1), 1690265. https://doi.org/10.1080/2331186X.2019.1690265

Durmuş, E. K. I. Z. (2020). Self-observation and peer-observation: Reflective diaries of primary student-teachers. *Elementary Education Online*, *5*(1), 45-45. https://www.ilkogretim-online.org/?mno=121082

Dutta, S. (2018). *Reinforcement Learning with TensorFlow: A beginner's guide to designing selflearning systems with TensorFlow and OpenAI Gym*. Packt Publishing Ltd. Reinforcement Learning with TensorFlow_ A beginner's guide to designing self-learning systems with TensorFlow and OpenAI Gym (PDFDrive.com).pdf (google.com)

Duvat, V. K., Anisimov, A., & Magnan, A. K. (2020). Assessment of coastal risk reduction and adaptation-labelled responses in Mauritius Island (Indian Ocean). *Regional Environmental Change*, *20*(4), 1-15. https://doi.org/10.1007/s10113-020-01699-2

Dyball, R., & Newell, B. (2014). *Understanding human ecology: A systems approach to sustainability*. Routledge, London. https://doi.org/10.4324/9780203109557

Dyment, J. E., & Hill, A. (2015). You mean I have to teach sustainability too?: Initial teacher education learners' perspectives on the sustainability cross-curriculum priority. *Australian Journal of Teacher Education (Online)*, *40*(3), 21-35. https://search.informit.org/doi/10.3316/informit.072057830271190

Edwards, S., Kemp, A. T., & Page, C. S. (2014). The Middle School Philosophy: Do We Practice What We Preach, or Do We Preach Something Different? *Current Issues in Middle Level Education*, *19*(1), 13-19. https://eric.ed.gov/?id=EJ1087684

EEASA. (2021). Conference Proceedings of Abstract of the 39th Annual International Online Conference of the Environmental Education Association of Southern Africa (EEASA). MIE Publication. 17-JUNEEVENING-EDITED-EEASA-PROG.pdf

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of management journal*, *50*(1), 25-32. https://doi.org/10.5465/amj.2007.24160888

Eisner, E. W. (2017). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. Teachers College Press, New York, NY 10027. The Enlightened Eye: Qualitative Inquiry and the Enhancement of Educational Practice, Reissued with a New Prologue and Foreword (daneshnamehicsa.ir)

Elliot, J. (1991). *Action research for educational change*. McGraw-Hill Education (UK). Action Research for Educational Change (another-roadmap.net)

Emmel, N. (2013). Purposeful sampling. *Sampling and choosing cases in qualitative research: A realist approach*, 33-45. http://digital.casalini.it/9781446287187

Ensor, J., & Harvey, B. (2015). Social learning and climate change adaptation: evidence for international development practice. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(5), 509-522. https://doi.org/10.1002/wcc.348

Estrada-Vidal, L. I., Olmos-Gomez, M. D. C., Lopez-Cordero, R., & Ruiz-Garzon, F. (2020). The differences across future teachers regarding attitudes on social responsibility for sustainable development. *International Journal of Environmental Research and Public Health*, *17*(15), 5323. https://doi.org/10.3390/ijerph17155323

Evans, N., Whitehouse, H., & Gooch, M. (2012). Barriers, successes and enabling practices of education for sustainability in far North Queensland schools: A case study. *The Journal of Environmental Education*, *43*(2), 121-138. https://doi.org/10.1080/00958964.2011.621995

Farghaly, A. (2018). Comparing and Contrasting Quantitative and Qualitative Research Approaches in Education: The Peculiar Situation of Medical Education. *Education in Medicine Journal*, *10*(1), 3-11. https://doi.org/10.21315/eimj2018.10.1.2

Farrell, J. B., & Weitman, C. J. (2007). Action research fosters empowerment and learning communities. *Delta Kappa Gamma Bulletin*, *73*(3), 36. https://brainmass.com/file/1448421/Action+Research+Fosters+Empowerment+and+Learning+Communities.pdf#page=37

Ferdous, T., & Karim, A. (2019). Working in Groups outside the Classroom: Affective Challenges and Probable Solutions. *International Journal of Instruction*, *12*(3), 341-358. https://eric.ed.gov/?id=EJ1220227

Ferguson, T., Roofe, C., & Cook, L. D. (2021). Teachers' perspectives on sustainable development:

the implications for education for sustainable development. *Environmental Education Research, 27*(9), 1343-1359. https://doi.org/10.1080/13504622.2021.1921113

Ferguson, R., Coughlan, T., Egelandsdal, K., Gaved, M., Herodotou, C., Hillaire, G., ... & Whitelock, D. (2019). Innovating pedagogy 2019: Open university innovation report 7. https://iet.open.ac.uk/file/innovating-pedagogy-2019.pdf

Fernandes, L., Winardi, Y., & Appulembang, O. D. (2019). Barriers to learning mathematics: A case study of grade 8 learners at a school in Semarang [Barriers to learning mathematics: A case study of grade 8 learners at a school in Semarang]. *JOHME: Journal of Holistic Mathematics Education,3*(1), 16-31. http://dx.doi.org/10.19166/johme.v3i1.2071

Fernandes, S., Flores, M. A., & Lima, R. M. (2012). Learners' views of assessment in project-led engineering education: Findings from a case study in Portugal. *Assessment & Evaluation in Higher Education, 37*(2), 163-178. https://doi.org/10.1080/02602938.2010.515015

Fernandez-Sanchez, G., & Berzosa, A., Bernaldo, M. O. (2017). Sustainability assessment tools for higher education: An empirical comparative analysis. *Journal of Cleaner Production, 161,* 812-820. https://doi.org/10.1016/j.jclepro.2017.05.194

Fernandez-Sanchez, G., Bernaldo, M. O., Castillejo, A., & Manzanero, A. M. (2014). Higher Learning Research Communications. *Education*. https://scholarworks.waldenu.edu/hlrc/vol4/iss3/2

Fichter, K., & Tiemann, I. (2018). Factors influencing university support for sustainable entrepreneurship: Insights from explorative case studies. *Journal of Cleaner Production, 175,* 512-524. https://doi.org/10.1016/j.jclepro.2017.12.031

Fildes, K. J., Beck, E., Bur, T., Burns, P., Chisholm, L. A., Dillon, C. T., ... & Kennedy, J. (2021). The first steps on the journey towards curriculum reconciliation in science, medicine and health education. *Higher Education Research & Development, 40*(1), 194-206. https://doi.org/10.1080/07294360.2020.1852393

Leal Filho, W., Pallant, E., Enete, A., Richter, B., & Brandli, L. L. (2018). Planning and implementing sustainability in higher education institutions: an overview of the difficulties and potentials. *International journal of sustainable development & world ecology, 25*(8), 713-721. https://doi.org/10.1016/j.jclepro.2019.06.322

Leal Filho, W., Raath, S., Lazzarini, B., Vargas, V. R., de Souza, L., Anholon, R., ... & Orlovic, V. L. (2018). The role of transformation in learning and education for sustainability. *Journal of cleaner production, 199,* 286-295. https://doi.org/10.1016/j.jclepro.2018.07.017

Flick, U. (2014). Challenges for qualitative inquiry as a global endeavor: Introduction to the special issue. *Qualitative Inquiry, 20*(9), 1059-1063. https://doi.org/10.1177/1077800414543693

Fobosi, S. C., & Fobosi, S. C. (2019). Original Paper Experience of Negotiating Access in the "Field": Lessons for Future Research. *World*, *6*(4), 503-519. http://dx.doi.org/10.22158/wjssr.v6n4p503

Folke, C., Polasky, S., Rockstrom, J., Galaz, V., Westley, F., Lamont, M., ... & Walker, B. H. (2021). Our future in the Anthropocene biosphere. *Ambio*, *50*(4), 834-869. https://doi.org/10.1007/s13280-021-01544-8

Fong, C., & Slotta, J. D. (2018). Supporting communities of learners in the elementary classroom: The common knowledge learning environment. *Instructional Science*, *46*(4), 533-561. https://doi.org/10.1007/s11251-018-9463-3

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (Vol. 7, p. 429). New York: McGraw-hill. http://www.johnlpryor.com/JP_Digital_Portfolio/EDU_7901_files/EDU%207901%20Data%20Definitions.pdf

Frenzel, F. (2010). Researching political tourists: a case study approach. *Methodology: Innovative approaches to research*, *1*(1), 24-26.

Fuertes-Camacho, M. T., Graell-Martín, M., Fuentes-Loss, M., & Balaguer-Fabregas, M. C. (2019). Integrating sustainability into higher education curricula through the project method, a global learning strategy. *Sustainability*, *11*(3), 767. https://doi.org/10.3390/su11030767

Gajparia, J., Strachan, G., Vare, P., & Ferguson, T. (2021). Identifying Assessment Opportunities in Postgraduate Learning for Sustainability. *Discourse and Communication for Sustainable Education*, *12*(1), 151-175. https://doi.org/10.2478/dcse-2021-0011

Gal, A., & Gan, D. (2020). Transformative sustainability education in Higher Education: Activating environmental understanding and active citizenship among professional studies learners. *Journal of transformative education*, *18*(4), 271-292. https://doi.org/10.1177/1541344620932310

Gall, G., & Gall, J. P. Borg. (2003). *Educational research: An introduction*, *7*. https://psycnet.apa.org/record/1996-97171-000

Gamage, K. A., Ekanayake, S. Y., & Dehideniya, S. C. (2022). Embedding Sustainability in Learning and Teaching: Lessons Learned and Moving Forward—Approaches in STEM Higher Education Programmes. *Education Sciences*, *12*(3), 225. https://doi.org/10.3390/educsci12030225

Gani, A., Imtiaz, N., Rathakrishnan, M., & Krishnasamy, H. N. (2020). A pilot test for establishing validity and reliability of qualitative interview in the blended learning English proficiency course. *Journal of critical reviews*, *7*(05), 140-143. http://dx.doi.org/10.31838/jcr.07.05.23

Garcia-Gonzalez, E., Jimenez-Fontana, R., & Goded, P. A. (2020). Approaches to teaching and learning for sustainability: Characterizing learners' perceptions. *Journal of Cleaner Production*, *274*, 122928. https://doi.org/10.1016/j.jclepro.2020.122928

Gatzweiler, M. K., Frey-Heger, C., & Ronzani, M. (2022). Grand challenges and business education: Dealing with barriers to learning and uncomfortable knowledge. In *Organizing for societal grand challenges*. Emerald Publishing Limited, 79, 221–237. http://doi.org/10.1108/S0733-558X20220000079021

Gayford, C. (2009). Learning for sustainability: From the learners' perspective. *UK: WWF Research Report*. https://wwfint.awsassets.panda.org/downloads/wwf_report_final_web.pdf

Gayford, C. (2003). Participatory Methods and Reflective Practice Applied to Research in Education for Sustainability. *Canadian Journal of Environmental Education*, *8*(1), 129-142. https://eric.ed.gov/?id=EJ881752

Gayford, C. (2001). Education for sustainability: An approach to the professional development of teachers. *European Journal of Teacher Education*, *24*(3), 313-327. https://doi.org/10.1080/02619760220128879

Getzin, S. (2019). *Shifting Education Towards Sustainability–How Degrowth Can Transform Education for Sustainable Development* (Doctoral dissertation, University of Zurich). https://www.zora.uzh.ch/id/eprint/184559/1/Getzin_Sofia_Dissertation.pdf

Gibbs, G. (2006). Why assessment is changing. In *Innovative assessment in higher education* (pp. 3142). Routledge. Innovative Assessment in Higher Education (ppu.edu)

Gibson, E. M., & Sandifer, M. C. (2020). It takes a village: service learning as our social responsibility in higher education. In *Civil Society and Social Responsibility in Higher Education: International Perspectives on Curriculum and Teaching Development*. Emerald Publishing Limited, Bingley, pp. 93-108. https://doi.org/10.1108/S2055-364120200000021008

Gill, P., & Baillie, J. (2018). Interviews and focus groups in qualitative research: an update for the digital age. *British dental journal*, *225*(7), 668-672. https://doi.org/10.1038/sj.bdj.2018.815

Ginsburg, J. L., & Audley, S. (2020). "You Don't Wanna Teach Little Kids about Climate Change": Beliefs and Barriers to Sustainability Education in Early Childhood. *International Journal of Early Childhood Environmental Education*, *7*(3), 42-61. https://scholarworks.smith.edu/edc_facpubs/13/

Giraldo-Garcia, R., Roy, M., & Alotebi, H. (2015). The interplay of technology and critical thinking skills in the 21st century blended classroom. *International Journal of Advanced Research in Education Technology*, *2*(3), 32-35.

Given, L. M. (Ed.). (2008). *The Sage encyclopedia of qualitative research methods*. Sage publications, New York. http://dx.doi.org/10.4135/9781412963909.n172

Goldkuhl, G. (2019). The generation of qualitative data in information systems research: the diversity of empirical research methods. *Communications of the Association for Information Systems, 44*, 572-599. https://doi.org/10.17705/1CAIS.04428

Gonzalez-Gomez, D., Jeong, J. S., & Canada-Canada, F. (2022). Enhancing science self-efficacy and attitudes of Pre-Service Teachers (PST) through a flipped classroom learning environment. *Interactive Learning Environments*, *30*(5), 896-907. https://doi.org/10.1080/10494820.2019.1696843

GIS, (2017). Government Information System, Republic of Mauritius. Accessed through: http://gis.govmu.org.

GIS, (2020). Government Information Service. Government Programmes 2020-2024: *"Towards an inclusive high income and green Mauritius, Forging ahead together"*. Accessed through: http://gis.govmu.org.

Gray, D., & Sosu, E. M. (2020). Renaturing science: the role of childhood nature in science for the anthropocene. *Research Handbook on Childhood nature: Assemblages of Childhood and Nature Research*, 557-585. https://doi.org/10.1007/978-3-319-67286-1_38

Gray, D., Colucci-Gray, L., Donald, R., Kyriacou, A., & Wodah, D. (2019). From Oil to Soil. Learning for Sustainability and Transitions within the School Garden: a project of cultural and social relearning. *Scottish Educational Review*, *51*(1), 57-70. https://brill.com/view/journals/ser/51/1/article-p57_7.xml

Greckhamer, T., Furnari, S., Fiss, P. C., & Aguilera, R. V. (2018). Studying configurations with qualitative comparative analysis: Best practices in strategy and organization research. *Strategic Organization*, *16*(4), 482-495. https://doi.org/10.1177/1476127018786487

Green, M., & Somerville, M. (2015). Sustainability education: Researching practice in primary schools. *Environmental Education Research*, *21*(6), 832-845. https://doi.org/10.1080/13504622.2014.923382

Greenwood, D. J., & Levin, M. (2007). *Introduction to action research: Social research for social change*. SAGE publications, Thousand Oaks. https://doi.org/10.4135/9781412984614

Grindheim, L. T., Bakken, Y., Hauge, K. H., & Heggen, M. P. (2019). Early childhood education for sustainability through contradicting and overlapping dimensions. *ECNU Review of Education*, *2*(4), 374-395. https://doi.org/10.1177/2096531119893479

Groenewald, J. (2021). Enhancing student success student success through the 'doing' and 'being' through the 'doing' and 'being' of residence heads residence heads. *Creating Conditions for Student Success: Social justice perspectives from a South African university*, 183.

Grove, A. (2019). *The Teacher's Role in Student Engagement*. Gardner-Webb University. https://search.proquest.com/openview/38d6478fce16b0e74487df8b4a0c9f21/1?pq-origsite=gscholar&cbl=18750&diss=y

Gruenewald, D. A., & Smith, G. A. (Eds.). (2014). *Place-based education in the global age: Local diversity*. Routledge, London. http://dx.doi.org/10.1080/13504620903132701

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, *2*(163-194), 105. http://miguelangelmartinez.net/IMG/pdf/1994_Guba_Lincoln_Paradigms_Quali_Research_chapter.pdf

Guetterman, T. (2015). Descriptions of sampling practices within five approaches to qualitative research in education and the health sciences. University of Nebraska, Lincoln. https://digitalcommons.unl.edu/edpsychpapers/263/

Gul, S., Parveen, Q., & Yousuf, M. I. (2021). Role of Research Supervisors to Implement Ethical Practices in Research of Social Sciences. *Pakistan Social Sciences Review*, 5(4), 737-751. https://pssr.org.pk/issues/v5/4/role-of-research-supervisors-to-implement-ethical-practices-in-research-of-social-sciences.pdf

Gungadeen, S., Hossanoo, Z., & Gungah, V. (2021). Corporate Social Responsibility in Mauritius. In *Current Global Practices of Corporate Social Responsibility* (pp. 493-523). Springer, Cham. https://doi.org/10.1007/978-3-030-68386-3_23

Gustafsson, J. (2017). Single case studies vs. multiple case studies: A comparative study. https://www.diva-portal.org/smash/get/diva2:1064378/FULLTEXT01.pdf

Hadjichambis, A. C., & Paraskeva-Hadjichambi, D. (2020). Education for environmental citizenship: The pedagogical approach. *Conceptualizing environmental citizenship for 21st century education*, *4*, 237-261. http://library.oapen.org/handle/20.500.12657/39551

Hacking, E. B., Scott, W., & Lee, E. (2010). *Evidence of impact of sustainable schools*. Department for Children, Schools and Families (DCSF). https://researchportal.bath.ac.uk/en/publications/evidence-of-impact-of-sustainable-schools

Halbe, J., & Pahl-Wostl, C. (2019). A methodological framework to initiate and design transition governance processes. *Sustainability*, *11*(3), pp 844. https://doi.org/10.3390/su11030844

Halbe, J. (2016). Governance of transformations towards sustainable water, food, and energy supply systems. In *Facilitating Multi-Level Learning Processes for Water, Food and Energy Supply*. University of Osnabruck Osnabruck. https://repositorium.uni-osnabrueck.de/bitstream/urn:nbn:de:gbv:700-2017022715609/6/thesis_halbe.pdf

Hamm, B., & Muttagi, P. K. (Eds.). (1998). *Sustainable development and the future of cities*. Intermediate Technology.

Handel, G. (2018). Research methods. In *The Psychosocial Interior of the Family* (pp. 79-82). Routledge. https://doi.org/10.4324/9781351328487

Hart, C. (2018). Doing a literature review: Releasing the research imagination. http://digital.casalini.it/9781526423146

Harvey, B., Ensor, J., Garside, B., Woodend, J., Naess, L. O., & Carlile, L. (2013). Developing selfperpetuating social learning: moving from constructive intervention to more autonomous group learning for drip irrigation in Morocco. https://hdl.handle.net/10568/36157

Hawken, P. (2007). *Blessed unrest: How the largest movement in the world came into being, and why no one saw it coming*. Penguin. https://search.proquest.com/openview/d3d48ae4b060abe2ddf34671e71e1bc3/1?pq-origsite=gscholar&cbl=39686

Hay, D. B., Kehoe, C., Miquel, M. E., Hatzipanagos, S., Kinchin, I. M., Keevil, S. F., & Lygo-Baker, S. (2008). Measuring the quality of e-learning. *British Journal of Educational Technology*, *39*(6), 1037-1056. https://doi.org/10.1111/j.1467-8535.2007.00777.x

Hemenway, T. (2015). *The permaculture city: regenerative design for urban, suburban, and town resilience*. Chelsea Green Publishing. https://www.thefreelibrary.com/The+Permaculture+city%3a+Regenerative+design+for+urban%2c+suburban%2c+and...-a0464450732

Hendricks, C. C. (2019). History of action research in education. *The Wiley handbook of action research in education*, 29-52.

Heng, L., Quinlivan, K., & du Plessis, R. (2022). Deconstructing initial teacher education: a critical approach. *International Journal of Inclusive Education*, *26*(6), 609-621. https://doi.org/10.1080/13603116.2019.1708982

Henham, M. L., Sim, M., & van Gorp, A. (2018). Observation techniques/ethnography. *Evaluating interventions that prevent or counter violent extremism*, 111. https://www.rand.org/content/dam/rand/pubs/research_reports/RR2000/RR2094/RAND_RR2094.pdf

Hennessey, J. M. (2021). Education, environment, advocacy, research, and tools: an annotated bibliography. *Journal of Environmental Studies and Sciences*, *11*(2), 194-199. https://doi.org/10.1007/s13412-021-00662-9

Hersted, L., Ness, O., & Frimann, S. (2019). Action research: Tradition and renewal. In *Action research in a relational perspective* (pp. 3-16). Routledge, New York. https://doi.org/10.4324/9780429289408

Hill, A., Emery, S., & Dyment, J. (2020). Introduction to the Australian curriculum sustainability cross-curriculum priority. *Geographical Education (Online)*, *33*, 8-10. https://search.informit.org/doi/10.3316/informit.593627849941446

Hlalele, D. (2013). Sustainable rural learning ecologies-a prolegomenon traversing transcendence of discursive notions of sustainability, social justice, development, and food sovereignty. *TD: The Journal for Transdisciplinary Research in Southern Africa*, *9*(3), 561-580. https://hdl.handle.net/10520/EJC149266

Hlalele, D. J. (2019). Indigenous knowledge systems and sustainable learning in rural South Africa. *Australian and international journal of rural education*, *29*(1), 88-100. https://search.informit.org/doi/10.3316/informit.267612438026855

Hodges, L. C. (2020). Student engagement in active learning classes. In *Active learning in college science* (pp. 27-41). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-33600-4_3

Holmberg, J., & Sandbrook, R. (2019). Sustainable development: what is to be done? In *Policies for a small planet* (pp. 19-38). New York: Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9780429200465-1/sustainable-development-done-johan-holmberg-richard-sandbrook

Holmes, A. G. D. (2020). Researcher Positionality--A Consideration of Its Influence and Place in Qualitative Research--A New Researcher Guide. *Shanlax International Journal of Education*, *8*(4), 1-10. https://eric.ed.gov/?id=EJ1268044

Holter, A. C. & Frabutt, J. M. (2012). Mission driven and data informed leadership. Catholic Education: A Journal of Inquiry and Practice, 15(2), 253-269. https://eric.ed.gov/?id=EJ970003

Hornby, G., & Blackwell, I. (2018). Barriers to parental involvement in education: An update. *Educational review*, *70*(1), 109-119. https://doi.org/10.1080/00131911.2018.1388612

Howell, M., Bradshaw, J., & Langdon, P. E. (2022). Asking the teachers: A Delphi study on the selection of skills and behaviours for an assessment of barriers to learning for learners on the

autism spectrum with intellectual disabilities. *British Journal of Learning Disabilities*, *50*(1), 3-12. https://doi.org/10.1111/bld.12350

Howell, R. A. (2021). Engaging learners in education for sustainable development: The benefits of active learning, reflective practices and flipped classroom pedagogies. *Journal of Cleaner Production*, *325*, 129318. https://doi.org/10.1016/j.jclepro.2021.129318

Hui, Y. K., Li, C., & Qian, S. (2019). Learning engagement via promoting situational interest in a blended learning environment. *Journal of Computing in Higher Education*, *31*(2), 408-425. https://doi.org/10.1007/s12528-019-09216-z

Hyysalo, S., Perikangas, S., Marttila, T., & Auvinen, K. (2019). Intermediate codesigning in transitions governance: catalysing and channelling participant action. *The Design Journal*, *22*(6), 873894. https://doi.org/10.1080/14606925.2019.1661557

Ishtiaq, M. (2019). Book Review Creswell, JW (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches. Thousand Oaks, CA: Sage. *English Language Teaching*, *12*(5),40. https://doi.org/10.5539/elt.v12n5p40

Ismail, N., Kinchin, G., & Edwards, J. A. (2018). Pilot study, does it really matter? Learning lessons from conducting a pilot study for a qualitative PhD thesis. *International Journal of Social Science Research*, *6*(1), 1-17. http://dx.doi.org/10.5296/ijssr.v6i1.11720

Janse van Rensburg, E. (2015). *Enabling occupation through service learning: perceptions of community representatives in occupational therapy service-learning engagements* (Doctoral dissertation, University of the Free State). https://scholar.ufs.ac.za/handle/11660/2233

Janse van Rensburg, E., & Mhoney, K. (2000). The spiral model of learning for sustainability: An exploration of process-oriented teacher development in environmental education. *Monograph learning for sustainability: An environmental education professional development case study informing education policy and practice*, 41-68. Learning for sustainability: an environmental education professional development case study informing education policy and practice | Request PDF (researchgate.net)

Jeffery, L. (2020). Sustainable Mauritius? Environmental Change, Energy Efficiency, and Sustainable Development in a Small Island State in the Indian Ocean. *Climate and Culture*, 177. https://library.oapen.org/bitstream/handle/20.500.12657/53804/1/9789004410848.pdf#page=198

Jickling, B., Lotz-Sisitka, H., Olvitt, L., O'Donoghue, R., Schudel, I., McGarry, D., & Niblett, B. (2021). *Environmental Ethics: A Sourcebook for Educators*. African Sun Media.

https://books.google.com/books?hl=en&lr=&id=CjtTEAAAQBAJ&oi=fnd&pg=PR1&dq=Jickling,+B.,+Lotz-Sisitka Bqyp1RJ3o837lA

Jiusto, S., McCauley, S., & Stephens, J. C. (2013). Integrating shared action learning into higher education for sustainability. *Journal of Sustainability Education*, *5*, 1-22. https://www.academia.edu/download/79782871/Jiusto-et-al-2013-Shared-Action-Learning-FINAL-1-PDF-Ready.pdf

Johnson, K., & Martinez Guzman, A. (2013). Rethinking concepts in participatory action research and their potential for social transformation: Post-structuralist informed methodological reflections from LGBT and trans-collective projects. *Journal of Community & Applied Social Psychology*, *23*(5), 405-419. https://doi.org/10.1002/casp.2134

Johnson, A. P. (2012). Humanistic and holistic learning theory. *Retrieved from www. OPDT-Johnsom. com*. https://search.proquest.com/openview/4e8d1479ce395006cb5df38f04355cc3/1?pq-origsite=gscholar&cbl=51922&diss=y

Johnson, B. & Christensen, L. (2012). Educational Research, Qualitative, Quantitative and Mixed Approach (4th ed). California: SAGE Publication, New York.

Jonker, J., & Pennik, B. (2010). The Essence of Research Methodology: A concise Guide for Master and PhD Learners in Management Science, Springer: Heidelber. The Essence of Research Methodology: A Concise Guide for Master and PhD Learners in Management Science | SpringerLink

Kabir, S. M. S. (2016). Basic guidelines for research. *An Introductory Approach for All Disciplines*, 168-180. BASIC-GUIDELINES-FOR-RESEARCH-An-Introductory-Approach-for-All-Disciplines.pdf (researchgate.net)

Kadji-Beltran, C., Zachariou, A., & Stevenson, R. B. (2013). Leading sustainable schools: Exploring the role of primary school principals. *Environmental education research*, *19*(3), 303-323. https://doi.org/10.1080/13504622.2012.692770

Kalamas Hedden, M., Worthy, R., Akins, E., Slinger-Friedman, V., & Paul, R. C. (2017). Teaching sustainability using an active learning constructivist approach: Discipline-specific case studies in higher education. *Sustainability*, *9*(8), 1320. https://doi.org/10.3390/su9081320

Kamal, S. S. L. B. A. (2019). Research paradigm and the philosophical foundations of a qualitative study. *PEOPLE: International Journal of Social Sciences*, *4*(3), 1386-1394. https://dx.doi.org/10.20319/pijss.2019.43.13861394

Kambouri-Danos, M., & Pieridou, M. (2020). Qualitative doctoral research in educational settings: Reflecting on meaningful encounters. *International Journal of Evaluation and Research in Education*, *9*(1), 21-31. https://doi.org/10.11591/ijere.v9i1.20360

Kang, I., Cui, H., & Son, J. (2019). Conformity consumption behavior and FoMO. *Sustainability*, *11*(17), 4734. https://doi.org/10.3390/su11174734

Kang, W. (2019). Perceived barriers to implementing education for sustainable development among Korean teachers. *Sustainability*.11(9):2532. https://doi.org/10.3390/su11092532

Kassier, T. (2022). *Grade 9 learners' views concerning the environment: a correlation study in Msunduzi and the Midlands, Kwazulu-Natal* (Doctoral dissertation). https://researchspace.ukzn.ac.za/handle/10413/21000

Kaushik, V., & Walsh, C. A. (2019). Pragmatism as a research paradigm and its implications for social work research. *Social sciences*, *8*(9), 255. https://doi.org/10.3390/socsci8090255

Kawulich, B. (2012). Collecting data through observation. *Doing social research: A global context*, *6*(12), 150-160. https://www.academia.edu/download/41186923/5550ba0b08ae739bdb91fa02.pdf20160115-19908-e2ha94.pdf

Kelly, M., Dowling, M., & Millar, M. (2018). The search for understanding: The role of paradigms. *Nurse researcher*, *25*(4), 9-13. http://dx.doi.org/10.7748/nr.2018.e1499

Kemmis, S., McTaggart, R., & Nixon, R. (2019). Critical participatory action research. In *Action learning and action research: Genres and approaches*. Emerald Publishing Limited,176-192. https://www.emerald.com/insight/content/doi/10.1108/978-1-78769-537-520191001/full/html

Kezar, A. J., & Holcombe, E. M. (2020). Barriers to organizational learning in a multi-institutional initiative. *Higher Education*, *79*(6), 1119-1138. https://doi.org/10.1007/s10734-019-00459-4

Khadka, A., Li, C. J., Stanis, S. W., & Morgan, M. (2021). Unpacking the power of place-based education in climate change communication. *Applied Environmental Education & Communication*, *20*(1), 77-91. https://doi.org/10.1080/1533015X.2020.1719238

Khatri, K. K. (2020). Research paradigm: A philosophy of educational research. *International Journal of English Literature and Social Sciences*, *5*(5), 1435-1440. https://journal-repository.theshillonga.com/index.php/ijels/article/view/2497

Khatun, R., & Salahuddin, M. (2019). Practicing Diploma in Primary Education at Government Primary Schools: Policy and Reality. *Primary Education Journal*, *10*(1), 13. https://commons.und.edu/ehb-stu/3

Kilvington, M., & Allen, W. (2010). Social learning: A basis for practice in environmental management. Landcare Research, Manaake Whenua. https://www.academia.edu/download/49221038/viewcontent.pdf#page=222

Kimanen, A., Alisaari, J., & Kallioniemi, A. (2019). In-service and pre-service teachers' orientations to linguistic, cultural and worldview diversity. *Journal of Teacher Education and Educators*, 8 (1), 35-54. Retrieved from https://dergipark.org.tr/en/pub/jtee/issue/44909/542205

Kim, K. G. (2016). Book review: Deep learning. *Healthcare informatics research*, *22*(4), 351-354. https://synapse.koreamed.org/articles/1075818

Kioupi, V., & Voulvoulis, N. (2019). Education for sustainable development: A systemic framework for connecting the SDGs to educational outcomes. *Sustainability*, *11*(21), 6104. https://doi.org/10.3390/su11216104

Kirk, K. (2017). A Case Study examining the extent that Learning for Sustainability is embedded across the Broad General Education in a Scottish Secondary School. *Unpublished MSc dissertation*.

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, *6*(5), 26-41. https://eric.ed.gov/?id=EJ1154775

Knowles, M. (1990). *The modern practice of adult education: From pedagogy to andragogy.* New York: Cambridge Books. https://eric.ed.gov/?id=ED043812

Kolb, D. A. (1976). Management and the learning process. *California management review*, *18*(3), 21-31. https://doi.org/10.2307/41164649

Kolb, D. A. (1976). *The Learning Style Inventory: Technical Manual*, Boston, Ma.: McBer.

Komatsu, H., Rappleye, J., & Silova, I. (2021). Student-centered learning and sustainability: Solution or problem? *Comparative Education Review*, *65*(1), 000-000. https://www.journals.uchicago.edu/doi/abs/10.1086/711829

Korotkova, T. S., & Zakirova, D. I. (2021). Environmental education and education for sustainable development: general and special. *Вестник университета Туран*, (1), 110-115. https://doi.org/10.46914/1562-2959-2021-1-1-110-115

Kumar, R. (2020). The United Nations and global environmental governance. *Strategic Analysis*, *44*(5), 479-489. https://doi.org/10.1080/09700161.2020.1824462

Kumatongo, B., & Muzata, K. K. (2021). Research paradigms and designs with their application in education. *Journal of Lexicography and Terminology (Online ISSN 2664-0899. Print ISSN 2517-9306).*, *5*(1), 16-32. https://medicine.unza.zm/index.php/jlt/article/view/551

Kuzich, S. (2019). *The Paradox of Education for Sustainability (EfS): An Interpretive Inquiry into*

Teachers' Engagement with Sustainability Policy Imperatives in a Western Australian Primary School (Doctoral dissertation, Curtin University). http://hdl.handle.net/20.500.11937/77188

Kuzmina, K., Trimingham, R., & Bhamra, T. (2020). Organisational Strategies for Implementing Education for Sustainable Development in the UK Primary Schools: A Service Innovation Perspective. *Sustainability*, *12*(22), 9549. https://doi.org/10.3390/su12229549

Kyngas, H. (2020). Qualitative research and content analysis. In *The application of content analysis in nursing science research* (pp. 3-11). Springer, Cham. https://doi.org/10.1007/978-3-030-30199-6_1

Lai, E. R. (2011). Critical thinking: A literature review. *Pearson's Research Reports*, *6*(1), 40-41. http://www.pearsonassessments.com/research

Lamnek, S. (2005). Qualitative Sozialforschung. 4., vollst. überarb. Aufl. *Basel: Beltz*.

Langkos, S. (2014). Research Methodology: Data collection method and research tools. *Derby, England: University of Derby. doi*, *10*(2.1), 3023-1369.

Lasen, M., Skamp, K., & Simoncini, K. (2017). Teacher perceptions and self-reported practices of education for sustainability in the early years of primary school: An Australian case study. *International Journal of Early Childhood*, *49*(3), 391-410. https://doi.org/10.1007/s13158-017-0200-x

Laurie, R., Nonoyama-Tarumi, Y., Mc Keown, R., & Hopkins, C. (2016). Contributions of education for sustainable development (ESD) to quality education: A synthesis of research. *Journal of Education for Sustainable development*, *10*(2), 226-242. https://doi.org/10.1177/0973408216661442

Laurillard, D. (2020). The significance of Constructionism as a distinctive pedagogy. *CONSTRUCTIONISM 2020*, *29*. http://www.tara.tcd.ie/bitstream/handle/2262/92768/C2020-Proceedings.pdf?sequence=1#page=29

Leal Filho, W., Dinis, M. A. P., Sivapalan, S., Begum, H., Ng, T. F., Al-Amin, A. Q., ... & Neiva, S. (2021). Sustainability practices at higher education institutions in Asia. *International Journal of Sustainability in Higher Education*, 23(6), 1250-1276. https://doi.org/10.1108/IJSHE-06-2021-0244

Leal Filho, W., Pallant, E., Enete, A., Richter, B., & Brandli, L. L. (2018). Planning and implementing sustainability in higher education institutions: An overview of the difficulties and potentials. *International journal of sustainable development & world ecology*, *25*(8), 713-721. https://doi.org/10.1080/13504509.2018.1461707

Leal Filho, W., Raath, S., Lazzarini, B., Vargas, V. R., de Souza, L., Anholon, R., ... & Orlovic, V. L. (2018). The role of transformation in learning and education for sustainability. *Journal of cleaner production*, *199*, 286-295. https://doi.org/10.1016/j.jclepro.2018.07.017

Leal Filho, W., Tripathi, S. K., Andrade Guerra, J. B. S. O. D., Gine-Garriga, R., Orlovic Lovren, V., & Willats, J. (2019). Using the sustainable development goals towards a better understanding of sustainability challenges. *International Journal of Sustainable Development & World Ecology*, *26*(2), 179-190. https://doi.org/10.1080/13504509.2018.1505674

Lee, K. (2021). Critique of design thinking in organizations: Strongholds and shortcomings of the making paradigm. *She Ji: The Journal of Design, Economics, and Innovation*, *7*(4), 497-515. https://doi.org/10.1016/j.sheji.2021.10.003

Lee, K., Gjersoe, N., O'Neill, S., & Barnett, J. (2020). Youth perceptions of climate change: A narrative synthesis. *Wiley Interdisciplinary Reviews: Climate Change*, *11*(3), 641. https://doi.org/10.1002/wcc.641

Lee, K., Barker, M., & Mouasher, A. (2013). Is it even espoused? An exploratory study of commitment to sustainability as evidenced in vision, mission, and graduate attribute statements in Australian universities. *Journal of Cleaner Production*, 48, 20-28. https://doi.org/10.1016/j.jclepro.2013.01.007

Lewin, K. (1948). Resolving social conflicts; selected papers on group dynamics. Harper, Washington, DC 20002-4242. https://psycnet.apa.org/record/1948-04891-000

Lewin, K. (1946). Action research and minority problems. *Journal of social issues*, *2*(4), 34-46. https://doi.org/10.1111/j.1540-4560.1946.tb02295.x

Li, Y., & Krasny, M. E. (2019). Practice change in environmental education: lessons from professional development. *Environmental Education Research*, *25*(7), 1119-1136. https://doi.org/10.1080/13504622.2018.1540033

Lincoln, Y. S., & Guba, E. G. (2016). *The constructivist credo*. New York: Routledge.

Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. *The Sage handbook of qualitative research*, *4*(2), 97-128. (PDF) PARADIGMATIC CONTROVERSIES/ CONTRADICTIONS/ AND EMERGING CONFLUENCES | Alejandro Reyes - Academia.edu

Lindorff, A., & Sammons, P. (2018). Going beyond structured observations: looking at classroom practice through a mixed method lens. *ZDM*, *50*(3), 521-534. https://doi.org/10.1007/s11858-018-0915-7

Lindsay, S. (2019). Five approaches to qualitative comparison groups in health research: a scoping review. *Qualitative health research*, *29*(3), 455-468. https://doi.org/10.1177/1049732318807208

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice* (Vol. 28). John Wiley & Sons. Methods in educational research : from theory to practice (stikespanritahusada.ac.id)

Lombardi, D., Shipley, T. F., & Astronomy Team, Biology Team, Chemistry Team, Engineering Team, Geography Team, Geoscience Team, and Physics Team. (2021). The curious construct of active learning. *Psychological Science in the Public Interest*, *22*(1), 8-43. https://doi.org/10.1177/1529100620973974

Lotz-Sisitka, H., Rosenberg, E., & Ramsarup, P. (2021). Environment and sustainability education research as policy engagement: (re-) invigorating 'politics as potentia' in South Africa. *Environmental Education Research*, *27*(4), 525-553. https://doi.org/10.1080/13504622.2020.1759511

Lotz-Sisitka, H., & Raven, G. (2001). *Active Learning in OBE: Environmental Learning in South African Schools: Report of the National Environmental Education Programme-GET Pilot Research Project, June 2001*. Rhodes University Environmental Education Unit. 25173-Article Text-15418-1-10-20081104.pdf

Lucas, P., Fleming, J., & Bhosale, J. (2018a). Employing use of self for transparency, rigor, trustworthiness, and credibility in qualitative organizational research methods. *OD practitioner*, *52*(1), 50-58. https://www.academia.edu/download/93118191/UoS_in_Research_Final_PublishedODR_V52_No1_Shufutinsky.pdf

Lucas, P., Fleming, J., & Bhosale, J. (2018b). The utility of case study as a methodology for workintegrated learning research. *International Journal of Work-Integrated Learning*, *19*(3), 215222. https://eric.ed.gov/?id=EJ1196748

Luna-Nemecio, J., Tobon, S., & Juarez-Hernandez, L. G. (2020). Sustainability-based on socioformation and complex thought or sustainable social development. *Resources, Environment and Sustainability*, *2*, 100007. https://doi.org/10.1016/j.resenv.2020.100007

Lune, H., & Berg, B. L. (2017). *Qualitative research methods for the social sciences*. Pearson Education, England.

Lysgaard, J. A., & Bengtsson, S. (2022). Action Incontinence: Action and Competence in Dark Pedagogy. In *Pedagogy in the Anthropocene* (pp. 107-128). Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-90980-2_6

Maarouf, H. (2019). Pragmatism as a supportive paradigm for the mixed research approach: Conceptualizing the ontological, epistemological, and axiological stances of pragmatism. *International Business Research*, *12*(9), 1-12. https://doi.org/10.5539/ibr.v12n9p1

Mahadew, R., & Appadoo, K. A. (2018). Tourism and climate change in Mauritius: assessing the adaptation and mitigation plans and prospects. *Tourism Review*, 74(2), 204-215. https://doi.org/10.1108/TR-12-2017-0203

Maharaj, N. (2015). Using field notes to facilitate critical reflection. *Reflective Practice*, *17*(2), 114124. https://doi.org/10.1080/14623943.2015.1134472

Maidou, A., Plakitsi, K., & Polatoglou, H. (2019). Knowledge, Perceptions and Attitudes on Education for Sustainable Development of Pre-Service Early Childhood Teachers in Greece. *World Journal of Education*, *9*(5), 1-15. https://eric.ed.gov/?id=EJ1232274

Maiorescu, I., Sabou, G. C., Bucur, M., & Zota, R. D. (2020). Sustainability barriers and motivations in higher education–a learners'perspective. *Amfiteatru Economic*, *22*(54), 362-375. https://www.ceeol.com/search/article-detail?id=851866

Majid, M. A. A., Othman, M., Mohamad, S. F., Lim, S. A. H., & Yusof, A. (2017). Piloting for interviews in qualitative research: Operationalization and lessons learnt. *International Journal of Academic Research in Business and Social Sciences*, *7*(4), 1073-1080. http://dx.doi.org/10.6007/IJARBSS/v7-i4/2916

Makovec, D. (2018). The teacher's role and professional development. *International Journal of Cognitive Research in Science, Engineering and Education*, *6*(2), 33. https://www.ceeol.com/search/article-detail?id=690086

Malandrakis, G. (2018). Influencing Greek pre-service teachers' efficacy beliefs and self-confidence to implement the new 'Studies for the Environment'curricula. *Environmental Education Research*, *24*(4), 537-563. https://doi.org/10.1080/13504622.2016.1272672

Malmqvist, J., Hellberg, K., Mollas, G., Rose, R., & Shevlin, M. (2019). Conducting the pilot study: A neglected part of the research process? Methodological findings supporting the importance of piloting in qualitative research studies. *International Journal of Qualitative Methods*, *18*, 1609406919878341. https://doi.org/10.1177/1609406919878341

Manasia, L., Ianos, M. G., & Chicioreanu, T. D. (2019). Pre-service teacher preparedness for fostering education for sustainable development: An empirical analysis of central dimensions of teaching readiness. *Sustainability*, *12*(1), 166. https://doi.org/10.3390/su12010166

Manteaw, B. O. (2020). Education and learning in sustainable development: Foregrounding an emergent discourse. *Discourse and Communication for Sustainable Education*, *11*(2), 5-19. https://sciendo.com/article/10.2478/dcse-2020-0015

Martin, J., Blanche, T., Durrheim, K., & Painter, D. (Eds.). (2014). *Research in practice: Applied methods for the social sciences*. Juta Limited. Research in Practice: Applied Methods for the Social Sciences - Google Books

Marton, F., & Saljo, R. (1976). On qualitative differences in learning: I—Outcome and process. *British journal of educational psychology*, *46*(1), 4-11. https://doi.org/10.1111/j.2044-8279.1976.tb02980.x

Maruyama, U., Prado, P., Trigo, A., & Trigo, J. (2020). Nurturing the Seeds of Sustainability Governance: Rio+ 25 Brazilian Higher Education Institution Case Study. In *Universities as Living Labs for Sustainable Development* (pp. 151-166). Springer, Cham. https://doi.org/10.1007/978-3-030-15604-6_10

Masuku, M. M., Jili, N. N., & Sabela, P. T. (2021). Assessment as a pedagogy and measuring tool in promoting deep learning in institutions of higher learning. *International Journal of Higher Education*, *10*(2), 274-283. https://eric.ed.gov/?id=EJ1285666

McCracken, C., & Coleman, R. (2020). A meaningful measure of homeschool academic achievement: Statistical analysis of standardized test performance in Alaska public correspondence schools. *Other Education-the journal of educational alternatives*, *9*(1), 207-252. https://www.othereducation.org/index.php/OE/article/view/258

McGibbon, C., & Van Belle, J. P. (2015). Integrating environmental sustainability issues into the curriculum through problem-based and project-based learning: a case study at the University of Cape Town. *Current Opinion in Environmental Sustainability*, *16*, 81-88. https://doi.org/10.1016/j.cosust.2015.07.013

McGrath, S., Ramsarup, P., Zeelen, J., Wedekind, V., Allais, S., Lotz-Sisitka, H., ... & Russon, J. A. (2020). Vocational education and training for African development: a literature review. *Journal of Vocational Education & Training*, *72*(4), 465-487. https://doi.org/10.1080/13636820.2019.1679969

McMillan, J. H., & Schumacher, S. (2010). Research in Education: Evidence-Based Inquiry, MyEducationLab Series. *Pearson*. https://eric.ed.gov/?id=ED577250

McNiff, J., Edvardsen, O. Steinholt, Margit. (2018). 'Impact', educational influence, and the practice of shared expertise. Educational Action Research, 26 (5). pp. 803-819. https://doi.org/10.1080/09650792.2018.1426469

McNiff, J. (2016). *You and your action research project*. London: Routledge. https://doi.org/10.4324/9781315693620

McTaggart, R. (1994). Participatory action research: Issues in theory and practice. *Educational Action Research*, *2*(3), 313-337. https://doi.org/10.1080/0965079940020302

Mehrad, A., & Zangeneh, M. H. T. (2019). Comparison between qualitative and quantitative research approaches: Social sciences. *International Journal for Research in Educational Studies, Iran*. https://gnpublication.org/index.php/es/article/view/998/783

Menon, S., & Suresh, M. (2020). Synergizing education, research, campus operations, and community engagements towards sustainability in higher education: A literature review. *International Journal of Sustainability in Higher Education*. https://doi.org/10.1108/IJSHE-03-2020-0089

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. John Wiley & Sons, Jossey-Bass, San Francisco. Qualitative Research: A Guide to Design and Implementation, 4th Edition | Wiley

Merritt, E. G., Archambault, L., & Hale, A. E. (2018). Sustainability education in elementary classrooms: Reported practices of alumni from a pre-service teacher course. *Discourse and Communication for Sustainable Education*, *9*(1), 18-35. https://doi.org/10.2478/dcse-2018-0002

Mertens, D. M. (2019). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. London: Sage publications.

Mertler, C. A. (Ed.). (2019). *The Wiley handbook of action research in education*. John Wiley & Sons. The Wiley Handbook of Action Research in Education | Wiley

Messerli, R., Murniningtyas, E., Eloundou-Enyegue, P., Foli, E. G., Furman, E., Glassman, A., Hernandez Licona, G., Kim, E. M., Lutz, W., Moatti, J. P., Richardson, K., Saidam, M., Staniskis, J. K., & Ypersele, J-P. V. (2019). Global Sustainable Development Report 2019: The Future is Now - Science for Achieving Sustainable Development. United Nations Publications. United Nations, New York. Department of Economic and Social Affairs. https://doi.org/10.1038/s41893-019-0394-z

Messikh, D. (2020). A systematic review of the outcomes of using action research in education. *Arab World English Journal (AWEJ), 11*(1). https://dx.doi.org/10.2139/ssrn.3582371

Meyer, K., & Willis, R. (2019). Looking back to move forward: The value of reflexive journaling for novice researchers. *Journal of gerontological social work*, *62*(5), 578-585. https://doi.org/10.1080/01634372.2018.1559906

Mezirow, J. (2018). Transformative learning theory. *In Contemporary theories of learning* (p. 114128). Routledge, New York, NY. https://www.taylorfrancis.com/books/mono/10.4324/9781315147277/contemporary-theories-learning?refId=e12f6283-4def-4d9f-845d-0cfef0b0d051&context=ubx

Michel, J. O. (2020). Mapping out learners' opportunity to learn about sustainability across the higher education curriculum. *Innovative Higher Education*, *45*(5), 355-371. https://doi.org/10.1007/s10755-020-09509-7

Miedijensky, S., & Abramovich, A. (2019). Implementation of" Education for Sustainability" in Three Elementary Schools--What Can We Learn about a Change Process?. *EURASIA Journal of Mathematics, Science and Technology Education*, *15*(10). https://eric.ed.gov/?id=EJ1302276

MIE-UNESCO (2011). Situational Analysis of Education for Sustainable Development at school level in Mauritius (unpublished).

MoE. (2007). *National Environmental Policy*. Ministry of Environment & NDU for the Republic of Mauritius. Government of Mauritius. White Paper on (fao.org)

MoEHR. (2016). *National Curriculum Framework.* Republic of Mauritius. National Curriculum Framework Grades 1-6- Mauritius Pages 1-50 - Flip PDF Download | FlipHTML5

MoEHR. (2008). *Education & Human Resources Strategy Plan 2008-2020.* Ministry of Education and Human Resources. Government of Mauritius. Mauritius. Microsoft Word - ANNEX A-Education & HR Strategy Plan, 2008-2020_18.02.2010.doc (unesco.org)

MoEHR. (2006). *National Curriculum Framework-Primary.* Republic of Mauritius. National Curriculum Framework | PDF | International Development | Curriculum (scribd.com)

MoEHRTESR. (2016a). *Nine Year Continuous Basic Education.* The National Curriculum Framework. Ministry of Education and Human Resources. Republic of Mauritius. INSPIRING EVERY CHILD FINAL.PDF (govmu.org)

MoEHRTESR. (2016b). *Annual Report on Performance,* 2016-2017. Republic of Mauritius. Annual Report on Performance 2016-17.pdf (govmu.org)

MoESD. (2016). *Annual Report on Performance,* 2016-2017. Republic of Mauritius. Annual Report on Performance 2016-17.pdf (govmu.org)

MoESD. (2013). *Maurice Ile Durable Policy, Strategy and Action Plan*. Ministry of Environment and Sustainable Development. full report midpolicy.pdf (govmu.org)

MoESD. (2011). Maurice Ile Durable: Towards a National Policy for a Sustainable Mauritius. Green Paper. Republic of Mauritius. greenpaper.pdf (govmu.org)

MoFED. (2022). *Budget Speech,* 2022-2023. Republic of Mauritius. budgetmof.govmu.org

MoFED. (2017). *Budget Speech,* 2017-2018. Republic of Mauritius. 2017_18budgetspeech.pdf (edbmauritius.org)

MoFED. (2017). *Government's Economic Mission Statement, 2017*. Republic of Mauritius. ANNUAL REPORT 2017-2018.PDF (govmu.org)

Mogren, A., Gericke, N., & Scherp, H. Å. (2019). Whole school approaches to education for sustainable development: A model that links to school improvement. *Environmental education research*, *25*(4), 508-531. https://doi.org/10.1080/13504622.2018.1455074

Mohajan, H. K. (2018). Qualitative research methodology in social sciences and related subjects. *Journal of Economic Development, Environment and People*, *7*(1), 23-48. https://www.ceeol.com/search/article-detail?id=640546

Moon, K., & Blackman, D. (2017). A guide to ontology, epistemology, and philosophical perspectives for interdisciplinary researchers. *Integration and Implementation Insights*, *2*. Moon, K., & Blackman, D. (2017). A guide to ontology,... - Google Scholar

Moroi, T. (2021). Quantitative and Qualitative Research and Philosophical Assumptions. *Journal of Bunkyo Gakuin University, Department of Foreign Languages*, (20), 127-132. https://www.bgu.ac.jp/library/wp-content/uploads/sites/11/2022/08/fsell-2020_127-132.pdf

Morris, T. H. (2020). Experiential learning–a systematic review and revision of Kolb's model. *Interactive Learning Environments*, *28*(8), 1064-1077. https://doi.org/10.1080/10494820.2019.1570279

Morrison, K. (2018). Using randomised controlled trials in education: by Paul Connolly, Andy Biggart, Sarah Miller, Liam O'Hare and Allen Thurston, London, Sage Publications. 24(8), 538-540. https://doi.org/10.1080/13803611.2018.1628421

Moyer, J. M., & Sinclair, A. J. (2020). Learning for sustainability: Considering pathways to transformation. *Adult Education Quarterly*, *70*(4), 340-359. https://doi.org/10.1177/0741713620912219

Mthembu, M. S., & Ocholla, D. N. (2018). Perceptions on Job Requirements of LIS Graduates in Public Libraries: A Reflection on Public Libraries in KwaZulu-Natal, South Africa. *Mousaion*, *36*(4). https://hdl.handle.net/10520/EJC-195f604f8c

Mudaly, R., & Ismail, R. (2016). Professional development in environmental and sustainability education: Voices, practices and reflections of science teachers. *Southern African Journal of*

Environmental Education, *32*, 66-86. https://www.ajol.info/index.php/sajee/article/view/152735

Mughal, S. H., Qaisrani, N., Solangi, G., & Faiz, S. (2011). Promoting education for sustainable development: Challenges and issues for higher education institutions in Pakistan. *International Journal of Learning & Development*, *1*(1), 159-165. http://dx.doi.org/10.5296/ijld.v1i1.1131

Muijs, D., & Reynolds, D. (2017). *Effective teaching: Evidence and practice*. London: Sage publications. http://digital.casalini.it/9781526418449

Murphy, C., Mallon, B., Smith, G., Kelly, O., Pitsia, V., & Martinez Sainz, G. (2021). The influence of a teachers' professional development programme on primary school learners' understanding of and attitudes towards sustainability. *Environmental Education Research*, *27*(7), 1011-1036. https://doi.org/10.1080/13504622.2021.1889470

Muzari, T., Shava, G. N., & Shonhiwa, S. (2022). Qualitative Research Paradigm, a Key Research Design for Educational Researchers, Processes and Procedures: A Theoretical Overview. *Indiana Journal of Humanities and Social Sciences*, *3*(1), 14-20. IJHSS_3(1)_14-20_61f38990115064.95135470.pdf (indianapublications.com)

Myende, P. E., & Hlalele, D. (2018). Framing sustainable rural learning ecologies: A case for strengthbased approaches. *Africa Education Review*, *15*(3), 21-37. https://doi.org/10.1080/18146627.2016.1224598

Mystakidis, S. (2021). Deep meaningful learning. *Encyclopedia*, *1*(3), 988-997. https://doi.org/10.3390/encyclopedia1030075

Natkin, L. W. (2016). Education for sustainability: exploring teaching practices and perceptions of learning associated with a general education requirement. *The Journal of General Education*, *65*(3-4), 216-240. https://doi.org/10.5325/jgeneeduc.65.3-4.0216

Nawaz, M. A., Azam, A., & Bhatti, M. A. (2019). Natural Resources Depletion and Economic Growth: Evidence from ASEAN Countries. *Pakistan Journal of Economic Studies (PJES)*, *2*(2), 155172. https://journals.iub.edu.pk/index.php/pjes/article/view/16

Naz, N., Gulab, F., & Aslam, M. (2022). Development of Qualitative Semi-Structured Interview Guide for Case Study Research. *Competitive Social Science Research Journal*, *3*(2), 42-52. https://cssrjournal.com/index.php/cssrjournal/article/view/170

Nelson, M. K., & Shilling, D. (Eds.). (2018). *Traditional ecological knowledge: Learning from Indigenous practices for environmental sustainability*. Cambridge University Press. http://dx.doi.org/10.1017/9781108552998

Ness, O., & Heimburg, D. V. (2020). Collaborative action research: Co-constructing social change for the common good. *SAGE Handbook of Social Constructionist Practice. London: Sage*, 34-45. Ness, O., & Heimburg, D. V. (2020). Collaborative... - Google Scholar

Nevin, E. (2008). Education and sustainable development. *Policy & Practice-A Development Education Review*, (6).

Newcomer, K. E., Hatry, H. P., & Wholey, J. S. (2015). Conducting semi-structured interviews. *Handbook of practical program evaluation*, *492*, 492. https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781119171386

Ng'ong'Ocholla, D. (2022). A Research Dashboard for Aligning Research Components in Research Proposals, Theses, and Dissertations in Library and Information Science. In *Handbook of Research on Mixed Methods Research in Information Science* (pp. 629-640). https://doi.org/10.4018/978-1-7998-8844-4.ch029

Nguyen, K. A., Borrego, M., Finelli, C. J., DeMonbrun, M., Crockett, C., Tharayil, S., ... & Rosenberg, R. (2021). Instructor strategies to aid implementation of active learning: a systematic literature review. *International Journal of STEM Education*, *8*(1), 1-18. https://doi.org/10.1186/s40594-021-00270-7

Nkambwe, M., & Essilfie, V. N. (2012). Misalignment between policy and practice: Introducing environmental education in school curricula in Botswana. *Educational Research and Reviews*, *7*(1), 19-26. https://doi.org/10.5897/ERR11.016

Nor, N. M., Embong, R., Muda, H., Yunus, K., & Nor, J. M. (2019). Effects of teachers' teaching competencies on learners' academic performance mediated by holistic centered learning style based on SUMUR Program at Secondary Religious Schools. *International Journal of Academic Research in Progressive Education and Development*, *8*(2), 25-38. http://dx.doi.org/10.6007/IJARPED/v8-i1/5600

Norton, B., & Yonts, N. (2022). Traditional versus modern teaching styles: Effect on mathematical achievement and motivation. PSY 485 Thesis Final Paper (researchgate.net)

Nousheen, A., Zai, S. A. Y., Waseem, M., & Khan, S. A. (2020). Education for sustainable development (ESD): Effects of sustainability education on pre-service teachers' attitude towards sustainable development (SD). *Journal of Cleaner Production*, *250*, 119537. https://doi.org/10.1016/j.jclepro.2019.119537

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods*, *16*(1), 1609406917733847. https://doi.org/10.1177/1609406917733847

O'Neill, E. (2020). What is Adult Learning Theory?

Ocholla, D. N., & Le Roux, J. (2011). Conceptions and misconceptions of theoretical frameworks in library and information science research: A case study of selected theses and dissertations from eastern and southern African universities. *Mousaion, 29*(2), 61-74. https://hdl.handle.net/10520/EJC124917

O'Donoghue, R., Misser, S., & Snow-Macleod, J. (2021). Review of a Course-supported Design Research Intervention Process for the Inclusion of Education for Sustainable Development in School Subject Disciplines. *Teaching and Learning for Change*, 165. SKM_458e22040812370 (researchgate.net)

O'Donoghue, R., Henze, C., Shimray, C., Sarabhai, K. V., & Rivera, J. C. A. S. (2020). Hand-Print CARE: Towards Ethics-led Action Learning for ESD in School Subject Disciplines. *Journal of Education for Sustainable Development, 14*(1), 41-60. https://doi.org/10.1177/0973408220934647

O'Donoghue, R., & Roncevic, K. (2020). The development of education for sustainable developmentmaterials for inclusive education in South African curriculum settings. *ZEP: Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik, 43*(1), 20-26. https://doi.org/10.25656/01:20444

O'Donoghue, R., Sandoval-Rivera, J. C. A., & Payyappallimana, U. (2019). Landscape, memory and learning to change in changing worlds: Contemplating intergenerational learning and traditional knowledge practices within social-ecological landscapes of change. *Southern African Journal of Environmental Education, 35*. https://doi.org/10.4314/sajee.v35i1.10

O'Donoghue, R., Kibuka-Sebitosi, E., Tshiningayamwe, S., & Palmer, C. (2019). Navigating nonsense by exemplifying situated life experience and intergenerational heritage knowledge in Education for Sustainable Development learning spaces. *Southern African Journal of Environmental Education, 35*. https://doi.org/10.4314/sajee.v35i1.8

O'Donoghue, R. (2018). Think Piece on Amanzi for Food: Working with Critical Realism to Inform a Situated Learning Framework for Climate Change Education. *Southern African Journal of Environmental Education, 34*. https://creativecommons.org/licenses/by-nc-sa/4.0/

O'Donoghue, R., Taylor, J., & Venter, V. (2018). How are learning and training environments transforming with ESD. *Issues and trends in Education for Sustainable Development*, 111-131. SKM_458e22040812370 (researchgate.net)

O'Donoghue, R. (2017). Situated learning in relation to human conduct and social-ecological change. In *Schooling for Sustainable Development in Africa* (pp. 25-38). Springer, Cham. https://doi.org/10.1007/978-3-319-45989-9_2

O'Donoghue, R. (2007). Environment and sustainability education in a changing South Africa: A critical historical analysis of outline schemes for defining and guiding learning interactions. *Southern African Journal of Environmental Education*, *24*, 141-157. https://www.ajol.info/index.php/sajee/article/view/122749

O'Donoghue, R., Lotz-Sisitka, H., Asafo-Adjei, R., Kota, L., & Hanisi, N. (2007). Exploring learning interactions arising in school-in-community contexts of socio-ecological risk. *Social learning towards a sustainable world*, 435-449. https://www.wageningenacademic.com/doi/pdf/10.3920/978-90-8686-594-9#page=437

O'Donoghue, R. & Lotz-Sisitka, H. (2006). Situated learning, rubbish, and risk reduction in Southern Africa at the start of the UN Decade of Education for Sustainable Development. *Australian Journal of Environmental Education,* 22 (1), 105–113. https://doi.org/10.1017/S0814062600001737

O'Donoghue, R., & Russo, V. (2004). Emerging patterns of abstraction in environmental education: a review of materials, methods, and professional development perspectives. *Environmental Education Research, 10*(3), 331-351. https://doi.org/10.1080/1350462042000258170

O'Donoghue, R. (2001). Environment and active learning in OBE: NEEP guidelines for facilitating and assessing active learning in OBE. Howick: ShareNet.

Olmos-Gomez, M., Estrada-Vidal, L. I., Ruiz-Garzon, F., Lopez-Cordero, R., & Mohamed-Mohand, L. (2019). Making future teachers more aware of issues related to sustainability: An assessment of best practices. *Sustainability*, *11*(24), 7222. https://doi.org/10.3390/su11247222

Ombudsperson for children, Annual Report, 2017-2018, Republic of Mauritius. Annual Reports (govmu.org)

One Planet Schools Working Group. (2012). Learning for sustainability. *Edinburgh: Scottish*. ONE PLANET SCHOOLS WORKING GROUP – DRAFT REPORT (education.gov.scot)

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International journal of social research methodology*, *8*(5), 375-387. https://doi.org/10.1080/13645570500402447

O'Riordan, T., & Voisey, H. (2013). Continuing the transition. In *The Transition to Sustainability* (pp. 292-297). Routledge, New York.

https://www.taylorfrancis.com/chapters/edit/10.4324/9781315071060-23/continuing-transition-tim-riordan-heather-voisey

Orr, K. (2019). VET teachers and trainers. *The Wiley handbook of vocational education and training*, 329-348. https://doi.org/10.1002/9781119098713.ch17

Owens, D. C., Sadler, T. D., Barlow, A. T., & Smith-Walters, C. (2020). Student motivation from and resistance to active learning rooted in essential science practices. *Research in Science Education*, *50*(1), 253-277. https://doi.org/10.1007/s11165-017-9688-1

PAGE. (2020). Mauritius Puts Sustainable Development at the Forefront for 2020-2024. Accessed through: https://www.un-page.org/news/mauritius-puts-sustainable-development-at-the-forefront-for-2020-2024/

Pahl-Wostl, C. (2019). The role of governance modes and meta-governance in the transformation towards sustainable water governance. *Environmental science & policy*, *91*, 6-16. https://doi.org/10.1016/j.envsci.2018.10.008

Pahnke, J., O'Donnell, C., & Bascope, M. (2019). Using science to do social good: STEM education for sustainable development. *Proceedings of the Second International Dialogue on STEM Education (IDoS), Berlin, Germany*, 5-6.

Painuly, P. K., Tyagi, R., Vishwakarma, S., Khare, S. K., Haghighi, M. (2020). Energy Supply Using Nexus Approach for Attaining Sustainable Development Goal 7. In: Leal Leal Filho, W., Azul, A.M., Brandli, L., Lange Salvia, A., Wall, T. (eds.). Affordable and Clean Energy. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007/978-3-319-95864-4_84

Palmberg, I., Hofman-Bergholm, M., Jeronen, E., & Yli-Panula, E. (2017). Systems thinking for understanding sustainability. Nordic student teachers' views on the relationship between species identification, biodiversity, and sustainable development. *Education Sciences*, *7*(3), 72. https://doi.org/10.3390/educsci7030072

Pandey, P., & Pandey, M. M. (2021). *Research methodology tools and techniques*. Bridge Center. http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4666/1/RESEARCH%20METHODOLOGY%20TOOLS%20AND%20TECHNIQUES.pdf

Parry, S., & Metzger, E. (2021). Barriers to Learning for Sustainability: Reflections from a British Science Teacher. https://doi.org/10.21203/rs.3.rs-266453/v1

Patrick, L. E., Howel, L. A., & Wischusen, W. (2016). Perceptions of active learning between faculty and undergraduates: Differing views among departments. *Journal of STEM Education: Innovations and Research*, *17*(3). https://www.jstem.org/jstem/index.php/JSTEM/article/view/2121

Patton, M. Q. (2002). *Qualitative research & evaluation methods*. Sage, New York.

Payne, P. G., & Hart, P. (2020). Environmental education, democracy, Thunberg, and XR. *The Journal of Environmental Education*, *51*(4), 263-269. https://doi.org/10.1080/00958964.2020.1744109

Pennacchia, J., Jones, E., & Aldridge, F. (2018). Barriers to learning for disadvantaged groups: report of qualitative findings. http://hdl.voced.edu.au/10707/462485

Penuel, W. R., Riedy, R., Barber, M. S., Peurach, D. J., LeBouef, W. A., & Clark, T. (2020). Principles of collaborative education research with stakeholders: Toward requirements for a new research and development infrastructure. *Review of Educational Research*, *90*(5), 627-674. https://doi.org/10.3102/0034654320938126

Pesanayi, T. V., O'Donoghue, R., & Shava, S. (2019). Think Piece: Situating Education for Sustainable Development in southern African philosophy and contexts of social-ecological change to enhance curriculum relevance and the common good. *Southern African Journal of Environmental Education*, *35*. https://doi.org/10.4314/sajee.v35i1.15

Peterson, M. (2022). Book Review: Regeneration: Ending the Climate Crisis in One Generation by Paul Hawken. https://doi.org/10.1177/02761467221096875

Pompeii, B., Chiu, Y. W., Neill, D., Braun, D., Fiegel, G., Oulton, R., ... & Singh, K. (2019). Identifying and overcoming barriers to integrating sustainability across the curriculum at a teaching-oriented university. *Sustainability*, *11*(9), 2652. https://doi.org/10.3390/su11092652

Ponciano, L. (2013). The voices of youth in foster care: A participant action research study. *Action Research*, *11*(4), 322-336. https://doi.org/10.1177/1476750313502554

Potter-Nelson, E. M., & O'Neil, J. K. (2019). Role of Teachers on Education for Sustainable Development. *Journal: Encyclopedia of Sustainability in Higher Education*, 1429-1438. https://doi.org/10.1007/978-3-319-63951-2_226-1

Purvis, B., Mao, Y., & Robinson, D. (2019). Three pillars of sustainability: in search of conceptual origins. *Sustainability science*, *14*(3), 681-695. https://doi.org/10.1007/s11625-018-0627-5

Qablan, A. (2018). Building capacities of educators and trainers. *Issues and trends in Education for Sustainable Development*, 133. Building capacities of educators and trainers - UNESCO Digital Library

Quarmby, T., Daly-Smith, A., & Kime, N. (2019). 'You get some very archaic ideas of what teaching is…': primary school teachers' perceptions of the barriers to physically active lessons. *Education 3-13*, *47*(3), 308-321. https://doi.org/10.1080/03004279.2018.1437462

Quesada, D., Cruz-Monteagudo, M., Fletcher, T., Duardo-Sanchez, A., & Gonzalez-Diaz, H. (2019). Complex networks and machine learning: from molecular to social sciences. *Applied Sciences*, *9*(21), 4493. https://doi.org/10.3390/app9214493

Raheim, M., Magnussen, L. H., Sekse, R. J. T., Lunde, A., Jacobsen, T., & Blystad, A. (2016). Researcher–researched relationship in qualitative research: Shifts in positions and researcher vulnerability. *International journal of qualitative studies on health and well-being*, *11*(1), 30996. https://doi.org/10.3402/qhw.v11.30996

Ramcharrun A., Bholah R., Kaullysing., D., & Bhagooli R. (2021). Perception of Mauritians on the concept of and potential barriers to Sustainable Development in Mauritius. Star Publications Pvt. Ltd.

Ramdani, A., Syukur, A., Gunawan, G., Permatasari, I., & Yustiqvar, M. (2020). Increasing Learners' Metacognition Awareness: Learning Studies Using Science Teaching Materials Based on SETS Integrated Inquiry. *International Journal of Advanced Science and Technology*, *29*(5), 6708-6721. Increasing Learners' Metacognition Awareness: Learning Studies Using Science Teaching Materials Based on SETS Integrated Inquiry | International Journal of Advanced Science and Technology (sersc.org)

Rashid, Y., Rashid, A., Warraich, M. A., Sabir, S. S., & Waseem, A. (2019). Case study method: A step-by-step guide for business researchers. *International journal of qualitative methods*, *18*, 1609406919862424. https://doi.org/10.1177/1609406919862424

Ravindran, V. (2019). Data analysis in qualitative research. *Indian Journal of Continuing Nursing Education*, *20*(1), 40. https://www.ijcne.org/text.asp?2019/20/1/40/268687

Raymer, E. A. B. (2022). *Qualitative Study: Investigating Situational, Dispositional, and Institutional Barriers Among Learners Aged 35 and Older* (Doctoral dissertation, Capella University). https://search.proquest.com/openview/3f066e14d16f56b05d3ab13608ee0d26/1?pq-origsite=gscholar&cbl=18750&diss=y

Reason, P., & Bradbury, H. (2008). Concluding reflections: whither action research. *Handbook of Action Research*, 695-707. http://digital.casalini.it/9781446206584

Rehman, A. A., & Alharthi, K. (2016). An introduction to research paradigms. *International Journal of Educational Investigations*, *3*(8), 51-59. http://www.ijeionline.com/attachments/article/57/IJEI.Vol.3.No.8.05.pdf

Redman, E. (2013). Opportunities and challenges for integrating sustainability education into k-12 schools: Case study phoenix, AZ. https://keep.lib.asu.edu/_flysystem/fedora/c258/EfS_TeacherArticle.pdf

Reid, J. A. (2019). What's good enough? Teacher education and the practice challenge. *The Australian Educational Researcher*, *46*(5), 715-734. https://doi.org/10.1007/s13384-019-00348-w

Revans, R. (2017). *ABC of action learning*. Routledge, London.

Rezapouraghdam, H., Alipour, H., & Arasli, H. (2019). Workplace spirituality and organization sustainability: A theoretical perspective on hospitality employees' sustainable behaviour. *Environment, Development and Sustainability*, *21*(4), 1583-1601. https://doi.org/10.1007/s10668-018-0120-4

Richards, K. (2003). *Qualitative inquiry in TESOL*. Springer, London.

Richardson, C. R. (2015). *Engaging Knowledge: Active Learning Strategies.* Centre for Teaching and Assessment of Learning. Delaware: University of Delaware Press.

Rickinson, M. (2006). Researching and understanding environmental learning: Hopes for the next 10 years. *Environmental Education Research*, *12*(3-4), 445-457. https://doi.org/10.1080/13504620600799182

Rieckmann, M. (2018). Learning to transform the world: Key competencies in Education for Sustainable Development. *Issues and trends in education for sustainable development*, *39*, 39-59. Learning to transform the world: key competencies in education for sustainable development - UNESCO Digital Library

Rodriguez, M., Diaz, I., Gonzalez, E. J., & Gonzalez-Miquel, M. (2018). Motivational active learning: An integrated approach to teaching and learning process control. *Education for Chemical Engineers*, *24*, 7-12. https://doi.org/10.1016/j.ece.2018.06.003

Roller, M. R. (2019). *A quality approach to qualitative content analysis: Similarities and differences compared to other qualitative methods*. SSOAR-Social Science Open Access Repository. https://doi.org/10.17169/fqs-20.3.3385

Ronen, I. K. (2020). Action research as a methodology for professional development in leading an educational process. *Studies in Educational Evaluation*, *64*, 100826. https://doi.org/10.1016/j.stueduc.2019.100826

Rose, J., & Johnson, C. W. (2020). Contextualizing reliability and validity in qualitative research: toward more rigorous and trustworthy qualitative social science in leisure research. *Journal of Leisure Research*, *51*(4), 432-451. https://doi.org/10.1080/00222216.2020.1722042

Rosen, Y., Wolf, I., & Stoeffler, K. (2020). Fostering collaborative problem-solving skills in science: The Animalia project. *Computers in Human Behaviour*, *104*, 105922. https://doi.org/10.1016/j.chb.2019.02.018

Roulston, K., & Choi, M. (2018). Qualitative interviews. *The SAGE handbook of qualitative data collection*, 233-249. http://digital.casalini.it/9781526416063

Rovai, A. P., Baker, J. D., & Ponton, M. K. (2014). Social Sci. Research Design and Statistics: A Practitioner's Guide to Research Methods and IBM SPSS Analysis. *Chesapeake, VA: Watertree Press LLC.*

Ryan, A., & Cotton, D. (2013). Times of change: shifting pedagogy and curricula for future sustainability. In *The sustainable university* (pp. 177-193). Routledge. https://doi.org/10.4324/9780203101780

Sales, A., Moliner, O., & Traver, J. (2021). Participatory Action Research: a case study on the school 306ynthesizing306on process. *Research Papers in Education*, *36*(6), 704-725.

Samuel, M. A., & Mariaye, H. (2019). Schooling education in Mauritius: Negotiated connectivities. *Handbook of education systems in South Asia*, 1-31. https://doi.org/10.1007/978-981-13-3309-5_54-1

Scharp, K. M., & Sanders, M. L. (2019). What is a theme? Teaching thematic analysis in qualitative communication research methods. *Communication Teacher*, *33*(2), 117-121. https://doi.org/10.1080/17404622.2018.1536794

Schreiber, J., & Siege, H. (2016). Curriculum Framework – Education for Sustainable Development. Engagement Global gGmbH, Bonn, Germany. http://nuir.nkumbauniversity.ac.ug/handle/20.500.12383/1050

Schudel, I. (2021). Theorising Active Learning: A Historical Analysis. *Teaching and Learning for Change*, 127-147. African Minds, Cape Town, S. Africa.

Schudel, I. J. (2012). Examining emergent active learning processes as transformative praxis: The case of the schools and sustainability professional development programme. Doctor of Philosophy thesis, Rhodes University. Microsoft Word - Final-Ingrid-post-examination - Heila edits.docx (core.ac.uk)

Schudel, I., Le Roux, C., Lotz-Sisitka, H., Loubser, C., O'Donoghue, R., & Shallcross, T. (2008). Contextualising learning in Advanced Certificate in Education (Environmental Education) courses: synthesising contexts and experiences. *South African Journal of Education*, *28*(4), 543-559. https://hdl.handle.net/10520/EJC32180

Schwandt, T. (2015). *Evaluation foundations revisited: Cultivating a life of the mind for practice*. Stanford University Press.

Scotland, J. (2012). Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms. *English language teaching*, *5*(9), 9-16. https://eric.ed.gov/?id=EJ1080001

Scott, W. (2020). 25 years on: looking back at environmental education research. *Environmental Education Research*, *26*(12), 1681-1689. https://doi.org/10.1080/13504622.2020.1869185

Scott, W. A. (2015). Exploring a transformative orientation to sustainability in universities: a question of loose and tight framings. *Environmental Education Research*, *21*(6), 943-953. https://doi.org/10.1080/13504622.2014.954238

Seatter, C. S., & Ceulemans, K. (2017). Teaching Sustainability in Higher Education: Pedagogical Styles That Make a Difference. *Canadian Journal of Higher Education*, *47*(2), 47-70. https://eric.ed.gov/?id=EJ1154160

Sedrakyan, G., Malmberg, J., Verbert, K., Jarvela, S., & Kirschner, P. A. (2020). Linking learning behaviour analytics and learning science concepts: Designing a learning analytics dashboard for feedback to support learning regulation. *Computers in Human Behavior*, *107*, 105512. https://doi.org/10.1016/j.chb.2018.05.004

Serin, H. (2018). A comparison of teacher-centered and student-centered approaches in educational settings. *International Journal of Social Sciences & Educational Studies*, *5*(1), 164-167. https://doi.org/10.23918/ijsses.v5i1p164

Shah, Z., Kennedy-Clark, S., Xie, Y., Rahim, M. S., Mahdavi, M., & Levula, A. (2022). Teacher Views on Teaching Sustainability in Higher Education Institutes in Australia. *Sustainability*, *14*(14), 8431. https://doi.org/10.3390/su14148431

Shaw, I., & Holland, S. (2014). *Doing Qualitative Research in Social Work*. London: Sage. http://digital.casalini.it/9781473905023

Shea, R. P., & Ramgolam, Y. K. (2019). Applied levelized cost of electricity for energy technologies in a small island developing state: A case study in Mauritius. *Renewable energy*, *132*, 14151424. https://doi.org/10.1016/j.renene.2018.09.021

Shelton, J. M. (2021). *Situational, Institutional, Dispositional Barriers Faced by Nontraditional Learners in Their Access and Pursuit of Higher Education* (Doctoral dissertation, Trident University International). https://search.proquest.com/openview/90cbecd077322cf0db845ac778a5347b/1.pdf?pq-origsite=gscholar&cbl=18750&diss=y

Shiddike, M. O., & Rahman, A. A. (2020). Case study method in human resource development: Reviewing the research literature. https://doi.org/10.5539/ibr.v13n4p113

Showkat, N., & Parveen, H. (2017). In-depth Interview. e-PG Pathshala (UGC & MHRD).

Shufutinsky, A. (2020). Employing use of self for transparency, rigor, trustworthiness, and credibility in qualitative organizational research methods. *OD practitioner*, *52*(1), 50-58. https://www.academia.edu/download/93118191/UoS_in_Research_Final_PublishedODR_V52_No1_Shufutinsky.pdf

Silo, N., & Ketlhoilwe, M. J. (2020). Environmental Sustainability Education: Driving Towards Achieving SDG 4 through Teacher Education. In *Sustainability in Developing Countries* (pp. 207-223). Springer, Cham. https://doi.org/10.1007/978-3-030-48351-7_10

Simon, M. K. (2011). Dissertation and scholarly research: Recipes for success. Seattle, WA, Dissertation Success, LLC.

Singh, D. (2019). Understanding philosophical underpinnings of research with respect to various paradigms: Perspective of a research scholar. *Institute of Management, NIRMA University*. https://www.academia.edu/download/60641198/GM113_DiwakarSingh_Mod20190919-66659-recf3t.pdf

Sipone, S., Abella-García, V., Barreda, R., & Rojo, M. (2019). Learning about sustainable mobility in primary schools from a playful perspective: A focus group approach. *Sustainability*, *11*(8), 2387. https://doi.org/10.3390/su11082387

Sisitka, H. L., & Schudel, I. (2007). Rhodes University EE and Sustainability Unit. *Journal of Education for Sustainable Development*, *1*(1), 153-158. https://doi.org/10.1177/097340820700100127

Slevitch, L. (2011). Qualitative and quantitative methodologies compared: Ontological and epistemological perspectives. *Journal of quality assurance in hospitality & tourism*, *12*(1), 73-81. https://doi.org/10.1080/1528008X.2011.541810

Smith, W. (2019). The role of environment clubs in promoting ecocentrism in secondary schools: Student identity and relationship to the earth. *The Journal of Environmental Education*, *50*(1), 52-71. https://doi.org/10.1080/00958964.2018.1499603

Sobel, D. (2014). Place-Based Education: Connecting Classrooms and Communities. Closing the Achievement Gap: The SEER Report. *NAMTA Journal*, *39*(1), 61-78. https://eric.ed.gov/?id=EJ1183171

Soini, K., Jurgilevich, A., Perikhanian, J., & Korhonen-Kurki, K. (2018). Universities responding to the call for sustainability: a typology of sustainability centres. *Journal of Cleaner. Production.* 170, 1423-1432. https://doi.org/10.1016/j.jclepro.2017.08.228.

Sonetti, G., Barioglio, C., & Campobenedetto, D. (2020). Education for sustainability in practice: a review of current strategies within Italian universities. *Sustainability*, *12*(13), 5246. https://doi.org/10.3390/su12135246

Spacey, A., Harvey, O., & Casey, C. (2021). Postgraduate researchers' experiences of accessing participants via gatekeepers: 'wading through treacle!'. *Journal of Further and Higher Education*, *45*(4), 433-450. https://doi.org/10.1080/0309877X.2020.1774051

Spalding, H. E., Williams, D. R., & Wise, V. L. (2014). Designing and assessing learning outcomes: A framework for co-curricular sustainability programs. *Journal of Sustainability Education*, 6, 1-22. http://archives.pdx.edu/ds/psu/12971

Spiteri, J., Higgins, P., & Nicol, R. (2022). It's like a Fruit on a Tree: Young Maltese Children's Understanding of the Environment. *Early Child Development and Care*, *192*(7), 1133-1149. https://doi.org/10.1080/03004430.2020.1850444

Stahl, N. A., & King, J. R. (2020). Expanding approaches for research: Understanding and using trustworthiness in qualitative research. *Journal of Developmental Education*, *44*(1), 26-28. https://www.jstor.org/stable/45381095

Stains, M., & Vickrey, T. (2017). Fidelity of implementation: An overlooked yet critical construct to establish effectiveness of evidence-based instructional practices. *CBE—Life Sciences Education*, *16*(1), rm1. https://doi.org/10.1187/cbe.16-03-0113

Stake, R., & Munson, A. (2008). Qualitative assessment of arts education. *Arts Education Policy Review*, *109*(6), 13-22. https://doi.org/10.3200/AEPR.109.6.13-22

Staller, K. M. (2021). Big enough? Sampling in qualitative inquiry. *Qualitative Social Work*, *20*(4), 897-904. https://doi.org/10.1177/14733250211024516

Statistics Mauritius (2020). Annual report 2020-2021. Republic of Mauritius. Annual_Report_yr20-yr21_Statistics_Mauritius_201021.pdf (govmu.org)

Stead, J. G., & Stead, W. E. (2014). Building spiritual capabilities to sustain sustainability-based competitive advantages. *Journal of Management, Spirituality & Religion*, *11*(2), 143-158. https://doi.org/10.1080/14766086.2013.832359

Stump, G. S., Husman, J., & Corby, M. (2014). Engineering learners' intelligence beliefs and learning. *Journal of engineering education*, *103*(3), 369-387. https://doi.org/10.1002/jee.20051

Suarez-Lopez, R., & Eugenio-Gozalbo, M. (2021). How is sustainability addressed in primary and secondary education curricula? Assessing the cases of Spain and Portugal. *International Research in Geographical and Environmental Education*, *31*(2), 106-122. https://doi.org/10.1080/10382046.2021.1924498

Sukhonthachit, P., & Rattanawicha, S. (2022). Holistic Learning In Technology Age. *Journal of Positive School Psychology*, *6*(8), 6668-6678. https://www.journalppw.com/index.php/jpsp/article/view/10979

Sullivan, G. M., & Sargeant, J. (2011). Qualities of qualitative research: part I. *Journal of graduate medical education*, *3*(4), 449-452. https://doi.org/10.4300/JGME-D-11-00221.1

Sunassee, A., Bokhoree, C., & Patrizio, A. (2021). Learners' empathy for the environment through eco-art place-based education: A review. *Ecologies*, *2*(2), 214-247. https://doi.org/10.3390/ecologies2020013

Surroop, D., & Raghoo, P. (2017). Energy landscape in Mauritius. *Renewable and Sustainable Energy Reviews*, *73*, 688-694. https://doi.org/10.1016/j.rser.2017.01.175

Svenkerud, S., Madsen, J., Ballangrud, B. B., Strande, A. L., & Stenshorne, M. E. (2020). Sustainable use of ecological concepts in educational science. https://doi.org/10.2478/dcse-2020-0013

Sverdrup, H. U. (2019). The global sustainability challenges in the future: The energy use, materials supply, pollution, climate change and inequality nexus. In *What Next for Sustainable Development?* (pp. 49-75). Edward Elgar Publishing.

Swanborn, P. (2010). *Case study research: what, why and how?*. Sage, London. http://digital.casalini.it/9781446247921

Sweeney, T., West, D., Groessler, A., Haynie, A., Higgs, B. M., Macaulay, J., ... & Yeo, M. (2017). Where's the transformation? Unlocking the potential of technology-enhanced assessment. *Teaching and Learning Inquiry*, *5*(1), 1-16. http://hdl.handle.net/10453/162693

Tandrayen-Ragoobur, V., Gokulsing, D., & Irving, Z. (2021). Social policies, risks and vulnerabilities: A gender perspective for Mauritius. *Journal of International and Comparative Social Policy*, *37*(3), 273-292. https://doi.org/10.1017/ics.2021.10

Tassone, V. C., den Brok, P., Tho, C. W., & Wals, A. E. (2022). Cultivating learners' sustainabilityoriented learning at the interface of science and society: a configuration of interrelated enablers. *International Journal of Sustainability in Higher Education*, *23*(8), 255-271. https://doi.org/10.1108/IJSHE-01-2022-0014

Taylor, N., Quinn, F., Jenkins, K., Miller-Brown, H., Rizk, N., Prodromou, T., …Taylor, S. (2019). Education for Sustainability in the Secondary Sector—A Review. *Journal of Education for Sustainable Development*.13(1):102-22. https://doi.org/10.1177/0973408219846675

Taylor, N., Quinn, F., & Eames, C. (Eds.). (2015). *Educating for sustainability in primary schools: teaching for the future*. Senses publications, Rotterdam. The Netherlands. http://dx.doi.org/10.1007/978-94-6300-046-8

Tellings, A. (2001). Eclecticism and integration in educational theories: A metatheoretical analysis. *Educational Theory*, *51*(3), 277. https://search.proquest.com/openview/d2d7dd66a3af3c6b413cbcaab2874d6a/1?pq-origsite=gscholar&cbl=34718

Tennant, M., & Pogson, P. (1995). *Learning and Change in the Adult Years: A Developmental Perspective. Jossey-Bass Higher and Adult Education Series. Jossey-Bass Social and Behavioural Service Series*. Jossey-Bass Inc., 350 Sansome Street, San Francisco, CA 94104. https://eric.ed.gov/?id=ED382837

Ternel, M., & Greyling, L. (2018). An Assessment of Sustainable Tourism and its Opportunities in Mauritius. In *International Conference on Tourism Research* (pp. 142-150). https://search.proquest.com/openview/bb2f10166e02f983181ba00e261f3803/1?pq-origsite=gscholar&cbl=4451210

Think Mauritius, (2019). Rethinking the education system in Mauritius. *A discussion paper proposed by Think Mauritius*, Republic of Mauritius. 2019-03-13-Rethinking-Education-System.pdf (maurice-info.mu)

Thomas, K. (1962). The structure of scientific revolutions. *International Encyclopedia of Unified Science*, *2*(2). https://philpapers.org/rec/KUHTSO-10

Thurairajah, K. (2019). Uncloaking the researcher: Boundaries in qualitative research. *Qualitative Sociology Review*, *15*(1), 132-147. https://www.ceeol.com/search/article-detail?id=809804

Tikly, L. (2019). Education for sustainable development in Africa: a critique of regional agendas. *Asia Pacific Education Review*, *20*(2), 223-237. https://doi.org/10.1007/s12564-019-09600-5

Timm, J. M., & Barth, M. (2021). Making education for sustainable development happen in elementary schools: The role of teachers. *Environmental Education Research*, *27*(1), 50-66. https://doi.org/10.1080/13504622.2020.1813256

Tjora, A. (2018). *Qualitative research as stepwise-deductive induction*. London: Routledge.

Togo, M., & Lotz-Sisitka, H. (2013). Exploring a systems approach to mainstreaming sustainability in universities: a case study of Rhodes University in South Africa. *Environmental Education Research*, *19*(5), 673-693. https://doi.org/10.1080/13504622.2012.749974

Tolstikova, S., Osechkina, L., Tabolova, E., & Travinova, G. (2021). Development of teachers' professional skills in education for sustainable development. In *E3S Web of Conferences* (Vol. 250, p. 07007). EDP Sciences. https://www.e3s-conferences.org/articles/e3sconf/abs/2021/26/e3sconf_tresp2021_07007/e3sconf_tresp2021_07007.html

Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and learners' approaches to learning. *Higher education*, *37*(1), 57-70. https://doi.org/10.1023/A:1003548313194

Trischler, H. (2016). The Anthropocene: A challenge for the history of science, technology, and the environment. *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*, *24*(3), 309-335. https://doi.org/10.1007/s00048-016-0146-3

Tsayang, G. T, & Kabita, B. (2013). The status of education for sustainable development in the faculty of education, views from faculty members: University of Botswana. *Educational Research and Reviews, 8*(18), 1698–1708. http://hdl.handle.net/10311/1176

Tularam, G. A. & Machisella, P. (2018). Traditional vs non-traditional teaching and learning strategies—The case of e-learning. International Journal for Mathematics Teaching and Learning, 19(1). https://cimt.org.uk/ijmtl/index.php/IJMTL/issue/view/8

Tyagi, R., Vishwakarma, S., Rishi, M., & Rajiah, S. (2020). Reducing Inequalities Through Education and Skill Development Courses. *Reduced Inequalities*, 1-13. https://doi.org/10.1007/978-3-319-71060-0_102-1

UN. (2002). *Report of the World Summit on Sustainable Development*. Johannesburg. World Summit on Sustainable Development, Johannesburg 2002 | United Nations

UNCED. (1992). Agenda 21. *United Nations Conference on Environment & Development*, 03-14 June 1992. Rio de Janeiro, Brazil. United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, 3-14 June 1992 | United Nations

UNDP (2019). UNDP Mauritius Annual report 2019. Leaving no one behind. UNDP publication. UNDP-Mauritius-Annual-Report-2019.pdf

UNESCO. (2005). United Nations Decade of Education for sustainable Development (2005-2014): Draft: International Implementation Scheme; UNESCO: Paris, France. United Nations Decade of Education for Sustainable Development (2005-2014): international implementation scheme - UNESCO Digital Library

UNESCO. (2009). Bonn Declaration. In Proceedings of World Conference on Education for Sustainable Development (2005-2014). UNESCO World Conference on Education for Sustainable Development: 31 March-2 April 2009, Bonn, Germany: proceedings - UNESCO Digital Library

UNESCO. (2010). UNESCO *Strategy for the second half of the United Nations Decade of Education for Sustainable Development.* Paris, UNESCO. UNESCO strategy for the second half of the United Nations Decade of Education for Sustainable Development - UNESCO Digital Library

UNESCO. (2011). Education for sustainable development. An expert review of process and learning. Commissioned by UNESCO. Paris, France: Daniella Tilbury. Education for sustainable development: an expert review of processes and learning - UNESCO Digital Library

UNESCO. (2012a). Education for Sustainable Development Sourcebook. *Learning & Training Tools* No 4, 2012. Education for sustainable development: sourcebook; Education for sustainable development in action: learning & training tools; Vol.:4; 2013 (un.org)

UNESCO. (2012b). Shaping the education of tomorrow: 2012 report on the UN De Education for Sustainable Development. Shaping the education of tomorrow: 2012 report on the UN Decade of Education for Sustainable Development, abridged; 2012

UNESCO. (2015a). The 2030 Agenda for Sustainable Development. Population and the Sustainable Development Goals - Population Matters

UNESCO. (2015b). The Sustainable Development Goals Report 2015. Global Sustainable Development Report, 2015 edition | Latest Major Publications - United Nations Department of Economic and Social Affairs

UNESCO. (2017). Education for Sustainable Development Goals- Learning Objectives. Education for Sustainable Development Goals: learning objectives - UNESCO Digital Library

UNESCO. (2021). 2021 Global Education Meeting From recovery to accelerating SDG 4 progress. Paris, UNESCO. global-education-meeting-2021-final-report-en.pdf (unesco.org)

UNESCO-Regional office for Southern Africa-ROSA. (2018). *Sustainability starts with teachers- An ESD Action Learning Programme for Secondary Teacher Educators in Southern Africa*, Johannesburg, South Africa. SST_-_Final_Project_Report.pdf (ru.ac.za)

Valderrama-Hernandez, R., Rubio, L. A., Sanchez-Carracedo, F., Caballero, D., Serrate, S., GilDomenech, D., ... & Minano, R. (2020a). Does the Spanish university system form sustainability? Vision of the learners of four universities. *Education XX1*, *23*(1), 221-245.

Valderrama-Hernandez, R., Sanchez-Carracedo, F., Alcantara Rubio, L., Limon-Dominguez, D. (2020b). Methodology to analyze the effectiveness of ESD in a higher degree in education. A case study. *Sustainability*, 12, 222. https://doi.org/10.3390/su12010222

Van der Klis, M. H., & Tellings, J. L. (2020). Multidimensional scaling and linguistic theory. *arXiv. org*. https://dspace.library.uu.nl/bitstream/handle/1874/410879/2012.04946.pdf?sequence=1&isAllowed=y

Van Mierlo, B., Halbe, J., Beers, P., Scholz, G., & Vinke-de Kruijf, J. (2020). Learning about learning in sustainability transitions. *Environmental innovation and societal transitions*, 34, 251-254. https://doi.org/10.1016/j.eist.2019.11.001

Vannoni, M. (2014;2015). What are case studies good for? Nesting comparative case study research into the lakatosian research program. *Cross-Cultural Research*, 49(4), 331-357. https://doi.org/10.1177/1069397114555844

Vaughter, P., McKenzie, M., Lidstone, L., & Wright, T. (2016). Campus sustainability governance in Canada: A content analysis of post-secondary institutions' sustainability policies. *International Journal of Sustainability in Higher Education*, 17(1), 16-39. https://doi.org/10.1108/IJSHE-05-2014-0075

Vela, J. C., Fisk, J., & Ikonomopoulos, J. (2019). Exploring Latina clinical mental health counseling learners' perceptions of teaching practices. *Teaching and Supervision in Counseling*, *1*(1), 2. https://doi.org/10.7290/tsc010102

Verma, A. (2021). Using audio-diaries for research and education: AMEE Guide No. 144. *Medical Teacher*, *43*(12), 1346-1352. https://doi.org/10.1080/0142159X.2021.1972954

Vidyakala, K. (2020). A Study on Learning Styles among Computer Science Learners in Coimbatore. *International Journal of Research in Engineering, IT and Social Sciences*. https://ssrn.com/abstract=3616682

Villacanas de Castro, L. S., & Banegas, D. L. (2020). Philosophical tenets of action research in education. https://doi.org/10.1093/acrefore/9780190264093.013.1429

Vinke-de Kruijf, J., Pahl-Wostl, C., & Knieper, C. (2020). Wider learning outcomes of European climate change adaptation projects: A Qualitative Comparative Analysis. *Environmental innovation and societal transitions*, *34*, 270-297. https://doi.org/10.1016/j.eist.2018.09.004

Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods, and methodologies. *Journal of applied management accounting research*, *10*(1), 69-80. https://ssrn.com/abstract=2103082

Wallen, M., & Tormey, R. (2019). Developing teacher agency through dialogue. *Teaching and Teacher Education*, *82*, 129-139. https://doi.org/10.1016/j.tate.2019.03.014

Walliman, N. (2005). *Your research project: a step-by-step guide for the first-time researcher*. Sage, New York. Research Methods The Basics -Nicholas Walliman.pdf (vnbrims.org)

Wals, A. E., & Benavot, A. (2017). Can we meet the sustainability challenges? The role of education and lifelong learning. *European Journal of Education*, *52*(4), 404-413. https://doi.org/10.1111/ejed.12250

Wals, A., & Jickling, B. (2009). A framework for young people's participation in sustainability. *Young people, education, and sustainable development: Exploring principles, perspectives, and praxis*, 77-84. https://doi.org/10.3920/978-90-8686-691-5

Wals, A. E. (Ed.). (2007). *Social learning towards a sustainable world: Principles, perspectives, and praxis*. Wageningen Academic Publishers. Netherlands. https://doi.org/10.3920/978-90-8686-594-9

Walshe, N. (2017). An interdisciplinary approach to environmental and sustainability education: Developing geography learners' understandings of sustainable development using poetry. *Environmental Education Research*, *23*(8), 1130-1149. https://doi.org/10.1080/13504622.2016.1221887

Waltner, E. M., Scharenberg, K., Horsch, C., & Rieb, W. (2020). What teachers think and know about education for sustainable development and how they implement it in class. *Sustainability*, *12*(4), 1690. https://doi.org/10.3390/su12041690

Wang, C., Alvarez-Gaitan, J. P., Moore, S., & Stuetz, R. (2019). Social and institutional factors affecting sustainability innovation in universities: a computer re-use perspective. *Journal of cleaner production*, *223*, 176-188. https://doi.org/10.1016/j.jclepro.2019.03.093

Wang, X., & Cheng, Z. (2020). Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest*, *158*(1), 65-71. https://doi.org/10.1016/j.chest.2020.03.012

Watson, A. (2017). Sustainability education in primary and secondary schools: Great needs and possible solutions. University of Tennessee, Knoxvill. https://trace.tennessee.edu/utk_chanhonoproj/2026

Watson, E. (2017). Unexpected questions: Reflecting on the teacher's experience of responding in class. *High School Journal*, *101*(1), 49-61. https://www.jstor.org/stable/90024225

WCED, (1987) *Our common future*. Oxford University Press. https://doi.org/10.1080/07488008808408783

Webster-Deakin, T. (2020). Exploring the fluidity of relationships and methodology as an 'insider'action researcher. *Educational Action Research*, *29*(5), 722-737. https://doi.org/10.1080/09650792.2020.1748677

Weiss, M., Barth, M., & von Wehrden, H. (2021). The patterns of curriculum change processes that embed sustainability in higher education institutions. *Sustainability Science*, *16*(5), 1579-1593. https://doi.org/10.1007/s11625-021-00984-1

Welby-Solomon, V. (2015). *The continuous learning cycle. Investigating possibilities for experiential learning* (Doctoral dissertation, University of the Western Cape). http://hdl.handle.net/11394/5357

Westbrook, J. (2013). Pedagogy, curriculum, teaching practices and teacher education in developing countries. https://core.ac.uk/download/pdf/19765560.pdf

Whiteley, S. (2006). Memletics accelerated learning manual: discover the high-performance learning system that improves your memory and helps you learn faster. *Melbourne, Victoria, Australia: Advangy Publishing*.

Wilkinson, R. G. (2022). *Poverty and progress: an ecological model of economic development*. Taylor & Francis. https://doi.org/10.4324/9781003306351

Williams, M., & Moser, T. (2019). The art of coding and thematic exploration in qualitative research. *International Management Review*, *15*(1), 45-55. http://www.imrjournal.org/uploads/1/4/2/8/14286482/imr-v15n1art4.pdf

Williams, R. T. (2020). The paradigm wars: Is MMR really a solution? *American Journal of Trade and Policy*, *7*(3), 79-84. https://research.tees.ac.uk/en/publications/the-paradigm-wars-is-mmr-really-a-solution

Willis, J. W., Jost, M., & Nilakanta, R. (2007). *Foundations of qualitative research: Interpretive and critical approaches*. Sage, New York. https://doi.org/10.4135/9781452230108

Winkler, I., & Rybnikova, I. (2019). Student resistance in the classroom—Functional-instrumentalist, critical-emancipatory and critical-functional conceptualisations. *Higher Education Quarterly*, *73*(4), 521-538. https://doi.org/10.1111/hequ.12219

Woods, A., Cashin, A., & Horstmanshof, L. (2022). The social construction of nurse educator professional identities: Exploring the impact of a community of practice through participatory action research. *Journal of Advanced Nursing*. https://doi.org/10.1111/jan.15200

Woods-Jaeger, B., Briggs, E. C., Gaylord-Harden, N., Cho, B., & Lemon, E. (2021). Translating cultural assets research into action to mitigate adverse childhood experience–related health disparities among African American youth. *American Psychologist*, *76*(2), 326. https://psycnet.apa.org/doi/10.1037/amp0000779

World Bank Report. (2017). Republic of Mauritius. World Bank Document

World Risk Report. (2021). *Analysis and Prospects.* Republic of Mauritius. mauritius.docx (live.com)

WWF- UK. Government Information Services, Prime Minister's Office, (2017). Republic of Mauritius. Final Annual Report 2017-2018.pdf (govmu.org)

Wyness, L., & Dalton, F. (2018). The value of problem-based learning in learning for sustainability: Undergraduate accounting student perspectives. *Journal of Accounting Education*, *45*, 1-19. https://doi.org/10.1016/j.jaccedu.2018.09.001

Xu, W., & Zammit, K. (2020). Applying thematic analysis to education: A hybrid approach to interpreting data in practitioner research. *International Journal of Qualitative Methods*, *19*, New South Wales, Australia. https://doi.org/10.1177/1609406920918810

Yilmaz, K. (2013). Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European journal of education*, *48*(2), 311-325. https://doi.org/10.1111/ejed.12014

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed). Thousand Oaks, CA: Sage. Case study research and applications design and methods by Campbell, Donald Thomas Yin, Robert K. (z-lib.org) - JAHARUDDIN - Page 1 - 414 | Flip PDF Online | PubHTML5

Yli-Panula, E., Jeronen, E., & Lemmetty, P. (2019). Teaching and learning methods in geography promoting sustainability. *Education Sciences*, *10*(1), 5. https://doi.org/10.3390/educsci10010005

Young, J. C., Rose, D. C., Mumby, H. S., Benitez-Capistros, F., Derrick, C. J., Finch, T., ... & Mukherjee, N. (2018). A methodological guide to using and reporting on interviews in conservation science research. *Methods in Ecology and Evolution*, *9*(1), 10-19. https://doi.org/10.1111/2041-210X.12828

Yulianto, H. (2021). Philosophy of Management Science: Ontology, Epistemology, and Axiology Perspectives. *Cross-Border Journal of Business Management*, *1*(1), 152-162. http://journal.iaisambas.ac.id/index.php/cbjbm/article/view/655

Zamora-Polo, F., & Sanchez-Martin, J. (2019). Teaching for a better world. Sustainability and sustainable development goals in the construction of a change-maker university. *Sustainability*, *11*(15), 4224. https://doi.org/10.3390/su11154224

Zamora-Polo, F., Corrales-Serrano, M., Sanchez-Martin, J., & Espejo-Antunez, L. (2019). Nonscientific university learners training in general science using an active learning merged pedagogy: Gamification in a flipped classroom. *Education Sciences*, *9*(4), 297. https://doi.org/10.3390/educsci9040297

Zhiri, Y. (2019). Towards Metacognition, Autonomy, and Learners' Knowledge/Meaning Construction in EFL Context. *International Journal of English Literature and Social Sciences (IJELS)*, *4*(3), 568-572. https://journal-repository.theshillonga.com/index.php/ijels/article/view/655

Zibell, L. (2013). Ten ways to introduce sustainability into your classroom. (besides building a vegetable garden). *Practically Primary*, *18*(1), 36-37. https://go.gale.com/ps/i.do?id=GALE%7CA318107216&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=13245961&p=AONE&sw=w

Zohrabi, M., Torabi, M. A., & Baybourdiani, P. (2012). Teacher-centered and/or student-centered learning: English language in Iran. *English language and literature studies*, *2*(3), 18. http://dx.doi.org/10.5539/ells.v2n3p18

Zuber-Skerritt, O. (2015). Participatory action learning and action research (PALAR) for community engagement: A theoretical framework. *Educational research for social change*, *4*(1), 5-25. https://core.ac.uk/download/pdf/143898604.pdf

Zukauskas, P., Vveinhardt, J., & Andriukaitiene, R. (2018). Philosophy and paradigm of scientific research. *Management culture and corporate social responsibility*, *121*. http://dx.doi.org/10.5772/intechopen.70628

APPENDICES

APPENDIX A: Gatekeeper's Permission

Date: 11 July 2018

To:

The Senior Chief Executive

Ministry of Education and Human Resources, Tertiary Education and Scientific Research.

MITD House, Phoenix.

From:

Mr Hinchoo Threelocknath Sing. (Educator).

[redacted].

Dear Sir/Madam,

Subject: Authorisation to conduct PhD Research at [redacted].

I am Mr Hinchoo Threelocknath Sing, Educator at [redacted]. I am currently enrolled on PhD in Education at the University of Kwazulu-Natal in Durban, South Africa. My supervisors are Professor Dipane Hlalele from the School of Education at the University of Kwazulu-Natal and Dr Ravhee Bholah, Associate Professor from the School of Science and Mathematics, Mauritius Institute of Education (MIE), Reduit.

My research project is entitled: Teachers' understanding and enhancement of learning for sustainability in Mauritian primary schools. The aim of my study is to explore understanding and enhancement of learning for sustainability in primary schools and to investigate how teachers' understanding is enhancement. The outcome of my study will develop and empower appropriate behavioral changes and acquire competencies that will enable to cater for sustainability challenges that current society is facing.

As part of the requirements of my doctoral studies, I will be starting data collection as from August 2019. This phase should last about one month. It will involve interviewing participants (i.e. teachers) and observing teachers in their classes for data collection. The interviews will take place after school hours while observation sessions will be conducted preferably when I will be having my free periods (Asian languages, ICT and Hollistic classes). I wish to assure you that needful will be done so that it does not hamper my duties and that of the educators at the school. Arrangements will be made to reschedule interviews or observation sessions as and when required.

It would therefore be appreciated if permission for same could be granted to carry out the research at [redacted]. I wish to assure you that I will be present merely as an observer and will not intrude in the running of the classes in any way. Should my presence have adverse effects on the classes, I will leave the classes immediately.

If you wish to have any further information about any aspect of the study, feel free to contact me on [redacted] or at school on [redacted]. You may also contact my UKZN supervisor, Prof Hlalele at +2731 2603858 or by email hlaleled@ukzn.ac.za and my local supervisor Dr Bholah at the MIE on 4016555 or by email r.bholah@mie.ac.mu.

Thanking you in anticipation.

Yours faithfully

Hinchoo Threelocknath Sing

MINISTRY OF EDUCATION AND HUMAN RESOURCES, TERTIARY EDUCATION AND SCIENTIFIC RESEARCH

Pre-Primary, Primary & Curriculum Development and Evaluation
MITD House, Phoenix - MAURITIUS
Tel: 601 5218 Fax : (230) 697 9699
e-mail: moe-smd@govmu.org

Ref: ME/305/3/V5

23 October 2018

Mr Threelocknath Sing Hinchoo
[redacted]

Dear Sir

Please refer to your letter dated 11 July 2018.

This is to inform you that approval is being comveyed for you to carry out your research in connection with your PHD at [redacted]

By copy of this letter, the Headmaster of [redacted] is kindly requested to give access to Mr T.S. Hinchoo to conduct his research.

You are kindly requested to submit a copy of your findings of your research to the Ministry upon completion of your studies.

Yours faithfully,

[redacted]

A. Ghoorah (Mrs)
for Senior Chief Executive

Copy : Headmaster [redacted]

Pre-Primary, Primary & Curriculum Development and Evaluation
MITD House, Phoenix - MAURITIUS
Tel: 601 5218 Fax : (230) 697 9699

APPENDIX B: Ethical Clearance Letter

07 November 2019

Mr Threelouknath Sing Hinchoo (218045038)
School Of Education
Pietermaritzburg Campus

Dear Mr Hinchoo,

Protocol reference number: HSSREC/00000240/2019
Project title: Teachers understanding and enhancement of learning for sustainability in Mauritian primary schools.

Full Approval — Expedited Application

This letter serves to notify you that your application received on 21 August 2019 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted FULL APPROVAL

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid for one year from 07 November 2019.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

Yours sincerely,

[redacted]

Professor Urmilla Bob
University Dean of Research

Humanities & Social Sciences Research Ethics Committee Dr
Rosemary Sibanda (Chair)
UKZN Research Ethics Office Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001 , Durban 4000
Website: http://research.ukzn.ac.za/Research-Ethicsl

APPENDIX C: Permission to Carry out Research During Office Hours

Letter to Head Master, [redacted]

To: The HM

[redacted]

Date: 31 July 2018

Dear Madam,

Subject: Permission to carry out field work during working hours

As part of the requirements of my doctoral studies, I am about to start data collection. This phase should last about one month. It will involve interviewing participants (i.e. teachers) and observing them teaching for data collection. The interviews will take place after school hours while observation sessions will be conducted in the morning preferably when I will be having my free periods (Asian languages, ICT and Holistic classes).

I would be grateful if you could allow me to carry out the field work during working hours. I wish to assure you that the needful will be done so that it does not hamper my duties as educator at the school. Arrangements will be made to reschedule interviews or observation sessions as and when required.

I thank you for your understanding and hope to receive a positive reply.

Yours faithfully

Hinchoo Threelocknath Sing

Date: 23rd August 2018.

From: [redacted] (HM)

[redacted]

Through: The Director.

Ministry of Education and Human Resources. (Zone 2)

To: The Human Resource Manager.

Ministry of Education and Human Resources. (Zone 2)

Attention: Mrs Boyroo.

Dear Sir/ Madam,

With reference to letter dated 31st July 2018 from Mr Hinchoo Threelocknath Sing, educator at [redacted] School, for permission to carry field work during office hours in the context of his doctoral research, I have no objection that he conducts the said research under the same conditions as mentioned in his letter for request.

Yours faithfully

[redacted]

[redacted] (HM)

[redacted]

MINISTRY OF EDUCATION & H.R., T.E. & S.R. * ZONE 2 *

APPENDIX D: Informed Consent Document for Participants (Teachers)

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL

For research with human participants

INFORMED CONSENT RESOURCE TEMPLATE

Note to researchers: Notwithstanding the need for scientific and legal accuracy, every effort should be made to produce a consent document that is as linguistically clear and simple as possible, without omitting important details as outlined below. Certified translated versions will be required once the original version is approved.

There are specific circumstances where witnessed verbal consent might be acceptable, and circumstances where individual informed consent may be waived by HSSREC.

Information Sheet and Consent to Participate in Research

Date: _____

Dear Educator

I am Mr Hinchoo Threelocknath Sing, Educator at [redacted]. [Mobile: [redacted]; email: ka_ash@live.com]. I am currently enrolled on PhD in Education at the University of Kwazulu Natal in Durban, South Africa. My supervisor is Professor Dipane Hlalele from the School of Education at the University of Kwazulu Natal and Dr Ravhee Bholah, Associate Professor from the School of Science and Mathematics, Mauritius Institute of Education, Reduit.

My research project is entitled: Teachers' understanding and enhancement of learning for sustainability in Mauritian primary schools. The aim of my action research study is to explore teachers' understanding of learning for sustainability in the primary schools and to investigate how their understanding is enhanced. My interest in the topic is due to my position as an educator. It stems from my observations of teaching to young learners and classroom practices

that individual teachers have their own sets of beliefs with regard to their subject, their learners and learning processes. I therefore wish to probe more deeply into the issue. The outcome of my study will develop and empower appropriate behavioural changes and acquire sustainability competencies that will enable to cater for sustainability challenges that current society is facing.

You are being invited to consider participating in the study that involves action research. The study is expected to enroll 6 participants from your school. It will involve semi-structured interviews and classroom observations. You will be required to design a lesson plan in a subject dealing with learning for sustainability that you will then implement it in your classroom (duration less than 60 minutes). Following the lesson implementation, you will be required to reflect about how you have enhanced learning for sustainability in your teachings. The interviews and classroom observations will be recorded with your permission.

It is understood that your participation in the study is voluntary and that you may refrain from answering questions you are not comfortable with or revealing information considered personal or confidential. You may also withdraw from the study at any point without any prejudice to you. Please note that there are no financial or other benefits for participating in this study.

Your contribution will however be considered invaluable in investigating an area which has undergone little scrutiny so far. You are assured that your input will be treated confidentially. Your anonymity is also guaranteed.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number_____).

In the event of any problems or concerns/questions you may contact me on [redacted], or my UKZN supervisor, Prof Hlalele at +2731 2603858 or by email hlaleled@ukzn.ac.za and my local supervisor Dr Bholah at the MIE on 4016555 or by email r.bholah@mie.ac.mu. You may also contact the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Should you be agreeable to participating in the study, you are requested to sign the declaration of intent below.

DECLARATION (CONSENT)

I, _____ have been informed about the study entitled: Teachers' understanding and enhancement of learning for sustainability in Mauritian primary schools by Hinchoo Threelocknath Sing, the researcher. I understand the purpose and procedures of the study.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

If I have any further questions/concerns or queries about my rights as a study participants related to the study I understand that I may contact the researcher or I may also contact the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

.

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557 - Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Additional consent, where applicable

I hereby provide consent to:

Audio-record my interview / focus group discussion YES / NO

Video-record my interview / focus group discussion YES / NO

Use of my photographs for research purposes YES / NO

_____ _____

Signature of Participant Date

_____ _____

Signature of Witness Date

(Where applicable)

_____ _____

Signature of Translator Date

(Where applicable)

APPENDIX E: Declaration for Participants to participate in the study

Declaration

I _____ agree/disagree to participate in Mr Threelocknath Sing Hinchoo's study. The purpose, terms and conditions of the research have been explained to me. I understand that I may withdraw from the project at any time. I hereby:

(please tick in the appropriate box in table below)

Agree to audio-recording	
Do not agree to audio-recording	

Signature_____ Date: _____

APPENDIX F: Classroom Observation Schedule

Date: ----------

School: ----------

Class Grade: ----------

Teacher's name: ----------

Subject: ---------- Title/

Topic: ----------

Observation stating time: ---------- End time: ----------

1. **Physical setting and Organisational Frames**

Table 1: The following particular classroom activities are the focal point of the observations.

	Physical setting and Organisational Frames	**Descriptions**
1	Arrangement of furniture	
2	Materials (posters and images on walls)	
3	What are the posters and images about?	
4	What messages do they convey?	
5	Are there any of them made by learners?	
6	How well is the classroom resourced in the subject matter?	
7	Short notes on the resources used by the teachers and the state of the classroom.	

2. Setting the scene

Table 2: Introduction of lesson focusing on objectives.

1	Greeting by the teacher	
2	Does the teacher communicate the objectives framed for the lesson (do they have all the requirements)	
3	Does the teacher tell the learners how the lesson will be conducted?	
4	How well are the objectives explained to learners?	

3. Interaction in the classroom: defined in terms of the role played by both teacher and learners in the lesson.

a) How is participation distributed among the classroom members in respect to teacher's understanding of learning for sustainability?

- Patterns of unequal participation may follow lines of teacher domination.

_____

- Teacher and learners' roles in the lesson (i.e does teacher demonstrate /teach, explains and ask questions on leaning for sustainability issues correctly?

_____

- Learners talk—in response to teacher's question or they can initiate it

_____

- Learners communicate with each other

_____

- Learners are given opportunity to work by themselves

_____

b) How is knowledge constructed, understood and shared in the classroom?

_____

c) What kind of speech acts do learners perform do they assert, challenge, explain or respond to teacher's question in respect to teacher's understanding of sustainability issues? _____

_____

4. Assessment strategies

a) What is the purpose for assessing understanding of learning for sustainability issues and their enhancement in the lesson?

_____

b) Does the teacher clarify the nature of assessment for learning for sustainability criteria to learners?

_____

c) What is the nature of assessment for learning for sustainability tasks used by teachers?

_____

d) Does the activities selected link the concepts with other subjects regarding learning for sustainability?

_____

e) What forms of assessment strategies do the teacher engage with and how are they understood and used?

_____

5. Feedback

- Does the teacher praise or encourages learners? _____
- How is feedback communicated to learners? _____
- Does the teacher's understanding of learning for sustainability provide the learners a realistic picture of their progress? _____
- Does the teacher's understanding of the subject on learning for sustainabilty provide learners a sense of how to improve? _____

_____

6. Remedial activities

• How is remediation planned and conducted as regards to teacher's understanding of learning for sustainability? _____

_____

7. Enhancement of learning for sustainability activities

• How is enhancement of learning for sustainability planned and conducted by the teacher?

_____

APPENDIX G: Interview Questions for Participants

1. Have you heard about “Learning for Sustainability”? Where have you heard about it from? (At school, workshop, universities, media…)
2. Do you think you are addressing learning for sustainability in your school curriculum and during your classes?
3. To what extent are you addressing learning for sustainability in your daily work at school?
4. How do you play a part in learning for sustainability at school and most importantly in your daily classes?
5. How do you enhance your understanding of LFS in your daily lesson.
6. Is there anything more you are doing at your class level or school level in the context of learning for sustainability?

APPENDIX H: Language Editing Certificate

590 Miami Road
Hibberdene
KZN
4220
Cell: 0842648401
brian.naidoo25@gmail

PROFESSIONAL LANGUAGE EDITING SERVICES

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TEACHERS' UNDERSTANDING AND ENHANCEMENT OF LEARNING FOR SUSTAINABILITY IN MAURITIAN PRIMARY SCHOOLS

Threelocknath Sing Hinchoo

Student Number: 218045038,

UNIVERSITY OF KWAZULU-NATAL

TO WHOM IT MAY CONCERN

This certificate confirms that the student submitted her draft doctoral thesis to me for language-editing, which included the correcting of in-text citations and the misrakes in the list of references. This was duly edited by me and sent back to the student for revisions as per suggestions from me. I make no claim as to the accuracy of the research content. The text, as edited by me, is grammatically correct. After completion of my language editing, the student has the option to accept or reject suggestions/changes prior to submission to the supervisor who will recheck the content and administer the turnitin process.

[redacted]

DATE: 30/08/2023

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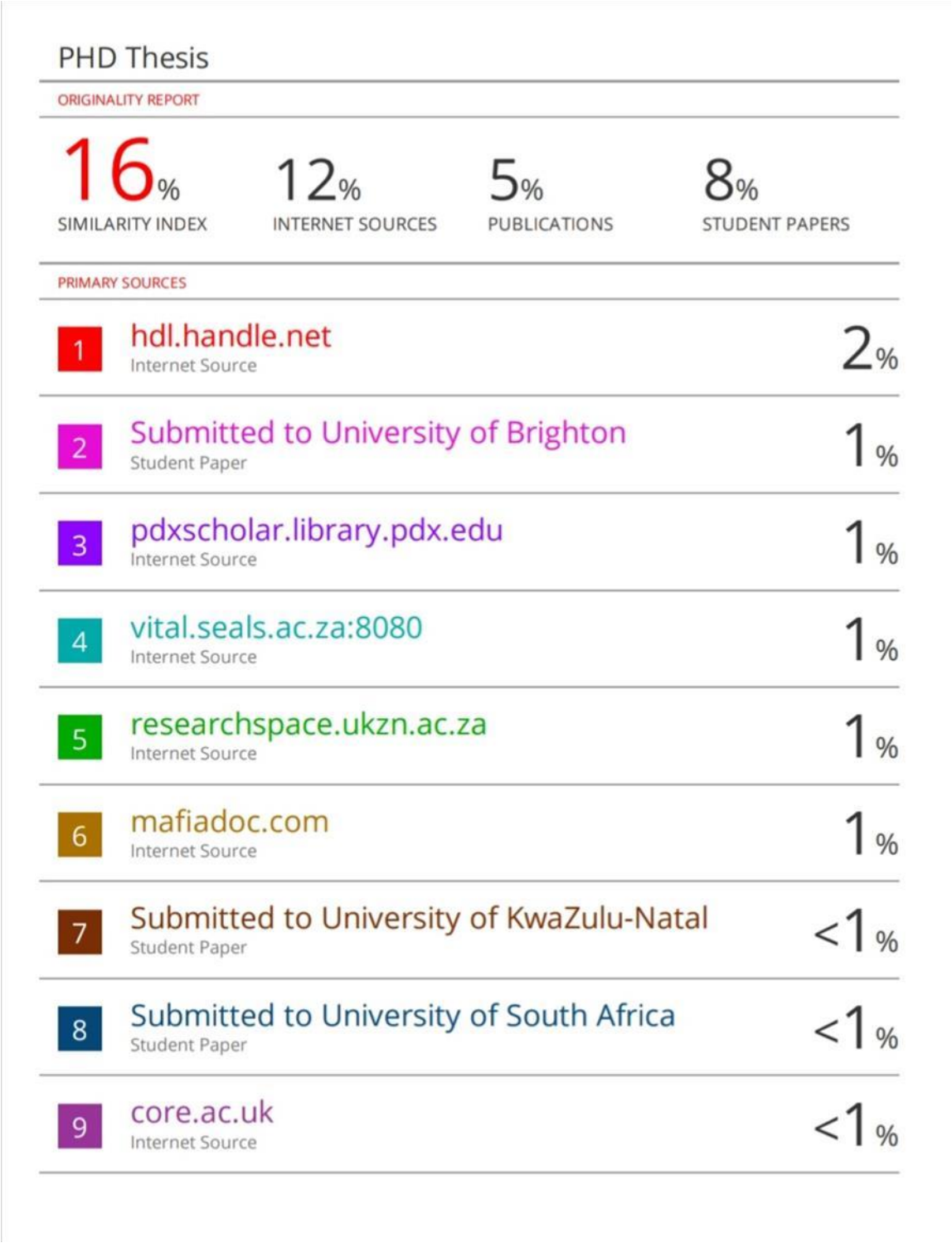
APPENDIX I: Turnitin Report



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