UNDERSTANDING THE IMPLEMENTATION OF SUSTAINABLE AND UNSUSTAINABLE PRACTICES WITHIN LGCSE AGRICULTURE CURICCULUM

BY

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Declaration

I hereby declare that this dissertation entitled "understanding the implementation of sustainable and unsustainable practices within LGCSE agriculture curriculum" is my own work. The sources used in this study are acknowledged in the reference section. I have not submitted the study to any university.

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Signature……

Supervisor Prof. Makomosela Qhobela Date……..

Signature…….

Dedication

This work is dedicated to my family that was always by my side when in despair, my beloved husband Mr. Johannes Seliane and my two daughters ‘Mary and Hloni Seliane.

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I would like to thank God for giving me the most wonderful, caring and understanding family and colleagues throughout this research journey. Specifically, I would like my special thanks to go to my research supervisor Prof. Qhobela for his incisive reviews and many months of congenial help. All I can say to him is that his effort is commendable because without him I would not have finished this study. I would also like to pay tribute to the Department of Science Education for their unwavering support and constructive comments during the presentations of this study. My appreciation will also point to the teachers who participated in the study because without them the study would not been successful. I am also indebted to my friends who were always supporting me emotionally and spiritually throughout the study.

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List of abbreviations

AfDB	African Development Bank
COSC	Cambridge Overseas School Certificate
CK	Content knowledge
ECOL	Examination Council of Lesotho
FAO	Food Agricultural Organization
IPM	Integrated Pest Management
LGCSE	Lesotho General Certificate for Secondary Education
MoET	Ministry of Education and Training
NRC	National Research Council
PCK	Pedagogical content knowledge
SA	Sustainable Agriculture
SMK	Subject matter knowledge
PGDE	Post Graduate Diploma in Education
UNESCO	United Nations Educational, Scientific and Cultural Organization

Abstract

The demand for sustainable agriculture has increased and schools are expected to adopt it to meet the rising demand for agricultural output while maintaining agro-ecological systems. Despite this importance, LGCSE agriculture curriculum consists of unsustainable agricultural practices. The purpose of the current study was to explore how LGCSE agriculture teachers implement the contradicting agriculture curriculum on sustainable and unsustainable agricultural practices. The research also aimed to establish if the participating teachers are aware of the contradictions in LGCSE agriculture curriculum. The study is informed by the theory of curriculum implementation developed by Rogan and Grayson's (2003) who argue that the implementation of the curriculum is not the same in schools and can be affected by various factors like teachers subject matter knowledge and pedagogical content knowledge.

Open-ended questionnaire and follow-up interviews were employed in this study as data collection methods using the qualitative method. Twenty teachers from Maseru district who participated in the study were selected using purposive sampling. They were selected based on the knowledge they have on teaching LGCSE agriculture. The pilot study was conducted with five teachers from Mafeteng district. The pilot study was done to assess the reliability and validity of the questionnaire before final data collection to check the suitability of the instrument.

The results reveal that most teachers understand the sustainable and unsustainable practices with different meanings like sustained food production, continued supply of food and the practices that meet the present and future needs. The teachers indicated that they are not aware of the contradictions about sustainable and unsustainable agricultural practices. They showed that the practices are independent and each deals with the different idea. The findings also indicate that during teaching of the practices, teachers employ different strategies such as classroom discussions, demonstrations and field trips. The results demonstrated that most teachers prefer to use classroom discussions to other techniques.

The study recommends that teachers be trained about sustainable agriculture before they can teach it in their classrooms. It also suggested that the same study be conducted in more than one district.

Key words: Curriculum implementation, LGCSE curriculum, Sustainable and unsustainable practice

CHAPTER ONE
INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 Introduction

This chapter provides the background to the study, statement of the problem, study purpose, research questions, rationale and chapter outline.

1.1 Background

Agricultural sector in Lesotho is challenged by severe land degradation, use of traditional agronomic practices, overgrazing and high climate variability (Government of Lesotho, 2015) Sustainable agriculture can provide solutions to the environmental problems. According to FAO (2009), the focus on improvement of agricultural sustainability should be one of the most important goals for the future generation. Prevailing agricultural practices are the key to food security, and some are considered unsustainable. The unsustainable practices degrade soil quality and the Lesotho's agricultural sector become affected by poor production (FAO, 2015).

In 2013, Lesotho gradually started phasing out Cambridge Overseas School Certificate (COSC) and introduced LGCSE Curriculum that was more relevant to the national development in Lesotho (Raselimo and Mahao, 2013). Lesotho General Certificate for Secondary Education (LGCSE) agriculture curriculum should be in the position to develop skills among secondary school learners that maintain the integrity of the environment. The current study investigates the implementation of sustainable and unsustainable agricultural practices that exist in LGCSE agriculture curriculum.

Agriculture is the science of working the soil to harvest crops and rear livestock for commercial gains (Larson et al., 2014). Agriculture affects the national economy, the environment as well as contributing to climate change that often results in delayed planting and reduced seed planting. Agriculture in Lesotho remains the dominant sector for increasing employment and rural incomes (African Development Bank (AfDB), 2013). According to World Bank (2011), agriculture production systems are expected to produce food for the global population that is expected to reach 9.1 billion people in 2050 and over 10 billion by end of the century. However, rapid growth in agricultural production led to exhaustion of the thin fertile soil layer, leading to a decline in agricultural yields (Lewis et al. 2011). To maintain productivity, the natural resources like land should remain non-declining to meet the basis of sustainability (FAO, 2009).

According to FAO (2010), the land use practices adopted in Lesotho include the extensive extractive cultivation system that leads to over-exploitation of soil with serious land depletion and soil erosion problem that hamper agricultural production. To address this problem, sustainable agriculture should be opted as it maintains a balance that is favorable to the environment (Berke & Conroy, 2007). Teaching learners the practices that do not degrade the land, bring about optimal utilization of the environment and high yields to meet the needs of the people indefinitely (FAO, 2012). This can address the problem faced by Lesotho as shown by World Bank (2018), that agriculture is challenged by relatively low adoption of modern agriculture practices by farmers. These challenges require urgent attention of knowledge on agricultural sustainability that can be disseminated to societies by learners through teachers.

Agriculture is one of the subjects done in schools so that it can be able to develop skills that bring learning to life. Sitinci and Morish (2011) added that lessons should include hands-on-activities for easy retention of the concepts. LGCSE syllabus focus mainly on promoting agriculture as an applied science and vocational programme that will allow learners to explore existing agricultural/ scientific knowledge, skills and attitudes acquired from the study of science and other subjects to address environmental and social economic issues in their day - to - day lives. Linking the real life with the classroom is the concern for any curriculum developer as it addresses the societal needs. LGCSE agriculture curriculum can therefore provide solutions to the environmental problems associated with production.

Agriculture education in Lesotho is available to students in primary (6 -12 years old), secondary school (13 -17 years old) and senior secondary (high school) known as LGCSE currently lasting for two years (ages 16 -18). Primary education is made free to every student in the country (Ministry of Education and Training (MoET, 2000). The aim was to ensure that every child in the country completes the primary cycle of education and ensure that education is affordable to the majority of Basotho. Agriculture is the compulsory subject at primary level and not at secondary level. This is experienced mostly in government schools and where is done; it is taken as an optional subject. Currently in secondary school curriculum, in grade 8 agriculture is integrated into the science curriculum and from grade 9 to 11 is taken as the separate subject.

Government of Lesotho in 2013 decided to localize COSC curriculum with a locally designed syllabus that will suit local needs. COSC (5090) agriculture syllabus was changed to LGCSE (0179) agriculture (ECOL, 2013). ECOL further indicated that the LGCSE was introduced

considering the existing and anticipated changes in the assessment of education in Lesotho that revealed that LGCSE was more relevant than COSC.

Educational objectives of teaching agriculture as a subject in LGCSE are pointed in the syllabus as follows.

- promote an appreciation of agriculture as an applied science
- stimulate an interest and create awareness of the existing problems and opportunities in agriculture
- stimulate the value of agriculture to the family and community
- encourage teaching in the practical manner
- Ensure that schools take active part in rural development by integration of agricultural activities into the school curriculum.
- encourage the development of practical areas
- harness conserve essential agricultural indigenous knowledge and experiences to promote biodiversity
- provide a basis, together with the basic science and mathematics, for more advanced studies in agriculture (MoET, 2018)

For better teaching of agriculture, teachers need to be supported so that their teaching takes place in an environment suitable for teaching the subject (Thobega et al., 2011). Harper (2004) assert that agriculture teaching generally takes place not only in a classroom and laboratories but also in the school farm. The teacher must master subject matter to be taught for better teaching of the subject. The teacher's skills and strategies are important in educative teaching. Good choice of the teaching method makes it easy for the learners to acquire necessary knowledge and master the subject; in the process, the lesson objectives are achieved. Sameipour (2017) supports this in his study that selection of teaching methods depends on the context of the topic. Secondary school teachers, therefore, have important role in the transfer of agricultural knowledge.

Teaching about sustainability in agriculture is of importance in the current study as learners can be taught about solutions to the issues of environment such as environmental pollution. According to Waithera (2013), teachers need to help learners realize the significance of caring for the environment. She points that education needs to find better ways of responding to challenges faced by environment. Sustainable agriculture can contribute as being part of the solution to mitigate the adverse effects on the environment and climate change through

agricultural practices that build soil fertility, promote wise use of crop and livestock chemicals (Berke & Conroy, 2007).

Studies suggest that the future of agriculture globally will be sustainable agriculture (FAO, 2018; Hanson, Hendrickson & Archer, 2008; Zhenmiam, Bixia, & Nagata, 2013). Sustainable agriculture is an agricultural system combining sustainable agricultural practices while simultaneously discontinuing the use of agricultural practices harmful to the environment (Amekawa, 2010). On the other hand, FAO (2012) describe sustainability in agriculture as the successful management of resources to satisfy changing human needs while maintaining the quality of the environment and conserving the natural resources so that future generation can have a fair share. Sustainable agriculture includes conservation of water, rotational grazing system in farming, crop rotation, less use of inorganic fertilizers, pesticides and herbicides, so that, over a period, food is produced on the land that do not damage the environment to sustain the economy of a nation (Altieri, 2018).

Sustainable agriculture includes many practices that strive to build and maintain healthy soil, help manage water wisely, minimize air and climate pollution and promote biodiversity. In Africa, rural people often meet their basic needs from the surrounding land, water, and forests and hence the current environment must be maintained by instilling sustainable agriculture practices to learners through agriculture education. Improving agricultural sustainability is one of the most important goals for the near future as unsustainable practices may be productive in the short term (FAO, 2009).

Table 1 shows the ideal case of sustainable agriculture, sustainable agriculture aspects in LGCSE agriculture syllabus and the missing aspects in LGCSE syllabus.

Table 1*:* The analysis of LGCSE agriculture syllabus considering aspects of SA, the ideal case of SA syllabus and the missing aspects of SA in LGCSE agriculture syllabus

Ideal case of SA syllabus	LGCSE syllabus (SA aspects)	Missing aspects of SA in LGCSE syllabus
1. Organic farming 2. Forestry and agroforestry 3. Soil conservation 4. Range management 5. Water quality/ wetlands 6. Climate change adaptive farming practices 7. Integrated Pest Management (IPM) 8. Wildlife conservation 9. Crop diversity 10. Soil nutrient management practices	1. Organic production 2. Land use (forestry, agroforestry, aquaculture, wildlife, range lands, recreational purposes, crop production) 3. Soil conservation practices 4. Management of surface and underground water 5. IPM 6. Climate change adaptive farming practices	1. Farming practices or technologies not adequately addressing sustainable agriculture.

The information in the table above indicates that there are missing aspects of sustainable agriculture in LGCSE syllabus. The learners are not taught some of the important concepts of sustainable agriculture. The knowledge gap in sustainable agriculture hinder effective teaching, as teachers will not have all the required skills to implement the concept. Through the required, pedagogical skills in agriculture education, the practice of sustainable agriculture, and a society's future can be sustained economically (Velten, Leventon, Jager, & Newig, 2015). Studies have been conducted on whether high school teachers teach sustainable agriculture and the level of importance the teachers put on the subject, teachers indicated that sustainable agriculture is vital part of the curriculum but do not have

enough knowledge on the concept to teach their students (Okeafor, 2002). It is important for high school teachers to have the knowledge to teach learners the required concept.

Ensuring sustainability in agriculture requires the integration of sustainable practices. Sustainable agriculture practices are environmentally non-degrading, resource conserving, socially acceptable, technically appropriate and economically viable whereas unsustainable agriculture practices are the practices that cause land resources to degrade – threatening future food security as well as livelihoods of poor rural people (FAO, 2011). The LGCSE agriculture curriculum consists of both practices. When teachers implement these contradicting practices in a single curriculum might be encountering some problems yet teachers must be effective and current in the subject matter and its pedagogy (Egbulu, 2004).

Implementation by teachers of LGCSE agriculture curriculum is of importance in this study, as learners' performance from 2015 to 2019 remained low. In Lesotho, the general performance of learners in LGCSE Agriculture was recorded as being poor from 2015 to 2019 (Report on Examinations Council of Lesotho). The table 2 below summarizes learners' percentage pass rate in these years.

Table 2: Analysis of LGCSE learners' percentage pass rate from 2015 to 2019

	YEARS (% pass)				
GRADES	2015	2016	2017	2018	2019
A*	0.22	0.21	0.12	0.08	0.19
A	0.84	0.76	0.66	0.04	0.95
B	10.6	8.56	7.93	5.43	9.28
C	30.5	31.3	32.2	27.9	32.5
D	24.2	24.3	21.1	27.3	21.9
E	16.3	17.8	18.5	16.6	13.9
F	10.9	11.5	13.8	14.1	14.4
G	4.03	4.01	4.24	5.58	4.55
U	2.05	1.34	1.23	2.35	2.15

The table above indicates the grades learners got for five years in LGCSE Agriculture Examinations. The report shows that All LGCSE learners in Lesotho who set for agriculture examination did not perform well. The performance is shown in percentages each year. The assessment of the questions on examination papers highlighted that there was approximately 30% of questions that were based on sustainable agriculture. The bad performance might be linked to sustainable and unsustainable practices in the curriculum. Learners got very poor percentages for better grades such as, A*, A and B that are required for entrance in higher institutions.

1.2 Statement of the problem

The demand for sustainable agriculture has increased and schools are expected to adopt it to meet the rising demand for agricultural output while maintaining agro-ecological systems. Despite this importance, LGCSE agriculture curriculum consists of unsustainable agricultural practices such as conventional tillage, chemical fertilizer application and monoculture. It is not clear how teachers handle this obvious contradiction.

1.3 Purpose of the study

The purpose of the study is to investigate how LGCSE agriculture teachers implement the contradicting agriculture curriculum on sustainable and unsustainable agricultural practices. It

will also establish if the participating teachers are aware of these contradictions in LGCSE agriculture curriculum.

1.4 Research questions

This study will respond to the following research questions:

1.4.1 Main question

How do LGCSE agriculture teachers teach sustainable and unsustainable agricultural practices in the curriculum?

This research question was broken down to the following sub-questions

1.To what extent are teachers aware of the contradictions in the curriculum?

2. How do they teach the contradicting topics in the curriculum?

1.5 Rationale

The study was necessitated by existence of the unsustainable agriculture practices in the curriculum that do not support the goals of sustainable agriculture. The performance of LGCSE learners is poor as shown in table 2 above. This poor performance might be the result of the way sustainable and unsustainable practices are implemented in the curriculum. Proper teaching of stainable and unsustainable practices can enhance learners understanding about sustainable agriculture is mostly likely to improve. The environment will be maintained as sustainable agriculture promises effective solutions to establish and strengthen a secure agriculture system for healthy sustainable future.

By informing students about the contradicting practices can help to reduce the problem of land degradation in Lesotho that seems to be high. The students will inform the societies about the impact of the practices on the environment. Sustainable agriculture is an interdisciplinary approach in nature that offers solutions to complex societal and environmental problems in the agri-food system, all of which have been unapproachable by single discipline in agriculture (Francis, 2008). Williams (2000) stresses that sustainable agriculture practices in the curriculum could indeed enhance a lasting rural economic development by improving the scientific teaching of agriculture in schools. The findings of the study will help teachers to be aware of better ways of teaching sustainable and unsustainable agriculture content in the curriculum. This is because for agriculture to be sustainable there must be agricultural practices that do not degrade the land,

optimal utilization of the environment and high yields to meet the needs of the people indefinitely.

1.6 Chapter Outline

This dissertation consists of six chapters as follows:

Chapter One

This chapter presents the background and motivation of the study. It gives the outline of the research problem associated with unsustainable practices in the curriculum, research questions and rationale of the study.

Chapter Two

Chapter two deals with literature related to curriculum implementation. The chapter also discusses the theoretical framework guiding the study.

Chapter Three

This chapter describes the methodology adopted in the study. It explains the research design, population, sampling procedure, data collection instruments and information about the pilot study and validity of the instruments and ethical consideration.

Chapter Four

Chapter four presents findings on teachers' conceptualization of sustainable and unsustainable agricultural practices

Chapter Five

Chapter five discusses the findings related to teachers' knowledge of subject matter.

Chapter six

This chapter presents the discussion and conclusions of the study. It also represents recommendations that may inform further research

1.7 Conclusion

This chapter provided a justification for the need of the study and its purpose. Agricultural sustainability is considered an important concept that enhances the environmental quality and the resource base on which agriculture depends. The significance of the study is based on the

teaching of sustainable and unsustainable agricultural practices in LGCSE curriculum. The next chapter will focus on the literature review.

CHAPTER TWO

Literature Review

2.1 Introduction

Chapter 1 examined the background of the study. The chapter provided the justification of why the study was conducted and its purpose. This chapter presents literature on curriculum implementation with particular emphasis on sustainable agriculture curriculum. The chapter is organized into sustainable agriculture, effective teaching of agriculture, and its teaching, learning theories in agriculture, curriculum implementation, and role of teachers in curriculum implementation, professional development, theoretical framework adopted and finally chapter summary.

2.2 Sustainable agriculture

Defining sustainable agriculture has been difficult task for farmer and agricultural professionals alike. The concept of sustainable agriculture became popular in 1980s. Before then, it was understood to be synonymous with terms such as organic, natural, ecological, and low input agriculture (Parr, 2010). The idea of sustainable agriculture is in line with the overarching concept of "sustainable development" (Velten, 2015).

According to Brennan and Withgott (2005), the purpose of sustainable agriculture is to ensure healthy and sufficient supply of food for the current generations by optimum use of the available natural resources. NRC (2010) argues that in order to meet global food demand all agriculture systems should become sustainable. According to Jacobsen (2012), sustainable agriculture is an integrated system of plant and animal production practices having a site-specific application that will over the long-term satisfy human food and fiber needs. Earles (2005) argue that sustainable agriculture is a type of agriculture that reduces abundant food without depleting the earth's resources or polluting its environment and have social values, one whose success is indistinguishable from vibrant rural communities, rich lives for families on the farms and wholesome food for everyone.

Cordell (2011) indicated that more sustainable agriculture practices must emerge to conserve and preserve resources. The cropping practices in sustainable agriculture do not deplete the soil fertility even over the long-term and they do not lead to the development of pests, diseases and weeds problems (Bromilow, 2013). Market and social needs and farm managers are expected to ensure good quality of food while protecting the environment, including water and air quality,

soil properties and ecosystems services (SobcZyk, 2014). Thus, farmers face the challenge of balancing social and economic goals without sacrificing the environment.

Lichtfouse et al., (2009) highlighted the primary goals of sustainable agriculture as follows:

- Promoting a more profitable income
- Promoting environmental stewardship, including:
- protecting and improving soil quality
- reducing dependence on non-renewable resources, such as fuel and synthetic fertilizers and
- minimizing adverse impacts on safety, wildlife, water quality and other environmental resources
- Promoting stable, prosperous farm families and communities

For the goals of sustainable agriculture to be achieved, sustainable agricultural practices need to be taught in schools (Williams, 2009). According to Cano (2005), sustainable practices are crucial in schools agriculture curriculum. This can better be achieved through hands-on practical work that provides an opportunity for better understanding of sustainability in agriculture (National Research Council, 2011). UNESCO (2010) also argues that understanding sustainability can be understood if taught in schools. According to Conroy (2000) to achieve this goal, tomorrows farmers must be knowledgeable about sustainable agricultural practices and hold positive perceptions of agricultural sustainability.

Studies have been conducted on whether or not high school teachers teach sustainable agriculture and the level of importance that teachers place on the subject. The studies revealed that teachers agree that sustainable agriculture is important part of the curriculum but they do not have enough knowledge on the subject to teach it to their learners (Okeafor, 2002).

2.3 Effective teaching of agriculture

Steffy (2010) defines teaching as a developmental process that includes interactions between a teacher and his or her environment. According to Brown (2011), effective teaching comprises of creativity, discovery, challenges, and conductive environment as set by teachers. Effective teaching is complex and a difficult goal to achieve in education. The term effective teaching includes variety of teaching, planning, activities, educating strategies as well as teaching materials in students learning process (Barry, 2010). It is believed that effective teaching could not only improve students learning skills but also shapes their learning attitude. Effective

teaching is the impact that both classroom and out of classroom factors such as teaching and learning methods, teacher/learner expectations, classroom organization and use of teaching and learning resources, have on learners' achievement (Goe, 2011). In this study, effectiveness of teaching refers to extent of the desired results of teaching and learning agriculture subject in terms of knowledge, skills, and attitudes.

Effective teaching of agriculture is a prime area of concern for most agriculture teachers (Goe, 2013). This is because most teachers do not use appropriate methods in teaching the subject. Effective teaching involves not only the use of tools, techniques, and strategies to optimize student learning but an understanding of context and how the students learn. According to Kyriacou (2009), effective teaching of agriculture is teaching that successfully achieves the learning by students.

According to Borkar (2013), the effectiveness of the educational system largely depends upon the effective teachers. Paolini (2015) mentioned, "exceptional instructors are culturally sensitive, respectful, passionate, and charismatic. They challenge learners to work to their potential by setting high, yet reasonable expectations, emphasizing open communication, and asking higherorder thinking questions that stimulate discussion" (p.21). Barry (2010) argues that teaching effectiveness can be understood by examining what effective teachers know and do in their daily professional practice. He added that these involves a deep understanding of subject matter, learning theory and learner differences, planning , classroom instructional strategies, knowing individual learners, and assessment of student understanding and proficiency with learning outcomes. This means that effective teachers have to master their subject matter while focused on their learners learning.

Teachers are expected to be effective in their teaching however, for them to be effective they must be accorded administrative and technical support. Agriculture teachers are no exception, they need to be supported so that their teaching takes place where the environment is good for teaching the subject (Thobega et al., 2011). Harper (2009) posit that agriculture education takes place not only in classroom and in laboratories but also in the school farm hence, the effective teaching is needed. Good skills in teaching are not important if the teacher does not master the subject matter

2.4 Learning theories and agriculture education

According to chuck (2012), a theory is a scientifically acceptable set of principles offered to explain a phenomenon. A theory provides frameworks for interpreting environmental observation and serves as a bridge between research and education (Ary & Sorenson, 2010). In the teaching profession the practice and development extract ideas from learning theories (Ary, 2010).

Learning theories explain how learning and teaching processes should be. A learning theory endeavors to describe how students learn (Lepi, 2012). The learning theories inform combinations of teaching strategies to be incorporated in a lesson (Chuck, 2012).

Learning theories differ in how they predict how learning occurs in the process of learning. Thus, some are oriented more towards basic learning and towards applied learning within different content areas.

Research in agriculture education propose the following learning theories; constructivist theory and cognitive theory (Ary & Sorensen, 2010)

2.4.1 Constructivism learning theory

Constructivism is not a clearly defined theory, it cannot be defined and explained from a single scientific point of view, but it consists of many streams constantly evolving (Janik, 2010). In constructivism, teachers believe that knowledge is not attained but constructed (Von Glasersfeld, 2009). Traditional epistemology views knowledge as an objective phenomenon while constructivist views it as a subjective understanding. The theory indicate that people must recognize that there is no knowledge out there, independent of the knower but only knowledge constructed during learning is regarded as true knowledge. Piaget (1976) states that the growth of the knowledge is the result of individual constructions made during learning. He further showed that constructivism is a way of explaining how people come to know about their world.

According to Kim (2005) there are three fundamental differences between constructivist teaching and other methods:

- Teaching is supporting the learner's constructive processing of understanding rather than delivering the information to the learner.
- Teaching is a learning-teaching concept rather than a teaching – learning concept. That is teaching is learner-centered

- Learning is an active constructive process rather than the process of knowledge acquisition.

In constructivism, it is assumed that learners must construct their own knowledge individually and collectively. Each learner has a toolkit of concept and skills with which he or she must construct knowledge to solve problems presented by the environment. The role of the community, other learners and teacher is to provide the setting, pose the challenges and offer the support that will encourage mathematical construction (Jones, 2002).

The learners in constructivism are given chance to solve current problems on the environment and teachers help them to test their own ideas. Constructivism can lead to conceptual change if teachers accept and encourage learners invented ideas. Constructivism can help to move from unsustainable agricultural practices to sustainable practices. This could be possible if the teacher encourages learner's predictions of the cause and effects so that solution can be found.

2.4.2 Cognitive learning theory

Cognitivism is predominant theoretical perspective for studying human learning today. Ormrod (2012) argues that cognitivism focus is on the cognitive processes that is, how people perceive, interpret, remember and in other ways think about the environmental events. This theory does not focus on observable behavioral changes, rather expands the understanding of learning to include internal mental process unique to each person, such as perception, insight, and meaning (Olson & Hergenhahn, 2013; Ormrod, 2016).

According to Ormrod (2016), there are underlying assumptions that support the cognitive view of learning:

- Some human learning is unique and differs from how animals learn
- Learning is a mental activity and may not result in overt behavioral changes
- People exert some control over their learning and actively participate in learning
- Knowledge is organized and connected to the persons' knowledge, beliefs, attitudes, and emotions
- Unobservable mental processes can often be reasonably inferred by observable behavior.

2.5 Curriculum

Curriculum is often one of the main concerns in the educational field. Jadhav and Pantankar

(2013) state that curriculum is a word derived from the Latin word 'currere' which means 'run', and it signifies a runway or a course which runs to reach the goal. This definition highlights that curriculum is goal oriented. The concept has gained many definitions from different scholars.

According to Wiles and Bondi (2014) curriculum is the complete enterprise or program developed for a school or student body that encompasses their experience and knowledge expectations. Curriculum can be explained as the learning experiences and intended learning outcomes systematically planned and guided by the school through the reconstruction of knowledge of the cognitive, affective, and psychomotor of the learner (Aneke, 2016; Akundolu, 2012). Morris and Adamson (2010) conceptualized curriculum as a planned outcome that systematically describes goals planned, objectives, content, learning activities and evaluation procedures. According to Jadhav and Patankar (2013), curriculum means all the learning, which is planned or guided by the school, whether it is carried in groups or individually, inside or outside the school. This definition highlights the fact that curriculum is goal oriented. An analysis of various definitions of curriculum presented by different authors point to the fact that curriculum is a plan of action that fosters learning in or outside school setting. This supported by Leung (2008) when pointing that curriculum starts as a plan which will turn out into reality when put into practice in teaching and learning process at schools.

Teaching and learning will mean nothing if teachers are not conscious of the outcomes and do not have the ability to put the programme into practice (Martins & Leiti, 2011). Morris and Adamson (2010) have dissected curriculum into parts: intended, implemented, experienced, and assessed.

- Intended curriculum is specifically focusing on the aims and content of what is to be taught. This curriculum is planned and expressed through curriculum frameworks and other formal documents that may be mandated by law.
- Implemented curriculum contains both the perceived (interpretations by users, particularly teachers) and the operational curriculum (as enacted in the classroom by both teacher and the learners). Implemented curriculum is the actual teaching and learning activities taking place in schools (Njenge'ere, 2010). That is, 'the curriculum in action' or the 'taught curriculum'. This is important for this study because is about the implementation phase. Afandideh in Orgar and Awhen (2015) also affirm this view of concept "curriculum implementation" stating that it is the actual engagement of learners with planned learning opportunities. Teachers are very important at this phase since they

are ones to implement the curriculum at classroom level. Sahebrao and Pantankar (2013) support this view indicating that teachers are very important at this phase because they understand the psychology of the learners, teaching methods, and strategies to achieve curriculum objectives.

- Experienced curriculum according to UNESCO-IBE (2013) is the formal learning that is experienced by learners. It focuses upon the learner's knowledge and perspectives, as well as the ability to learn and interact with the curriculum.
- Assessed curriculum refers to curriculum that is reflected by the assessment or evaluation of the learners conducted by teachers, schools, external organizations.

2.6 Curriculum implementation

Different scholars have defined curriculum implementation in various ways. Uiseb, (2007) define curriculum implementation as the process of putting a curriculum into operation. Mkpa and Izuagba (2009) in Obilo and Saugoleye (2015) point that curriculum implementation is the actual engagement of the learner with planned learning opportunities. Planning includes the instructional materials that are used for curriculum implementation at appropriate stages. Aneke (2015) view curriculum implementation as the task of translating the curriculum concept into operating curriculum by the combined efforts of the teachers and society.

Curriculum implementation is a very crucial stage at which the planned curriculum is actualized (Gbamanja, 2010). According to Ivowi (2009), curriculum implementation involves the dissemination of the structured set of learning experiences, the provision of resources to execute the plan, and the actual execution of the plan in the classroom setting where the teacher and the learner interactions take place. Effective curriculum implementation requires that teacher help learners by doing (Asienyo & Konyango, 2015). To create conducive environment for learning by doing, students need access to all the relevant agriculture-learning resources.

Cheplogoi (2014) and NRC (2013) argue that effective curriculum implementation is a product of providing adequate teaching and learning materials, professionally trained and competent personnel. Effective implementation of agriculture curriculum is partly a product of good teaching. The quality of knowledge and skills acquired by learners depends on quality of the teacher, as teachers are the pillars in curriculum implementation process. Sindale and Dlamini (2013) assert that qualified agriculture teachers appropriately interpret the curriculum and can determine the concepts to be taught and agricultural skills to be acquired.

The implementation of the curriculum is influenced by several teacher factors. Owoeye and Yara (2012) point that what a given teacher believes and knows highly influences the way the curriculum will be implemented. Owoeye and Yara further indicated that the teachers' attitude towards the curriculum influences the difference between the intended and implemented curriculum. Other teacher related factors influencing agriculture curriculum implementation are training level, competence, experience, innovativeness, commitment, experience, teaching load and job satisfaction (Kirima & Kinyua, 2016; Mapolisa & Tshabalala, 2013; Okugu, 2011; Puyate, 2012).

Wang and Lam (2009) note that educators encounter many difficulties in the process of implementing the new curriculum. Sometimes the problem with implementation has resulted from the curriculum (Caropreso, Haggerty & Ladenheim, 2016). The workshops offered to alleviate the curriculum implementation problems still fall short of addressing the reality of the classroom situations teachers face when implementing curriculum in schools (Selesho and Monyane, 2012).

This affect the quality and level of agricultural skills and knowledge acquired by learners.

2.7 Theoretical Framework

Theoretical frameworks are deemed component of research because they map a way for the researcher to conduct appropriate research. The theoretical framework provides a base for the literature review and, most importantly, the methods and analysis used (Grand & Osanloo, 2014).

The current study is informed by the theory of curriculum implementation developed by Rogan and Grayson's (2003). They argue that success of the implementation of the curriculum can be determined by using three constructs. They indicate that the constructs can be employed to unpack the fundamental characteristics and be able to determine the degree to which the new curriculum is successfully implemented. This theory, in its general form, is relevant to education in developing countries like Lesotho. It draws on, among others, school development, and educational change to develop the three constructs, as shown in figure 1 below:

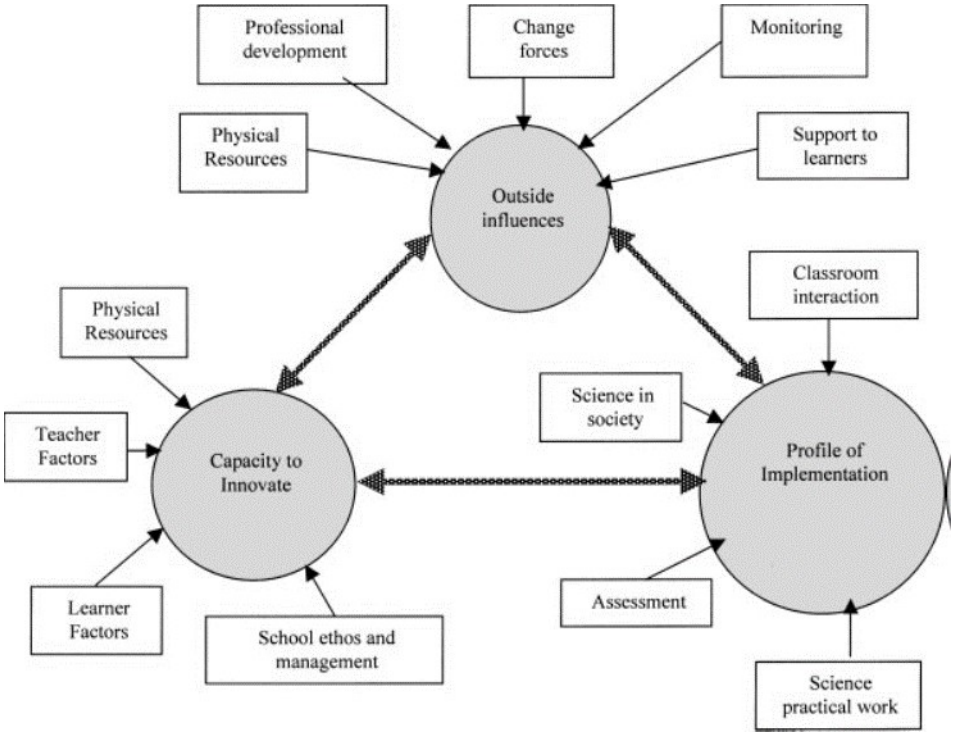


Figure 1 1: Rogan & Grayson's (2003) Framework of Curriculum Implementation

The three constructs are the outside influences, capacity to innovate and profile of implementation.

2.7.1 Outside influences

Outside influence is about the role of organizations outside school that includes departments of Ministry of Education and Training that interact with the school for facilitation of the implementation of the curriculum (Rogan & Grayson, 2003). Rogan and Grayson (2003) proposed the following sub - constructs under outside influence:

•**Physical Resources:** This includes availability of resources used for effective implementation of the curriculum such as buildings, apparatus, curriculum materials and computers.

•**Professional development**: Rogan and Grayson (2003) argue that professional development is the type of non-material support that is provided to teachers. For curriculum implementation to be done effectively, teachers must continuously expand their knowledge and skills (Kyahurwa, 2013).

•**Support to learners**: Rogan and Grayson (2003) argues that for curriculum implementation to succeed learners must be provided with supports such as place to study, laboratories, and extra classes. These will make the learner to concentrate and have positive attitude during teaching.

•**Change factors**: This factor expresses the kind of forces that an organization chooses to use as advantage about change (Rogan and Grayson, 2003).

•**Monitoring**: School-based personnel should undertake all the monitoring regarding the implementation of the curriculum. The inspectors will help to improve the teachers work.

2.7.2 Capacity to Support Innovation

Rogan and Grayson (2003) explain the construct 'capacity to support innovation in terms of aspects that either support or hinder the implementation of new ideas and intended practices in school. The construct assumes that the extent to which schools can implement an innovation is not the same. This construct is divided into the following sub- constructs:

•**Physical resources**: Rogan and Grayson (2003) argue that physical resources can highly influence the capacity to support an innovation. Poor resources and conditions can limit the performance of the teachers. Lack of resources like agriculture teachers, books and libraries may influence negatively on teaching and learning of some topics in the curriculum.

•**Teacher factors**: Under teacher factors Rogan and Grayson (2003) includes the teacher's qualifications, experience, professional development, teacher's subject matter knowledge and his or her pedagogical content knowledge. They argue that these affect the capacity to implement a curriculum. Alsubaie (2016) asserts that teachers are the ones responsible for introducing the curriculum at the classroom level. It is important to understand the teacher's capacity to implement the curriculum. The study primarily focuses on three teacher factors namely, teaching, knowledge of subject matter (SMK) and pedagogical content knowledge (PCK).

- **Teaching**

Effective implementation of curriculum is a product of good teaching. According to Mwira (2010), good education depends on good teaching and learning which in turn depends on good teachers. The quality of agricultural knowledge and skills acquired by learners depends on the quality of the teacher since the teachers are pillars in the curriculum implementation process. Past studies have indicated that qualified agriculture teachers appropriately interpret the curriculum and can determine concepts to be taught (Sindale & Dlamini, 2013).

Teachers must meet the challenge of individual differences of learners when teaching. De Clercq (2009) shares the same sentiments that teachers need competencies such as subject knowledge,

pedagogical and societal knowledge that will enable them to understand appropriate nature of curriculum when teaching.

Teaching requires many different types of knowledge. Teachers' self-knowledge together with the belief in subject will often influence how the subject is taught (Denby, 2012). Instruction that leads to learners learning not only requires deep content knowledge of a subject to present that content, but also knowledge surrounding that content that relates to how is learned (Grossman, 2010). Teachers' knowledge determines their decisions on instructional methods, materials and activities. It is not enough to be expect in a certain field hence teaching requires more. Teaching extends beyond simply understanding content and knowing the techniques of classroom management.

- **Pedagogical content knowledge**

The most significant impact on student learning is the teacher and how they use their knowledge to teach (Hattie, 2009). This special knowledge has come to be known as pedagogical content knowledge (PCK). PCK is regarded as the most important knowledge base a teacher can have for effective teaching (Baumert, 2010). It has been a significant topic to be discussed in teaching for a long time. Teacher education in agriculture has acknowledged the importance of PCK as a knowledge base for quality teachers with positive impact on teaching and learning (Kitchel, 2010).

Lee Shulman first introduced PCK in 1980s and described it as the synthesis of teacher's subject matter knowledge with their pedagogical knowledge. Shulman (1986) further defined PCK as teacher's ability to transform content knowledge into forms that are proper for learners understanding of the scientific concepts. On the other hand, Rice and Kitchel (2015) outline PCK as the transformation of content knowledge and pedagogical knowledge that forms a persuasive knowledge base on which teachers base their instructional strategies. Kind (2009) point that PCK is a concept that has come to represent the knowledge that teachers use in the teaching process. According to Roberts and Kitchel (2010), PCK is the most important knowledge base a teacher can possess. Van Driel and Berry (2012) also assert that PCK is not only specific to a concept or topic but also specific to the individual teacher. Successful learning requires pedagogical content knowledge that relies on the content knowledge quality (Kind and Chan, 2019).

Shulman (1986) emphasized three fundamental components of knowledge that a teacher should possess. The components include content knowledge, pedagogical content knowledge and curriculum knowledge. Compared to other teacher's knowledge bases that he listed, Shulman added that PCK holds more importance as is the type of teacher's knowledge that combines both teacher's mastery of content and pedagogical knowledge. Content knowledge (CK) refers to subject matter knowledge (SMK) that comprises is the knowledge gained through the study of the discipline such as agriculture. CK according to Shulman (1986) refers to the subject matter knowledge (SMK) that comprises the knowledge of the specific topic that is central element in teacher knowledge. For many years, some researchers focused on the discussion that teachers' content knowledge impacts learner's achievement. Some studies found that lack of teacher's knowledge find difficulties of teaching and learning process (Washburn, 2016). Quality teacher knows the content of their discipline and can communicate that content knowledge to learners (Okpala and Ellis, 2009). Agriculture teachers are expected to have both breadth and depth of content knowledge and are often looked to as the content experts in the communities in which they teach (Barrick and Garton, 2010).

Shulman (1986) added that SMK is the knowledge base required for teaching. This makes the mastery of subject matter one of the essential aspects of teacher capacity. In describing SMK, Shulman (1986) equates content knowledge to SMK. According to Mishra and Koehler (2006) subject matter knowledge by teachers is important in teaching. Subject matter is essential for the selection and evaluation of teaching materials and resources (Gess Newsome & Lederman, 1999). As described earlier, CK is going beyond knowledge of the concepts or facts of a domain and it requires understanding of the structures of the subject matter (Shulman, 1986). PK is the teacher's knowledge of effective teaching and learning. Shulman's last component of teacher's knowledge is curricular knowledge, which is the teacher's acquaintance of different instructional materials, and how to use them, as well as the teacher's awareness of the different topics taught at different school years (Shulman, 1986).

Kind (2014), assert that teaching without a comprehensive understanding of the necessary content knowledge has a negative effect on the teaching and learning processes, which also affects the choice of teaching methods to be used. She further contends that lack of content knowledge leads to unsatisfying science lessons. A teacher who is uninformed about subject content can pass inaccurate ideas to learners (Jadama, 2014). For better teaching, teachers are expected to have in depth content knowledge of subject for student learning (Garton, 2010).

Teachers are required to have the knowledge about the curriculum for effective teaching. Grobschedl (2015) embrace the view that knowledge of curriculum content and teaching are related and that this knowledge influences teachers practice. He further indicates that experienced teachers move away from textbooks towards a constructivist approach and seek explanations from learners rather than asking factual questions. Teachers need to know what learners have to know and why they must know (De Quadros, 2011). Luft and Zhang (2014) argue that most new teachers do not usually grasp the curriculum within a year, and it may take two years to make sense of the arrangement of their subject curriculum.

•**Learner factors**: The background of the students will determine the way they will learn at school. According to Rogan and Grayson (2003), the learner factor refers to barriers experienced by learners. These may include the language of teaching and learning and the support the learners get from their schoolwork. Even though there are more than one language used in Lesotho, the policy recommends use of English as the Language of Learning and Teaching (LOLT).

2.7.3 Profile of Implementation

Profile of implementation includes the extent to which the curriculum proposals are being put into practice. This includes the following sub-constructs.

•**Classroom interaction**: This is concerned with what teachers and learners do during the development of the lesson. The teacher prepares and draws examples from textbooks as these forms the main source of information. The teacher is dominant in the classroom activities. According to Rogan and Grayson (2003), the teacher prefers the question, answer techniques during teaching, and gives written tests that need both recall and higher order thinking. During the lesson, the learners become passive and wait for the instruction from the teacher.

•**Science practical work**: This also forms an important part of classroom interactions, as agriculture is a practically oriented subject. The types and nature of practical work going on as well as nature of engagement by learners constitute what might be regarded as good practice and learning. Through practical, agriculture practical work is seen as having potential to help learners develop problem-solving skills and apply scientific knowledge in solving everyday problems (Hofstein and Kesner, 2006). The teacher provides written tests that cover at least 50% of comprehension, application and analysis.

•**Science in society**: This is an important component in instruction because it helpful in enhancing learners process skills, creativity, scientific attitudes, decision making, and epistemological views about science. It allows teacher to engage learner and challenge them to use prior knowledge to connect with new concepts (Grayson and Grayson, 2003). The teacher provides assignments that may comprise learners giving reports on the activities they undertake, besides that include seen or unseen "guided discovery" type questions (Rogan and Grayson, 2003).

•**Assessment** is the part that depicts a teacher who takes on a facilitative role in the class (Rogan and Grayson, 2003). Learners take long-term projects within their subjects that relate to a specific problem in the community and try to find the solution. When assessing the learner's teacher integrates some questions that relate to the community project. Rogan and Grayson (2003) point that the teacher must encourage the learners to present their best work in portfolios.

2.8 Role of teacher in curriculum implementation

Curriculum is defined as a set of guidelines from the state on what should be taught on a given subject while curriculum implementation refers to how the teachers deliver instruction and assessment with specified resources provided in the curriculum (Hoare, 2012). The teachers' role in curriculum implementation is very crucial in this study as teachers are the key agents in the curriculum implementation (Onojerena, 2014). The teachers are responsible for implementation of the curriculum because they are the ones who interact with learners in the schools to deliver it. Teachers have to be trained to meet the curriculum objectives before the process of implementation (Jess, Carse, & Keay, 2016). The implementation starts with preparation of schemes and lesson plans. The teachers have to prepare their work before going to the class for effective teaching-learning process. According to Loflin (2016), the role of teachers remains instrumental in the success or failure of a curriculum.

Jess et al. (2016) believe that teachers require the capacity to design developmentally appropriate learning tasks that are aligned to the curriculum anticipations. This means that teachers need to have strong knowledge and understanding of child development. They should also be knowledgeable about the cultural and social expectations of the community that learner live in. These strategies will help the teacher to effectively implement the curriculum, as all the learners will learn in the conducive environment.

Teachers are expected to understand the content in the curriculum before implementation. Teachers' knowledge is regarded as the most important factor in improving learner performance as it determines teachers' decisions about classroom instruction and it is subsequent to effective learning (Kim, Ham & Paine, 2011; Moru, Qhobela & Maqutu, 2014). According to Heck (2009), teachers provide guidance to learners regarding the demands of the curriculum and assessment strategies. They develop various techniques that will help the learners to understand the content better.

2.9 Professional development

Professional Development (PD) is a means of attaining content knowledge, as well as curriculum to aid in lessening the pressures within the classroom (Kitchel, 2015). This means that all professions require a continuous update of knowledge and skills (Somers and Sikorova, 2002:103). In this case, the teaching profession is no exception. The changes experienced in education with regard to curriculum require the teachers to increase their level of skills and knowledge for teaching (Kyahurwa, 2013). The teaching of the contradicting topics in LGCSE in the current study require the teachers to have extra skills and knowledge for proper implementation of the curriculum.

The benefit of PD includes teachers increased comfort and skill levels for implementing new curriculum. According to Lia (2016), relevant and effective PD has been found to promote confidence and a greater understanding of curricula objectives. Richardson (2009) added that PD improves teacher's development of teaching techniques, content information and resource availability. The teachers when provided with the proper content knowledge will be able to better implement the contradicting curriculum in such a way that learners understand better than before. These teachers would have the new skills and knowledge that they can use to interpret the curriculum better.

Coldwell (2017) and Attard (2017) in their studies have found a connection between teacher confidence and PD. Coldwell found that PD improved skills and knowledge that enabled teacher's confidence and this increased teachers job satisfaction and professional motivation. The teachers with confidence about the content of the subject make sure that the learners' performance improves. Park and Sung (2013) support this idea in their study when indicating that the improvement of the teacher professional development is vital for effective

implementation of the curriculum. Teachers need support to cope with the difficulties of implementing a new curriculum.

PD bring better understanding of the content of sustainable agriculture practices as initial teacher educational training cannot provide teachers with the knowledge and skills for a lifetime of teaching (Lin & Fishman, 2006). The student's performance in agriculture can improve through engaging teachers in professional development. Showers (2010) mention that if the aim of professional development is to assist student learning, the leaders in education must examine the most effective ways of monitoring professional development activities to evaluate their impact on student achievement.

2.10 Conclusion

In this chapter, the discussion of the issues related to curriculum implementation were discussed. The description of sustainable agriculture was done together with effective teaching as teachers have to understand the sustainable agriculture before implementation of the curriculum. The study further explored the learning theories in agriculture education. Curriculum implementation and the teachers' role in the implementation were discussed. Teachers' professional development was done as it motivates teachers during implementation of the curriculum. The study suggested the theoretical framework that will be used to explore how teachers implement the curriculum on sustainable and unsustainable agricultural practices. The framework will focus on teachers' knowledge of subject matter, pedagogical content knowledge and teaching of the sustainable and unsustainable practices. In chapter 3, the research methodology will be presented.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

The previous chapter presented the literature informing this study including sustainable agriculture, effective teaching, learning theories and agriculture education, curriculum, curriculum implementation, role of the teacher in curriculum implementation and professional development. The chapter also presented the theory of curriculum implementation proposed by Rogan and Grayson (2003) as the theoretical framework of this study.

This chapter outlines the methodology followed in this study. The research design, data collection processes and data analysis will be explained. The chapter will also show the reliability and validity of the instruments, trustworthiness and the ethical consideration of the research addressed.

3.2 Research Design

The research design is a systematic and structured way of collecting and analyzing data (Yin, 2009). Burking and Saunders (2004) defines as a plan or guide for data collection and interpretation, with sets of rules that enable the researcher to conceptualize and observe the problem under study. It serves to provide a plan of how the research will be conducted (Creswell, 2009). The plan is based on some philosophical background and reasoning. The research design describes how the study was conducted in order to address the research problem (McMillan & Schumacher, 2006). The research design specifically gives the researcher direction on how to generate data needed to answer questions. The research has numerous designs and the appropriateness of each depends upon phenomenon under study. The researcher found appropriate to select inductive design that is qualitative in nature.

The qualitative approach is a type of educational research in which the researcher relies on the view of participants, may ask broad and general questions, collects data consisting largely of words or texts from participants, describes and analyses the words for themes (Creswell, 2005). A qualitative study involves study of a phenomenon in the natural setting, specifically with the aim to make sense of the meanings people make of various phenomena (Denzin & Lincolin, 2011). The qualitative researchers are expected to interpret data obtained from the participants and give it meaning. On the similar note, Springler (2010), point that a qualitative research

entails collection, analysis, and interpretation of comprehensive narrative and visual data in order to gain insights into a particular phenomenon of interest.

According to Polit and Beck (2010), qualitative approach is the flexible and elastic data collection method in which the researcher compare data from various participants and sources. McMillan and Schumacher (2010) identified some characteristics of qualitative research; research being done in natural settings, sensitivity to the context of study, obtaining rich narrative description, collection of data directly from the source and induction reasoning and mindful perspectives of the participants.

Since this study intends to investigate how LGCSE agriculture teachers implement the contradicting agriculture curriculum on sustainable and unsustainable practices, the qualitative approach is suitable as the researcher can get answers for the research questions. The participants are viewed as important sources of information for the study. The study followed an inductive approach with the aim of gaining a deeper understanding of the participant's implementation of LGCSE agriculture curriculum on sustainable and unsustainable practices. The researcher chose qualitative approach because of its interactivity with teachers in their own natural setting that is school. The researcher developed an understanding of teachers' world of work as she was contacting teachers for a longer period for collection of data.

In this inductive study, the researcher first collected data and then, from the analysis developed patterns and themes. Qualitative research employ various tools to collect data; namely interviews, observations, focus group discussions and field notes (Antwi & Hamza, 2015). In this study, the researcher opted for a questionnaire and follow-up interviews to collect data as qualitative research employ various tools to collect data such as interviews. The questionnaire that was constructed had open-ended questions to permit the complexity of a single idea or phenomenon to emerge from the participants perspectives. The use of follow–up interviews was to allow participants to clarify and elaborate their responses.

3.3 Population and sampling

Population includes all members that the researcher will use when collecting data during the study while sample is part of the population (Creswell, 2007). According to Johnson and Christensen (2012) sampling is a way of selecting a sample that is a set of elements from a population, which is assumed to be the representative of that population. Teachers of LGCSE

agriculture from Maseru district were targeted as the population of the study while twenty agriculture teachers were selected to participate in this study.

There are various sampling techniques that can be used in research but the researcher in the current study selected purposive sampling as an example of non-probability sampling. Martella, Nelson, Morgan and Marchand-Martella (2013) defines purposive sampling as deliberately selecting particular persons, events, and settings for the important information they provide and the selected participants have to fit in the particular study. The selection of Maseru district was made based on accessibility to the researcher. Freedman (2009) assert that the purposive sampling is used so that the sample members are selected based on their knowledge, relationship and expertise regarding a research subject. In this study, twenty teachers from Maseru district were purposively selected because of the experience and knowledge they have in the implementation of LGCSE agriculture curriculum.

3.4 Demographic data of participants

The study established the distribution of the respondents by gender, teaching experience, teaching level and their educational qualifications. This was done in order to find if their individual characteristics influence the implementation of LGCSE Agriculture curriculum on sustainable and unsustainable practices.

Table 3: Demographic data of participants

Designation of teacher	Gender	Teaching experience	Teaching level	Higher educational qualification
Teacher 1	Female	8 years	JC & LGCSE	BSc (agric)
Teacher 2	Female	13 years	JC & LGCSE	BSc (agric)
Teacher 3	Male	12 years	JC & LGCSE	PGDE
Teacher 4	Male	7 years	JC & LGCSE	BSc (agric)
Teacher 5	Male	30 years	JC & LGCSE	PGDE
Teacher 6	Female	10 years	JC & LGCSE	Diploma
Teacher 7	Female	12 years	JC & LGCSE	BSc (agric)

Teacher 8	Male	24 years	JC & LGCSE	BSc (agric)
Teacher 9	Female	9 years	JC & LGCSE	
Teacher 10	Male	10 years	JC & LGCSE	PGDE
Teacher 11	Male	30 years	JC & LGCSE	PGDE
Teacher 12	Male	21 years	JC & LGCSE	Diploma
Teacher 13	Female	6 years	JC & LGCSE	BSc (agric)
Teacher 14	Female	8 years	JC & LGCSE	Diploma
Teacher 15	Male	11 years	JC & LGCSE	BSc (agric)
Teacher 16	Female	8 years	JC & LGCSE	BSc (agric)
Teacher 17	Male	3 years	JC & LGCSE	BSc (agric)
Teacher 18	Male	11 years	JC & LGCSE	Diploma
Teacher 19	Male	17 years	JC & LGCSE	Honors
Teacher 20	Male	15 years	JC & LGCSE	BSc (agric)

Table above shows that there are more males than females teaching agriculture at LGCSE level from 20 teachers at Maseru. This could mean that few females pursue agriculture related courses at tertiary level in Lesotho. One teacher holds Honors, four have Post Graduate Diploma in Education (PGDE), and eleven teachers holds Bachelor of Science in Agriculture (Bsc agric) whereas the other four have Diploma in Agriculture Education. None of the teachers from the sampled population has master's degree. The teachers seem experienced for teaching agriculture at LGCSE level as most of them have more than five years teaching. This means that through experience these teachers have developed a repertoire of skills in the teaching of agriculture. Their experience on the curriculum is important, as they know the challenges than any other teachers with less exposure. Their teaching experience can help in the innovation of the curriculum and similarly improve learners understanding of the curriculum.

3.5 Data Collection and Instruments

The qualitative data are the best way of explaining difficult issues (Woods, 2011) but Dunlap and Benoit (2010) argue that qualitative data is massive and refer to it as mountains of words, hence it is less structured and more challenging to analyze as compared to quantitative data.

Data collection instruments are the materials out of which the researcher substantiates the research argument (Newby, 2014). There are various research instruments that can be used in qualitative approach such as case studies, focus group discussions, interviews, questionnaire, field notes and filming (Antwi & Hamza, 2015). For this study, open-ended questionnaire and follow-up interviews were used as instruments to collect the required data.

A questionnaire is defined as a document that is completed by the participants without the help of the researcher (Creswell, 2013). According to John (2011) questionnaire is good in saving time, money and when one want to collect data from people simultaneously. The questionnaire (Appendix 2) constructed was open-ended and composed of three sections (section A to C). The questions asked were constructed in such a way that they respond to the research questions. Section A was focusing on demographic data of participants, section B on conceptualization of sustainable and unsustainable agricultural practices and section C on subject matter knowledge regarding sustainable and unsustainable practices.

Follow-up interviews were conducted from five selected LGCSE agriculture teachers. Roulston, (2014:304) defines interviews as “a conversation with a purpose”. The purpose of conducting follow-up interviews in this study was to get thorough clarification from the respondents. The participants were probed to elaborate on the responses given in the questionnaire. The technique was considered appropriate for this study because it provided a deeper understanding that was not found in the questionnaire. The interviews were done telephonically as it was only the reliable source of communication with participants because of lock-down due to covid-19. The interviews were audio-recorded for accurate information during transcription of verbal interactions and transcribed verbatim.

3.6 Data Analysis

Creswell and Clarke (2011) define data analysis as a process of data coding which includes transformation of the text into small units by assigning a label to each unit, and grouping the codes into themes. Mathipa & Gumbo (2015) show that data analysis involves the transformation of raw data into patterns, themes and categories.

The researcher employed inductive approach for analyzing data. According to Thomas (2006, p.238), the inductive analysis refers to "approaches that primarily use detailed readings of raw data to derive concepts and themes". It entails going through the data line by line thoroughly and assessing codes to paragraphs of texts as concepts unfold relevant to the research questions (Thomas, 2006). Neeley and Dumas (2016) argue that inductive approach is the process that involves moving back and forth between data analysis to make meaning out of the emerging concepts.

In the study, the researcher organized data and reviewed it for several times. The reviewing of data was helpful because the researcher got sense of what the data contains and says. The codes were then created using highlighters to mark similar words or phrases of text with code label. The similar codes were then grouped into categories in order to reduce the number of different pieces of data. Lastly, the themes emerged which are regarded as higher-level of categorization. The themes turned to be main ideas of the study that need to be discussed. In the study, three themes emerged that guided the analysis process. The follow-up interviews were analyzed by listening to the audio-record to capture and understand the responses so that the codes, categories and themes are formed.

3.7 Reliability and validity

Patton (2001) argues that validity and reliability are two factors that any qualitative researcher should be concerned about while designing a study, analyzing results and judging quality of the study. Stenbacka (2001) indicates that since reliability, issue concerns measurements then it has no relevance in qualitative research. To ensure reliability in qualitative research, examination of trustworthiness is crucial and it is important to test if the results are consistent.

Validity refers to the extent to which research instrument measures what it claims to measure (Mertens, 2010). Validity in research is about the fairness of instrument applied to collect data. The instrument is applicable if it evaluates what it aims to quantify (Johnson & Christensen, 2014). In the current study, the researcher prepared the research instrument and validated by the research supervisor from the department of science education. The pilot study was also done to see if questionnaire would yield valid data. The validation was done for reducing ambiguity, leading questions emotive questions and stressful questions. The views and suggestions were incorporated while developing the final instrument.

3.8 Ethical considerations

In the field of educational research, ethical issues need to be taken seriously to protect participants against violation of their rights to freedom (Cohen et al., 2011). According to Maree (2011), it is outmost important that the researcher protects the privacy, confidentiality and anonymity of the participants. In this study, participating teachers were treated with respect and dignity because an attempt was taken to consider some of the participants' ethical issues.

A letter seeking permission to collect data at selected schools was delivered to the principals from the faculty of science education. After the approval was granted from schools, the participants were given the consent form to sign indicating that they are going to participate in the study. The researcher tried to avoid deception by being honest with participants about their status and purpose of the research. The researcher guaranteed privacy and confidentiality of all participants by tracking data with assigned numbers instead of names. This is done to protect the participants from public scrutiny and criticism. The researcher explained to the teachers that their participation is voluntary in the study.

3.9 Pilot Study

A pilot study is viewed synonymously with a feasibility study intended to guide the planning of a large-scale investigation (Thabane et al, 2010). According to Eldridge et al. (2016), a pilot study usually focuses on an experiment, project, or development undertaken in advance of a future wider experiment, project, or development. Van Teijlingen and Hundley (2002) argue that pilot studies refer to mini versions of a full-scale study, as well as the specific pre-testing of a particular research instrument such as questionnaire or interview.

In this study, the effectiveness and consistency of the questionnaire was tested using the pilot study. The pilot study was conducted before the questionnaire was put into final form. Five teachers from Mafeteng district were administered the questionnaire. The pilot study was aimed at determining whether the layout of the questionnaire is clear and to test if the study could be researchable. Data from pilot study helped to make some adjustments on some questions to reduce their ambiguity.

3.10 Conclusion

This chapter has outlined the research methodology implemented in this study. Due to the nature of the research, the inductive qualitative strategy was opted in order to address the research questions. The chapter described methods used for data collection such as questionnaire

and follow-up interviews, population and sampling, demographic data of participants, data analysis, reliability and validity of the research instruments, pilot study and ethical considerations.

The results of data analysis are presented in the next two chapters (chapter 4 and 5). Chapter 4 will present the results on teachers' conceptualization and teaching of sustainable and unsustainable agricultural practices. The next chapter will focus on presenting the findings on teachers' knowledge of the subject matter.

CHAPTER FOUR

Teachers conceptualization of sustainable and unsustainable practices

4.1 Introduction

The previous chapter discussed the methodology used to conduct this study. It specified research approach, research design, participant's selection, research instruments and their validation and data analysis. For this study, inductive approach was followed since the researcher first collect the data and then, codes categories and themes were developed. In this study, LGCSE agriculture teachers' invited to participate to get data using questionnaire and interviews. Twenty teachers' responded to a questionnaire and five were interviewed to improve the understanding of the data provided in the questionnaire. The collected data was analyzed using thematic analysis. It includes familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes.

In this chapter, the findings of the study are presented. The findings are classified into two themes:

-Teachers' understanding and awareness of sustainable and unsustainable practices

-Teachers' teaching of sustainable and unsustainable practices

4.2 Teachers' understanding and awareness of sustainable and unsustainable practices

It is important to determine the teachers' general understanding and awareness of sustainable and unsustainable practices within LGCSE curriculum because with sufficient content knowledge they can respond to learners' productively.

The responses indicated a number of meanings of sustainable agriculture practices; namely,

-Sustained food supply

-Continued production of food and

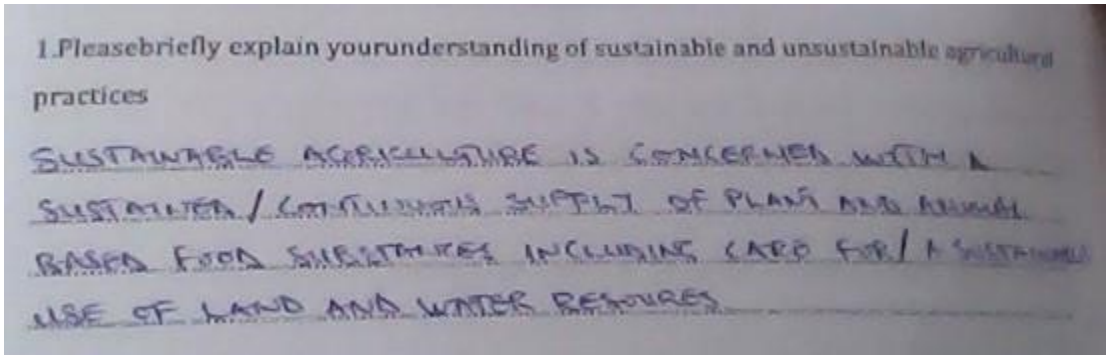
-Meeting the present and future needs

4.2.1 Sustained food supply

The sustained food supply is concerned with supply of food that satisfies the needs of people without damaging the land (Parr, 2007).

The responses from teachers, n=3 had similar meaning of sustainable agricultural practices. They conceptualize its meaning in terms of sustained food supply. Teachers say it brings about

sustainability in food supply. T20 indicated that it is concerned with a sustained supply of plant and animal based food substances. The extract below presents the teachers' conceptualization of sustainable agriculture. This is what T20 wrote;


1.Pleasebriefly explain yourunderstanding of sustainable and unsustainable agricultural practices

SUSTAINABLE AGRICULTURE IS CONCERNED WITH A SUSTAINED / CONTINUOUS SUPPLY OF PLANT AND ANIMAL BASED FOOD SUBSTANCES INCLUDING CARE FOR / A SUSTAINABLE USE OF LAND AND WATER RESOURCES

T20 understands sustainable practices in terms of caring for the land and water resources. These resources are in danger of being in extinct time goes on.

The following extract shows a discussion between the researcher and T20

R: *What do you mean by sustained supply of food?*

T20*: By sustained food, I mean practice that support food production for longer period*

R: How does use of the land bring about sustained food supply?

T2O: The practices done on the land should not damage the land such as continuous application of chemical fertilizers that affect the living organisms on the land

R: You talked about animal-based food can you explain this?

T20: Those are foods of animal origin that provide people with essential nutrients

R: Are unsustainable practices good because you did not talk about them

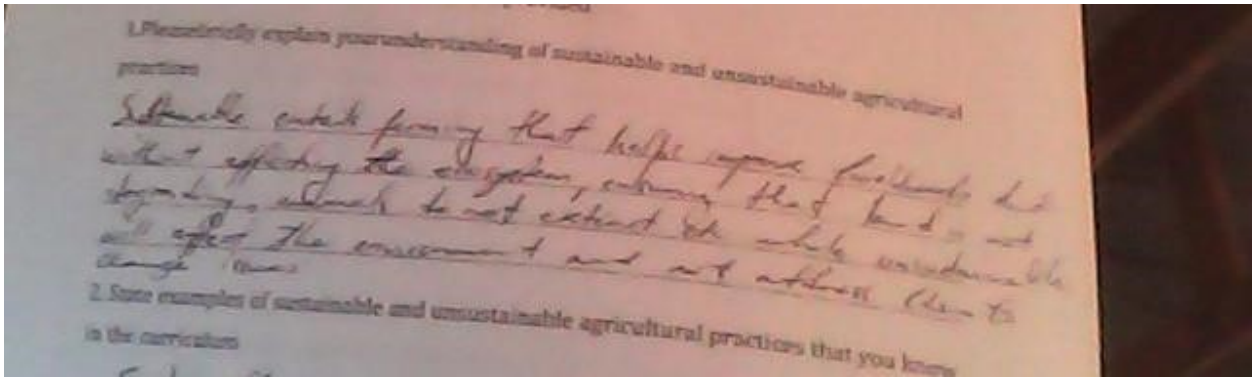
T20: They are the practices that do not bring sustained food production but short term production

R: Are the practices contradicting?

T20: No because each topic is dealt with separately

On the above extract, T20 understands sustainable practices in terms of caring for the land and water resources that are in danger of being in extinct as time goes on.

On the extract below, T18 indicates that when practicing sustainable practices resources will not be extinct and there will be sustained food supply,



The response in the above extract designates that T18 is aware of the differences between sustainable and unsustainable practices by showing that sustainable practices bring about improvement of livelihoods without degrading the land that supply food whereas the unsustainable practices affect the environment.

The following extract demonstrate the interview between the researcher and T18:

R: What can you say about unsustainable practices in the curriculum? T18:

They are the practices, which need to be taught at all levels at schools

R: Why?

T18: To make learners aware of them as they are very dangerous in food production because they damage the land. Which will result in low production.

R: Are the practices contradicting?

T18: They are contradicting somehow because unsustainable practices bring confusion to learners as to why they are taught yet they are not good on the land and natural resources

The above extract is clarifying that T18 understands sustainable and unsustainable practices.

4.2.2 Continued food production

Some teachers' are thinking that continued production of food means different things. The following are three ideas that they outlined regarding their understanding:

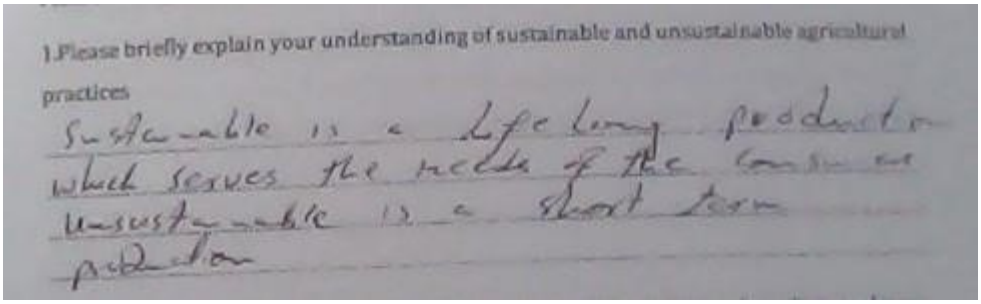
-Lifelong production

-Minimal harm to the environment

-Practice conservation agriculture practices

4.2.2.1 Lifelong production

Some teachers, n=3 made reference to lifelong production of food when describing their understanding of sustainable practices. This is what T8 wrote



In the above extract, T8 describes sustainable practices and unsustainable practices.

Extract below indicate the interview between researcher and T8

R: What do you mean when saying unsustainable practices deals with short-term production?

T8: It means the practices done bring about high production for a short period and low one for longer period

R: Do you know the practices that can lead to short term production of food?

T8: Yes, practicing continuous production and conventional tillage

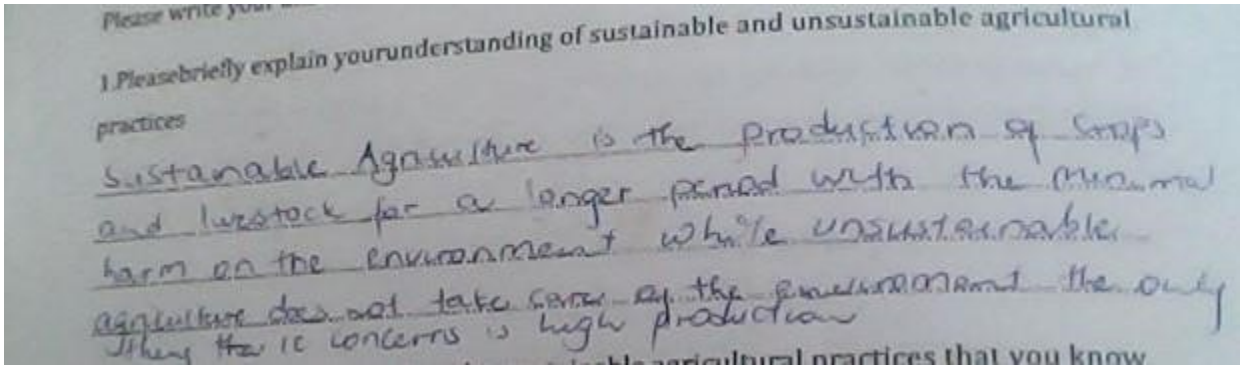
The above extract depicts the possible causes of low production when practicing unsustainable *practices*

R: Are the practices not contradicting the way you see them?

T8: They are not because each has its advantages and disadvantages

4.2.2.2 Minimal harm to the environment

Other teachers, n=5, stated that continued food production is recognized with practices that bring minimal harm to the environment. The following extracts reflect the teachers' understanding of sustainable agriculture practices. This is what T12 said:


Please write your
1. Pleasebriefly explain yourunderstanding of sustainable and unsustainable agricultural practices
Sustainable Agriculture is the production of crops and livestock for a longer period with the minimal harm on the environment while unsustainable agriculture does not take care of the environment the only thing it concerns is high production
agricultural practices that you know

T12's description of sustainable agriculture shows recognition of the environment. The central issue according to T12 is that the practice should be concerned about less disturbance on the environment while maintaining maximum production.

The extract below demonstrates the discussion between the researcher and T12

R: What do you mean when saying unsustainable agriculture practices are only concerned about high production?

T12: I mean that it is only concentrating on high production

R: According to you, which practice is better?

T12: Sustainable agriculture is the best

R: What is your reasons for saying that?

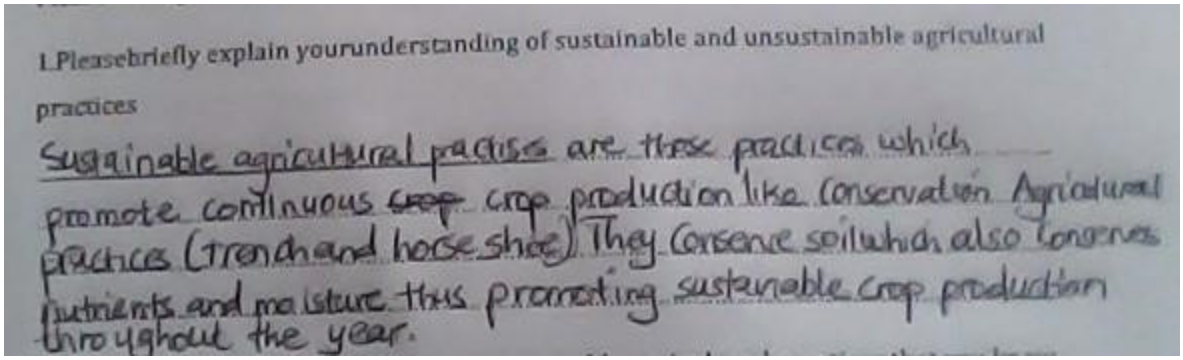
T12: Sustainable agriculture deals with practices that concentrate on the integrity of the land

R: Sustainable and unsustainable agriculture according to you are they not somehow contradicting when looking at the way you explained them.

T12: Yes, they are confusing to learners sometimes because they are taught about them and fail to understand why the unsustainable practice is still taught yet it brings damage to the land

The extract above clarify sustainable and unsustainable practices by reviewing their importance on the environment.

In the extract below, T15 is arguing that sustainable practices when done continually bring about high production of food without loss of soil and bringing about conservation of moisture. This is what T15 wrote


1.Pleasebriefly explain yourunderstanding of sustainable and unsustainable agricultural practices

Sustainable agricultural practices are those practices which promote continuous ~~crop~~ crop production like Conservation Agricultural practices (Trench and horse shoe) They Conserve soilwhich also conserves nutrients and moisture thus promoting sustainable crop production throughout the year.

T15 is pointing that sustainable agriculture deals with continuous production that conserves soil while food is produced throughout the year.

The discussion between the researcher and T15

R: What do you mean by sustainable crop production?

T15: It refers to agricultural production in such a way that does not impose any harm to the environment

R: Why did you indicate that sustainable practices are done continuously to obtain sustainable crop production?

T15: The practices done improve the fertility of the soil

R: Show examples of practices employed to achieve this kind of production.

T15: Intercropping, adopting biological control of pests, minimum tillage, Integrated Pest Management

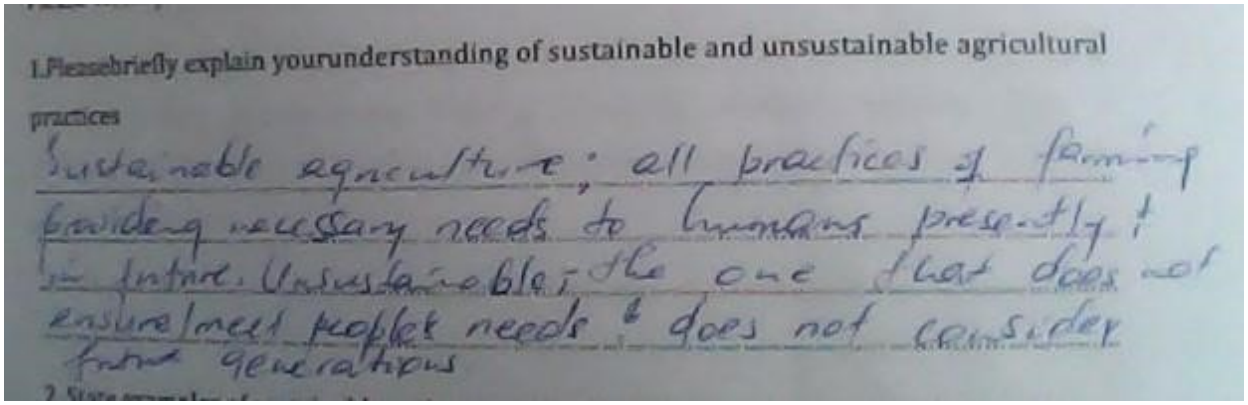
R: Do you think the two practices (sustainable and unsustainable practices) are contradicting according to your understanding

T15: They are not because they talk about different things

From the extract above, T15 is concerned about factors that can promote longer production of food without harm to the environment.

4.2.3 Meeting the present and future needs

Some teachers' conceptualize sustainable agriculture practices as the practices that are concerned with optimal utilization of the environment that can meet the needs of the present and the future people indefinitely. This is what T1 wrote


1.Plezsebriefly explain yourunderstanding of sustainable and unsustainable agricultural practices

Sustainable agriculture; all practices of farming providing necessary needs to humans presently & in future. Unsustainable; the one that does not ensure/meet peoples needs & does not consider future generations

The information presented above show that T1 sees sustainable practices as those practices that do not only focus on the present generation but also on the future generation.

The following extract demonstrates the discussion between the researcher and T1

R: How does sustainable practices provide the needs of the present and the future generation?

T1: By not destroying the natural resources, which are non-renewable

R: What are the challenges of practicing unsustainable practices?

T1: The land will lose its value and the food produced will not be enough for the people

R: Is it good to learn about the unsustainable practices yet they damage the environment

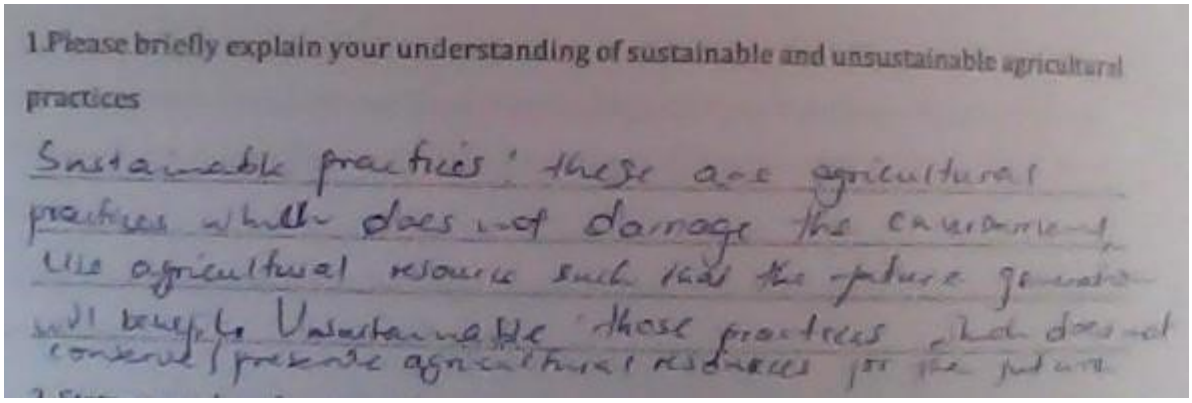
T1: Yes because the practices will be avoided due to their bad effects on the land

R: According to your explanation, do you see sustainable agriculture practices contradicting with unsustainable practices in the curriculum?

T1: No, because they deal with different things

The extract above demonstrate that T1 understand the sustainable and unsustainable practices through their impact on people's needs.

On the below extract T9 clarify that the sustainable practices usually do not damage the environment but the way the resources are used the future generation are taken care off. This is what T9 stated


1.Please briefly explain your understanding of sustainable and unsustainable agricultural practices

Sustainable practices: these are agricultural practices which does not damage the environment the agricultural resource such that the future generation will benefit. Unsustainable: those practices which does not conserve/preserve agricultural resources for the future

The extract depicts that sustainable agriculture practices are the practices that do not damage the environment but take care of it so the future generation can get a fair share.

The following extract shows the interview between the researcher and T9

R: How are the needs of the present and future generations met with sustainable agriculture practices?

T9: By not damaging, the resources but they should be used efficiently to benefit the present and the future generation

R: Which concepts do you usually consider when taking care of the environment in your school?

T9: soil conservation, soil structure maintenance, soil drainage improvement and humus content improvement.

R: Do you think sustainable practices are better than unsustainable practices?

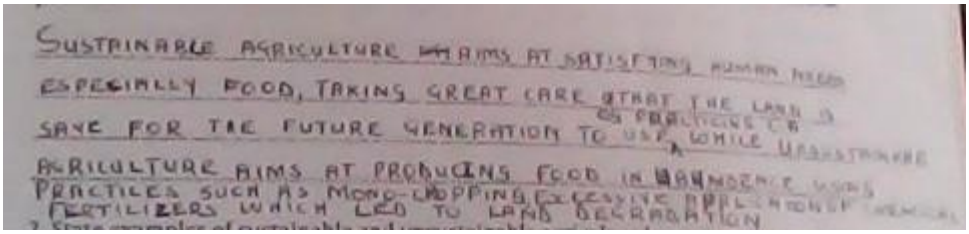
T9: Yes, because they help to maintain the resources that are damaged during unsustainable practices

R: Do you see any contradiction between sustainable and unsustainable practices?

T9: No, there are contradictions as each practice deals with different thing

The above extract depicts what T9 is saying about the sustainable and unsustainable practices for the future generation. T9 explains that the practices are not contradicting.

T14 argue that, sustainable practices mostly aim at making sure that the food is produced by taking care of the land so that the land is safe for the future generation to use whereas unsustainable practices do not care about the land and the future needs. This is what T14 indicated



T14 mention that sustainable agriculture aims at producing more food for people by taking care of the land so that future generation get fair share. The unsustainable practices using methods that destruct the land making the future generation to suffer.

This shows an interview between T14 and the researcher

R: How is the environment taken care of so that needs of the future generation is met?

T14: The land should be conserved by using practices that do not damage it like mono-cropping and continuous cropping

R: Do you think these practices, which damage the land learners, are aware of them as the bad practices?

T14: Yes, because they are taught at LGCSE together with the good ones

R: Do you see them as the practices that should be taught as they damage the land?

T14: No because they are bad practices that damage the land

R: Can you say the topics are contradicting the way you have explained them?

T14 No they are not because they talk about different things

In the extract above, the teachers are stating the importance of sustainable practices over unsustainable practices.

4.3 Teachers teaching of sustainable and unsustainable practices

Teachers' introduced various strategies of teaching sustainable and unsustainable practices. Their responses have demonstrated a number of strategies they use when teaching.

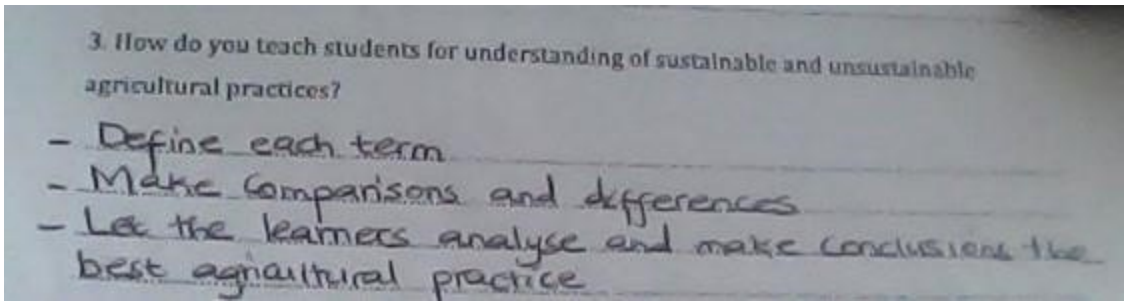
4.3.1 Classroom discussions

4.3.2 Farm visits/ Field trips, charts and videos

4.3.3Demonstrations

4.3.1 Classroom discussions

T12 showed that when teaching the learners are given chance to discuss the content of the lesson by defining, making similarities and differences about the concept of sustainable and unsustainable practices. The learners are the ones making the conclusion on the practices. The extract below demonstrates what T12 said


3. How do you teach students for understanding of sustainable and unsustainable agricultural practices?

- Define each term
- Make comparisons and differences
- Let the learners analyse and make conclusions the best agricultural practice

The extract above indicate that T12 has the procedure followed when teaching sustainable and unsustainable practices for easier understanding of the concepts. The procedure gives the learners' chance to make their own analysis and conclusions about the practices during the lesson.

On the same extract when interviewed, T12 explained that she is the one making conclusions as the learners could bring about many answers which are not correct. The learners are permitted to raise their points and the teacher is the one who will come up with the last answer in the class.

The following extract demonstrate an interview between the researcher and T12

R: Do learners make reasonable analysis of the practices?

T12: not always but I am usually the one who makes the last decisions all the time before the end of the lesson

R: Can you say this kind of teaching help them to learn and understand better? T12:

Yes, because they do not forget what they had been arguing about easily even

R: Is this kind of teaching not time consuming?

T12: Yes, but we do practice it when we have double lesson

Interview between the researcher and T5

R: Do you think the procedure you mentioned is good for understanding of sustainable and unsustainable practices?

T5: Yes, because it is learner centered and they are the ones making conclusions

R: Do you take the answers as they are from the learners

T5: No, I only take the reasonable ones before making conclusions

R: How do you monitor the noise in the class during the discussion?

T5: Each group has the supervisor who makes sure that everything goes smoothly during the lesson

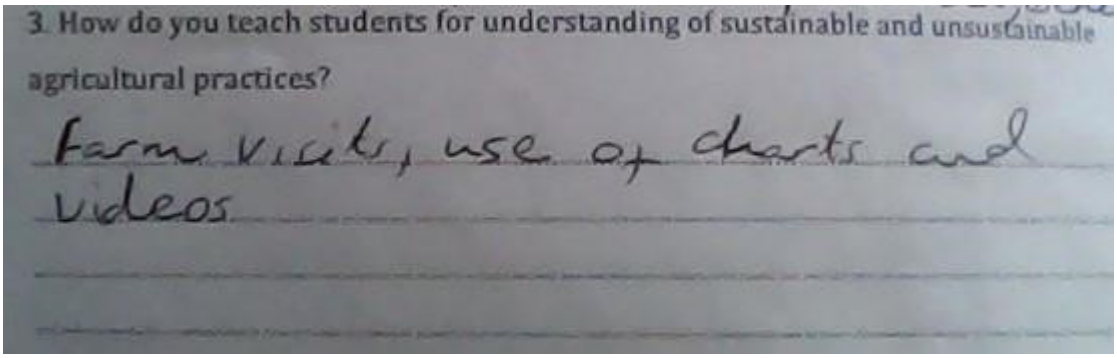
R: What is your duty then in the class during the lesson?

T5: To wait for the groups to present their work so that I can conclude the lesson

The above extract clarify the procedure followed when teaching sustainable and unsustainable practices. In the extract, is what is said by T12 and T5.

4.3.2 Farm visits/field trips, charts and videos

On the questionnaire some teachers, n= 3 (T10, T1 and T6), expressed that they prefer to use farm visits or field trips when teaching sustainable and unsustainable practices. They also included the use of charts and videos when teaching. The extract below summarizes what they said



The above extract indicates the teaching strategies teachers prefer to use when teaching sustainable and unsustainable practices. They know what to do for effective teaching of sustainable and unsustainable practices.

Interview between the researcher and T10

R: In the questionnaire, it was not clear what are farm visits, can you explain them

T10: They are trips taken to the farmers' fields so that the learners understanding is improved

R: Do you find this strategy good for teaching the contradicting topics in the curriculum like tillage practices?

T10: Farm visits are the best strategies when it comes to teaching of practices that seem confusing the learners. They will get chance to ask where they did not understand in class

R: You mentioned the use of videos to teach, how often do you use it?

T10: The video is not used very often due to lack of electricity in my school even though it is the good strategy for teaching

Interview between researcher and T6

R: Why do you prefer using farm visits and videos yet you can just use chart that is available at school all the time?

T6: Sometimes it becomes difficult for learners to understand the concepts when done in class but understand it better when done outside school premises R: How often do you practice these strategies?

T6: I do them once in a year due to financial problems.

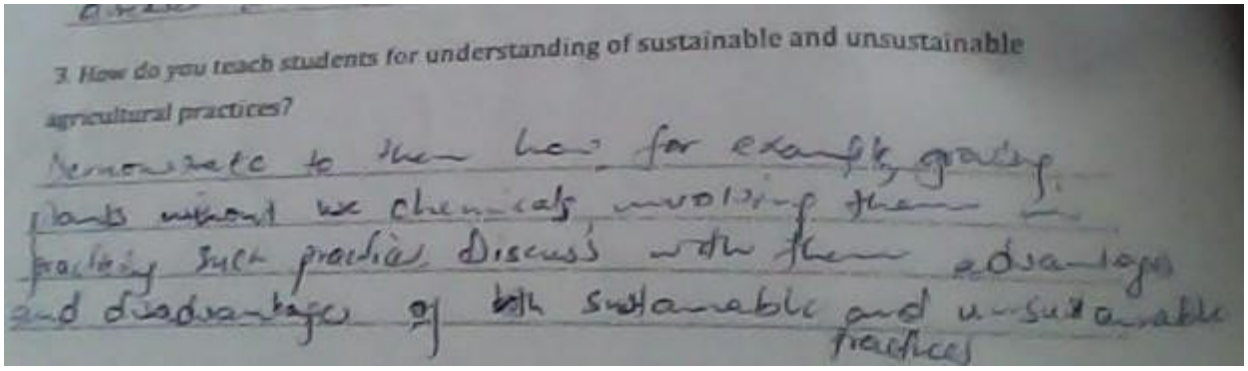
R: Why do you say learners understand the concepts better when using farm visits or video tapes?

T6: They show interest of the concepts than when taught by the same teacher all the time. They ask many questions than when in the classroom

From the above extract, it is revealed that T10 and T6 when interviewed about farm visits and video tapes indicated that they are good strategies of teaching, as it is easy for learners to see everything being taught.

4.3.3 Demonstrations

Some teachers, n=4, said they use demonstrations to teach sustainable and unsustainable practices. The learners are shown the advantages and disadvantages of each practice for better understanding. The extract below is what T9 said



The above extract points out that teachers, n=4, know the strategies that suits them for effective teaching of sustainable and unsustainable practices. The following extract is an interview between the researcher and T15

R: Why do you choose to use demonstrations?

T15: Because I can show my learners everything we are talking about in class by demonstrating to them by either using the demonstration plots

R: Is it not time consuming to use demonstration plots?

T15: No because we do not use them all the time as not all the concepts require thorough explanation

R: Do you see your learners' performance improving when practicing demonstrations?

T15: Their performance on the topic that we had demonstrated to them increases

Extract above reflects that teachers prefer to use demonstrations as the learners' performance improves.

4.4 Conclusion

In this chapter, the findings were presented from the questionnaire and follow-up interviews with regard to the teachers understanding of sustainable and unsustainable practices within the LGCSE agriculture curriculum. The next chapter will present the findings on teachers' knowledge of subject matter.

CHAPTER FIVE

Teachers Knowledge of Subject Matter and Teaching Strategies

5.1 Introduction

The previous chapter presented the findings on teachers understanding of sustainable and unsustainable agricultural practices. The findings were classified into two themes. This chapter presents the results of teachers' knowledge of subject matter on sustainable and unsustainable agricultural practices and the teaching strategies used.

5.2 Sustainable and unsustainable practices

Teachers were required to respond to four items based on aspects of sustainable and unsustainable practices. Table 4 below presents a summary of teachers' responses on these aspects of sustainable and unsustainable agricultural practices.

Table 4: **Summary of teachers' responses on aspects of sustainable and unsustainable practices**

	Item 1		Item 2		Item 3		Item 4	
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong
Total	17	1	18	2	13	7	19	1

Table 4 demonstrates that Item 3 is poorly performed with seven teachers choosing the wrong options. Item 1, 2 and 4 are performed better with 17 teachers who got Item 1 correct, 18 teachers got item 2 correct and 19 teachers got item 4 right. Two teachers did not respond to item 1. Table 5 below presents analysis of performance of 7 teachers who chose wrong option in Item 3.

Table 5: Analysis of 7 teachers' performance on all items

Teachers	Item 1		Item 2		Item 3		Item 4	
	Right	Wrong	Right	Wrong	Right	Wrong	Right	Wrong
1	D		B			A	A & B	
2	D		B			C	A & B	
11	D		B			B	A & B	
12	No response		B			C	A & B	
14	D			C		A	No response	
19	D		B			B	A & B	
20	D		B			C	A & B	
Total	6	0	6	1	0	7	6	0

Table 5 shows analysis of 7 teachers' performance on 4 items as they got item 3 wrong. Teachers' performance on item 3 made it important to examine their performance on the other items. From the analysis of item 3, it became important to analyze their performance on the other items. T14 got 2 items incorrect. He did not respond to item 4. This suggests worrying level of knowledge and understanding of sustainable and unsustainable agricultural practices. Another case is that of T12 who did not respond to item 1.

5.3 Justification of teachers' responses

The teachers were asked to justify their choices on item 1 to 4. The classification of responses is shown in table 6 below.

Table 6: Categories of teachers' justification on 4 items

Practice	Category
Sustainable practices	1.IPM, Organic production, climate change adaptive practices and soil conservation practices
Combination of sustainable and unsustainable practices	2.Inorganic production, IPM Soil conservation practices and non-climatic change adaptive practices

5. 4 Sustainable practices

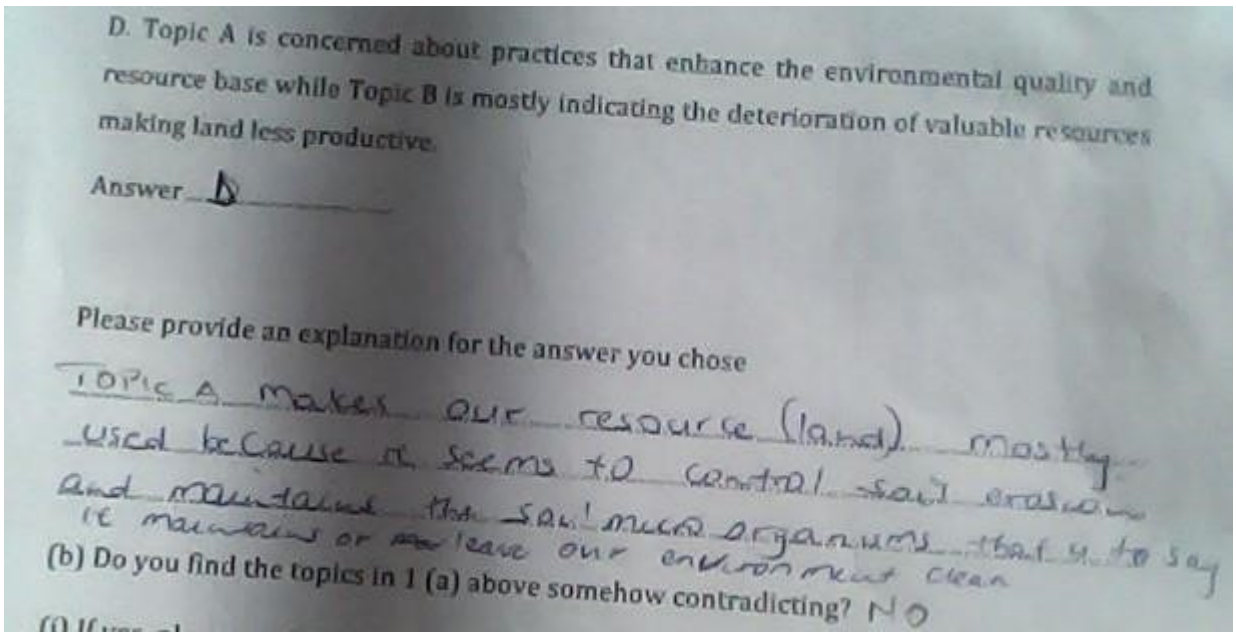
Table 6 above shows that some teachers selected responses related to sustainable agriculture practices using different justifications. These justifications are,

-soil conservation practices and climate change adaptive practices, and

-integrated Pest Management (IPM), organic production and soil conservation practices.

5.4.1 Soil conservation and climate change adaptive practices

The first meaning that was indicated by teachers (n=5) is soil conservation and climate change adaptive practices. The extracts from teachers show how they responded to the first item concerning the sustainable agriculture practice. T20 responded as follows when asked to choose the statement that best describes the sustainable and unsustainable practices:


D. Topic A is concerned about practices that enhance the environmental quality and resource base while Topic B is mostly indicating the deterioration of valuable resources making land less productive.

Answer A

Please provide an explanation for the answer you chose

Topic A makes our resource (land) mostly used because it seems to control soil erosion and maintains the soil micro organisms that is to say it maintains or we leave our environment clean

(b) Do you find the topics in 1 (a) above somehow contradicting? NO

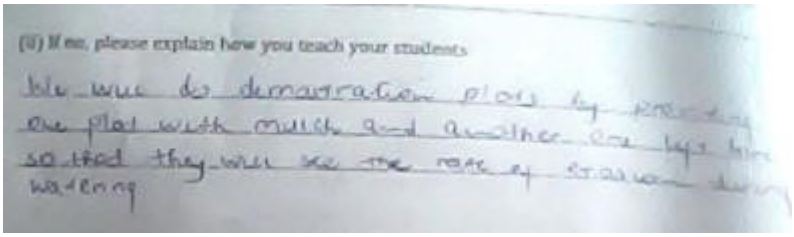
According to T20 topic A has the elements of sustainable agriculture practices, such as soil conservation practices, climate change adaptive practices and organic production. Even though

she did not state any unsustainable practice as required by the question, the explanation given is correct regarding the sustainable practice.

5.4.1.1 Teaching strategy

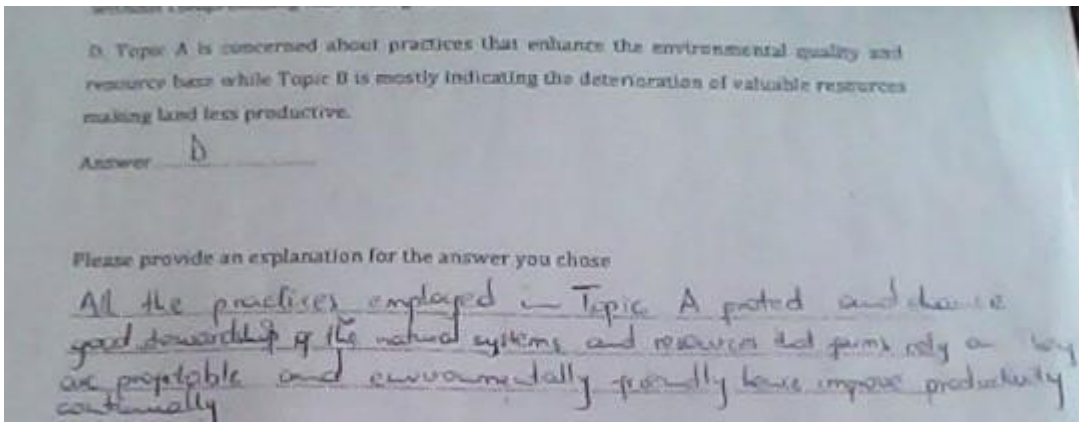
T20 was requested to indicate the teaching strategy she uses on item 1. She provided the following

response



The above extract indicate that T20 use demonstration plots when teaching the two topics that she indicated that they are not contradicting. The first plot is covered with mulch while the other one is not covered and these help learners to be able to see the rate erosion is high when watering.

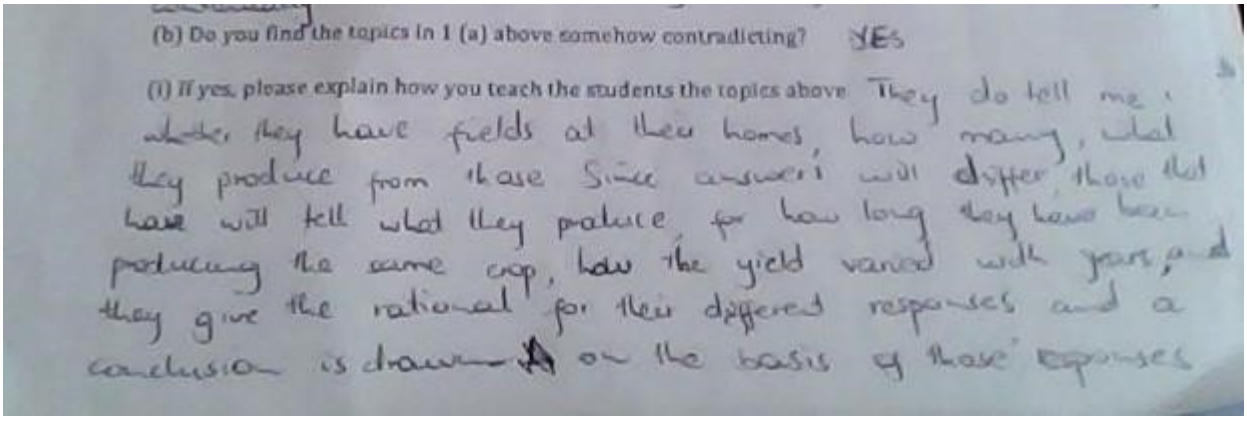
On the following extract, T13 is emphasizing on the same issue of soil conservation and climate change adaptive practices on item 1. T13 is highlighting the following reason for choosing D, as the correct option for item 1



The extract above clarify that T13 identifies the following aspects of sustainable practices; climate change adaptive practices, organic production and soil conservation practices

5.4.1.2 Teaching strategy

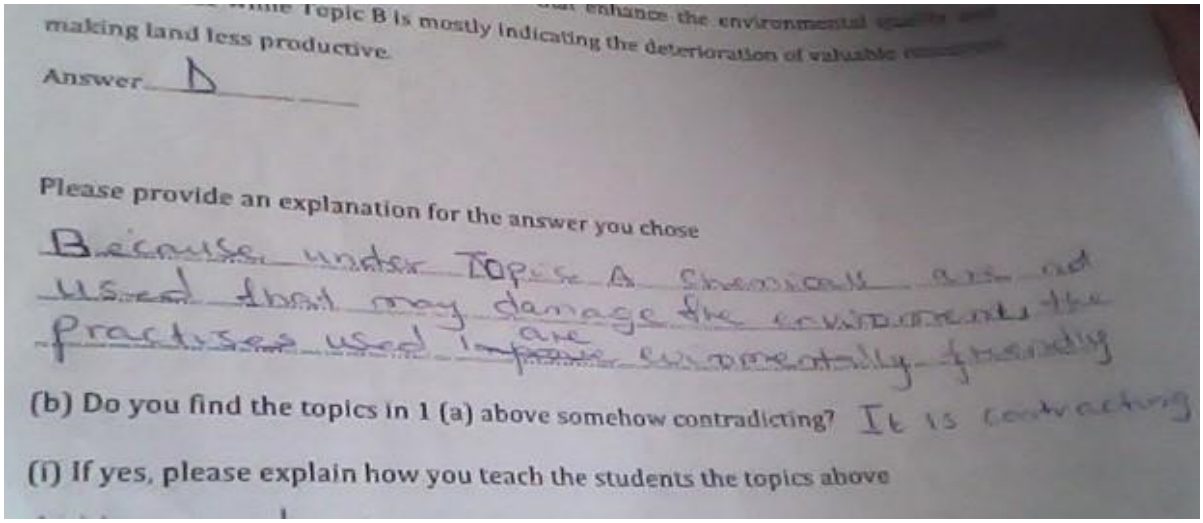
T13 is showing the procedure she uses when teaching learners, the two topics in item 1. This is what she said


(b) Do you find the topics in 1 (a) above somehow contradicting? YES

(i) If yes, please explain how you teach the students the topics above They do tell me whether they have fields at their homes, how many, what they produce from those Since answers will differ those that have will tell what they produce for how long they have been producing the same crop, how the yield varied with years and they give the rational for their different responses and a conclusion is drawn on the basis of those responses

According to the above extract, T13 sees the two topics contradicting. When teaching, she requests the learners to explain to her what they produce at their homes and ask them if they have the fields. The learners are asked to indicate how long they had been producing. The learners are also expected to show what kind of yield they get from fields and the conclusions are made from the learners' responses.

In this extract, T7 is adding the issue of chemicals about topic A. This is what she said


Topic B is mostly indicating the deterioration of valuable

making land less productive

Answer A

Please provide an explanation for the answer you chose

Because under Topic A Chemicals are not used that may damage the environment the practises used are environmentally friendly

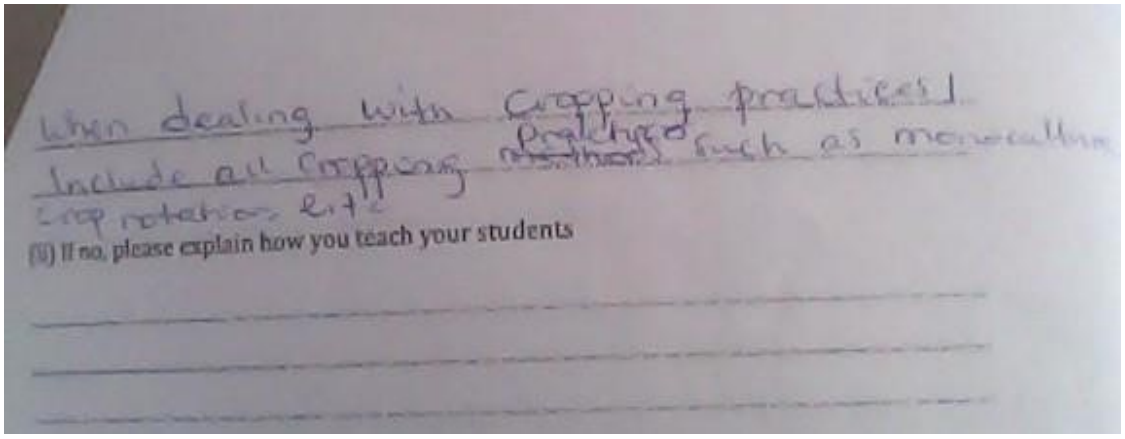
(b) Do you find the topics in 1 (a) above somehow contradicting? It is contradicting

(i) If yes, please explain how you teach the students the topics above

In the extract above, the option chosen was correct. According to T7 topic A, do not favor the usage of chemicals and the use of practices that do not degrade the environment. She is emphasizing on the issue of climate change adaptive practices. According to her, the topics are contradicting.

5.4.1.3 Teaching strategy

T7 in the following extract is showing the procedure she follows when teaching the two topics in item 1. This is what she wrote

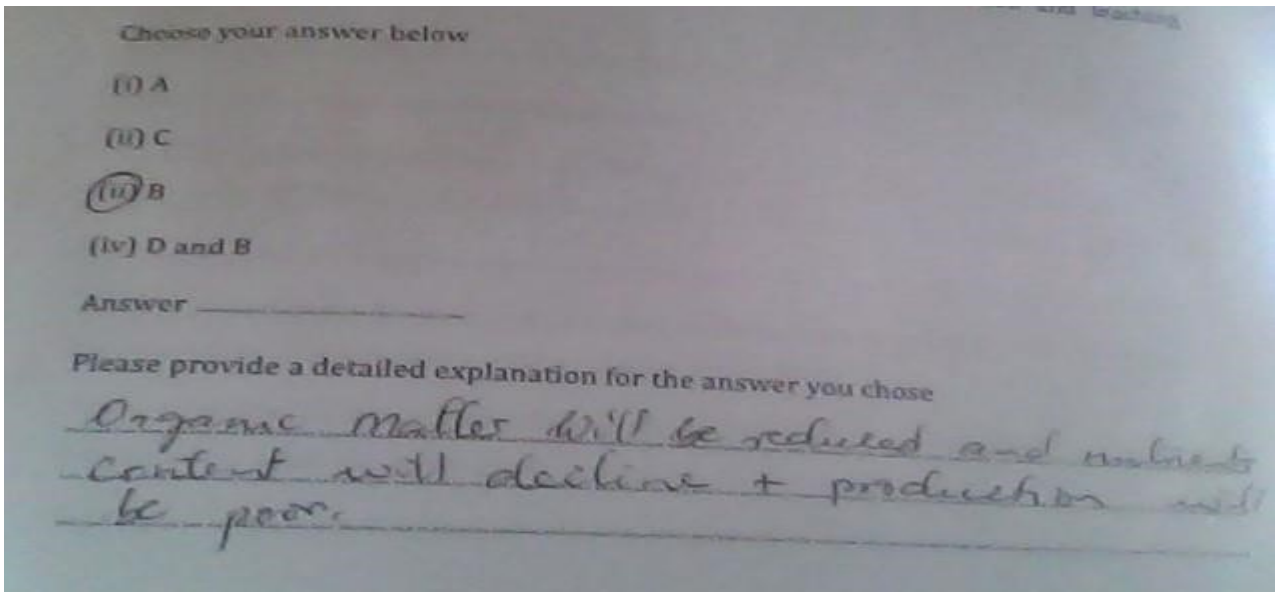


The extract above demonstrates what T7 do when teaching the two topics on item 1. She asserted that when teaching them, she includes all the cropping practices whether they damage the environment or not such as monoculture and crop rotation.

5.4.2. IPM, Organic production and soil conservation practices

The second meaning teachers had about the aspects of sustainable practices include, IPM, organic production and soil conservation practices.

The teachers gave justification on item 2 that requested them to choose the best statement that describes the effect of removing crop residues in the field. The right option was B and teachers (n=8) pointed IPM, organic production and soil conservation practices. T5 got the item right. This is what she wrote

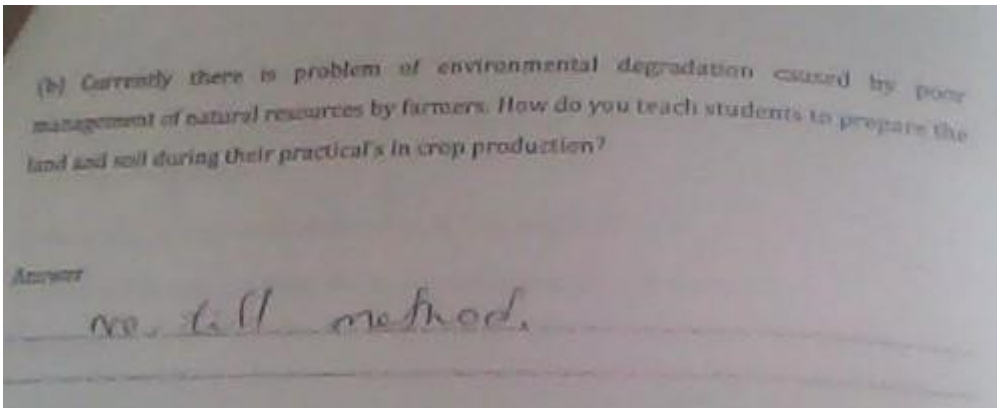


According to T5 when the crop residues are removed from the field, there will be reduction of organic matter. He added that the reduction would lead to poor nutrients and low production. In

this case, T5 is concerned about soil conservation and organic production, as crop residues are required for conserving the soil and increase nutrients that will help to produce food naturally without use of chemicals.

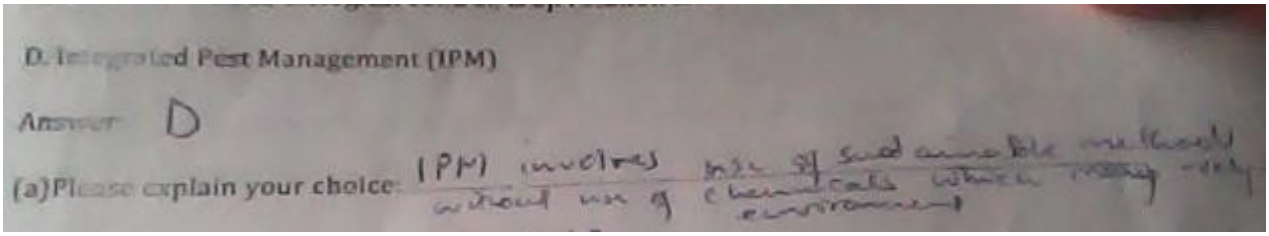
5.4.2.1 Teaching strategy

On item 2, teachers were also asked to show how they teach their learners organic production and soil conservation practices as aspects of sustainable practices. This is what T5 wrote



On the extract above, T5 have indicated that he uses no till method when teaching learners to avoid problem of environmental degradation due to removal of crop residues on the land.

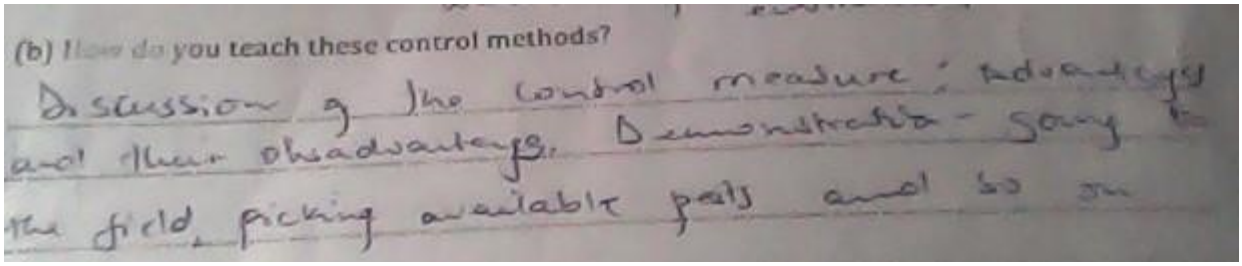
In the questionnaire, on item 3, the learners were requested to select the best methods that could be used for controlling weeds, pests and diseases. T9 got this item correct and provided the following explanation for the option she chose



According to T9, IPM is described as the method that involves use of sustainable methods without use of chemicals. She indicated no use of chemicals in IPM that may affect the environment.

5.4.2.2 Teaching strategy

The following extract is about how T9 teach the learners IPM for controlling weeds, pests and diseases in item 3



On the above extract, T9 is indicating the use of discussion method with advantages and disadvantages of IPM when teaching. Again, she practices demonstrations with learners by going to the field and pick the pests

5.5 Combination of sustainable and unsustainable agricultural practices

Some teachers (n=5) provided justification in terms of combination of sustainable and unsustainable practices. Their meanings are:

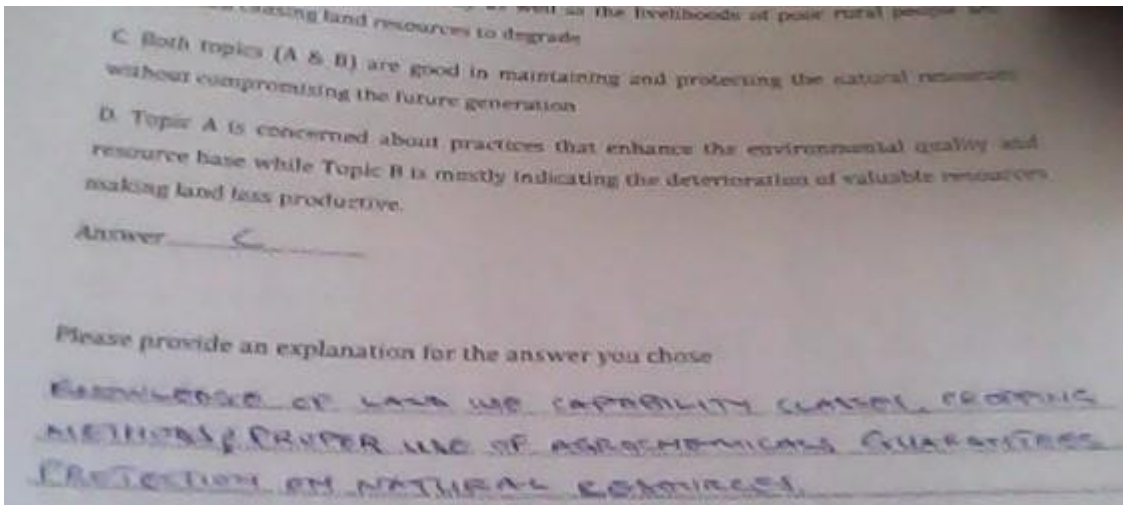
-inorganic production, soil conservation and non- climate change adaptive practices, and

-IPM and non–climate change adaptive practices

5.5.1 Inorganic production and soil conservation practices

The first meaning the teachers have about combination of sustainable and unsustainable practices was inorganic production, soil conservation and non-climate change adaptive practices.

On item 1, teachers were requested to select the best statement that describes the topics given in terms of sustainable and unsustainable practices. T18 selected the incorrect option and offered the following explanation

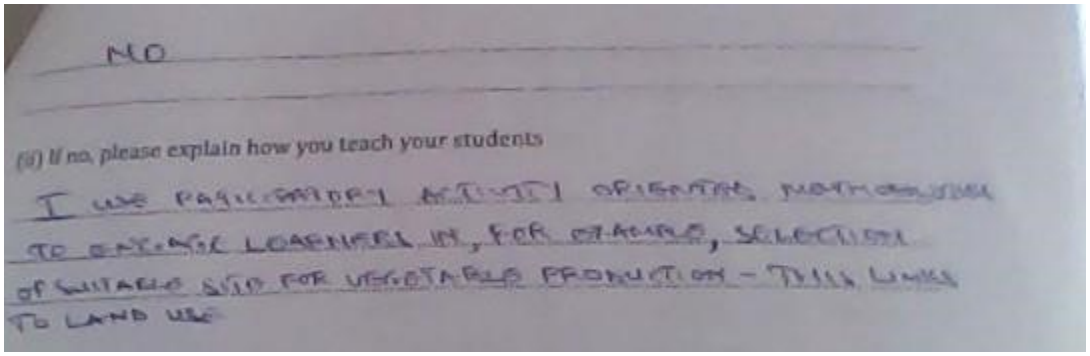


T18 selected a wrong option and the explanation for the choice he gave is showing the elements of both sustainable and unsustainable practices. His justification uses the inorganic production and non-climatic change adaptive practices as examples of unsustainable practices. On the other

hand, he talked of protection on the natural resources, which is aspect of sustainable practices such as soil conservation.

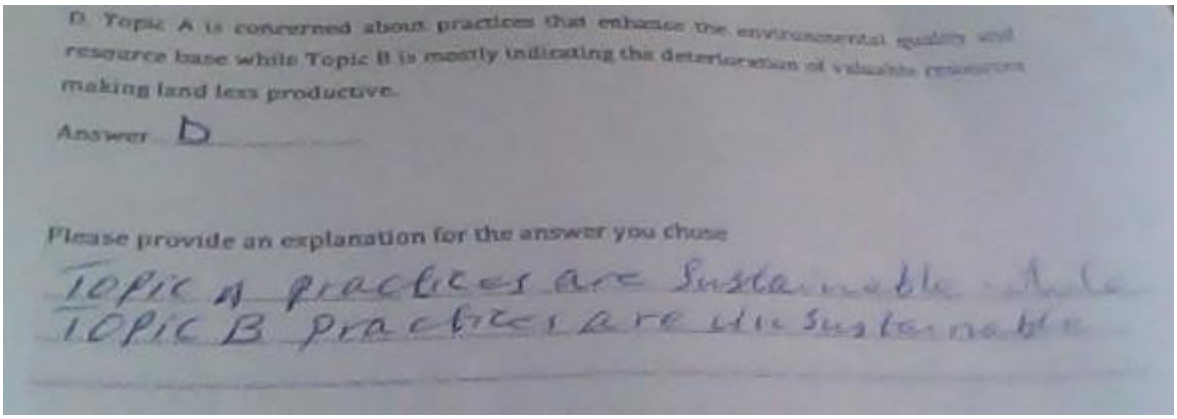
5.5.1.1 Teaching strategy

On item 1, teachers were asked to indicate if the topics are contradicting or not and explain how they teach them. T18 responded as follows



On the above extract, T18 is saying that there is no contradiction between the topics. He pointed participatory activity methodologies to teach learners for better understanding of the aspects of sustainable and unsustainable practices.

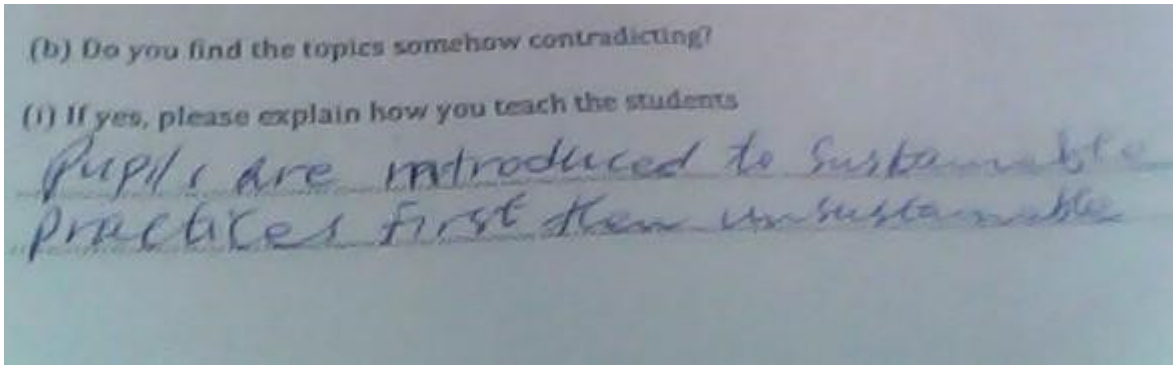
On the same item, T10 selected the correct item. On his explanation, he talked about both sustainable and unsustainable. T10's response is shown in the extract below.



T10 is indicating that topic A covers sustainable practices while topic B is concerned about unsustainable practices. He is showing the combination of sustainable and unsustainable practices.

5.5.1.2 Teaching strategy

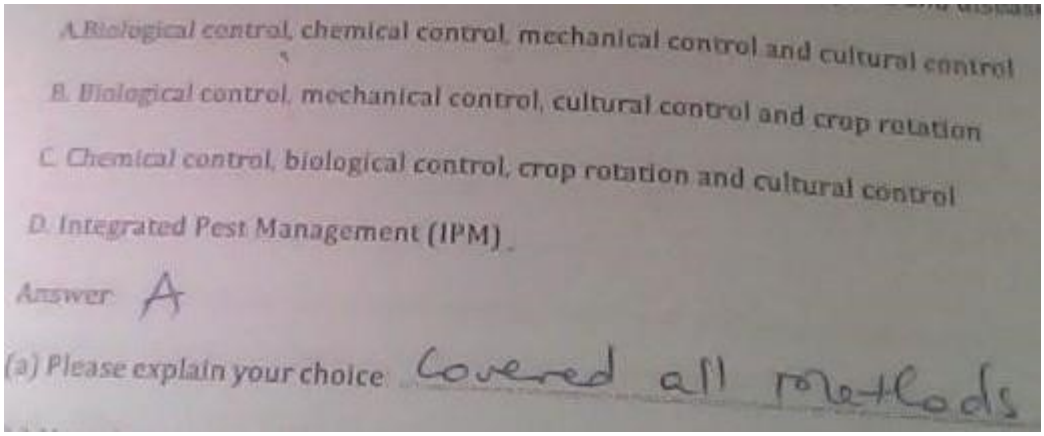
T10 was asked to explain the teaching strategy he uses when teaching the two topics and this is what he wrote



According to T10, the two topics are contradicting. He is indicating that the learners are taught sustainable practices followed by unsustainable practices.

5.5.2 IPM and non-climate change adaptive practices

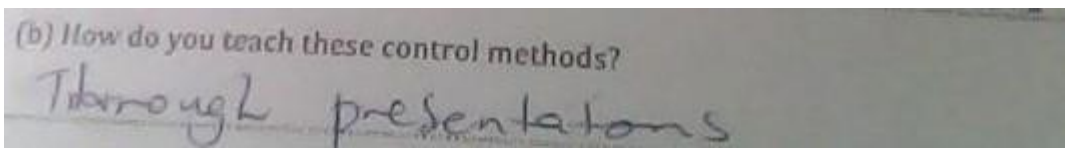
The second meaning teachers have about combination of sustainable and unsustainable practices was IPM and non-climate change adaptive practices. On item 3, T3 chose option A and provided an explanation for the choice she made. This is what she wrote



Option A that T3 chose is incorrect. T3 showed that the option consists of all the methods of pests, weeds and diseases control. They consist of both sustainable and unsustainable control methods. IPM was the correct option for this item as it focuses on long–term prevention of pests by managing the ecosystem.

5.5.2.1 Teaching strategy

Having analyzed explanation T3 gave about the option chosen on item 3, the teaching strategy she used is then presented in the following extract



The above extract indicate that T3 adopt presentations when teaching the learners.

5.6 Conclusion

This chapter presented findings from the questionnaire on four items from section C. The presentation was done based on teachers' knowledge of subject matter and the teaching strategies they employ. The analysis was on aspects of sustainable and unsustainable practices. The next chapter will present the discussion of the findings to answer the research questions and the recommendations will follow.

CHAPTER SIX

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter presented findings on knowledge of subject matter. They showed that most teachers are not aware of the contradictions in the curriculum. In particular, teachers did not see contradiction in sustainable and unsustainable agricultural practices in the curriculum. The results further show that most teachers use classroom discussions, demonstrations and field trips when teaching sustainable and unsustainable agricultural practices.

This chapter presents discussion, conclusions and recommendations. The purpose of the study was to investigate how LGCSE agriculture teachers implement the contradicting agriculture curriculum on sustainable and unsustainable practices. The study also established if the participating teachers are aware of the contradictions in LGCSE agriculture curriculum. This study intended to answer two research questions, to what extent are teachers aware of the contradictions in the curriculum and how they teach the contradicting topics.

6.2 Findings

This section is organized into three themes that emerged from the analysis of the data. Firstly, the understanding and awareness of sustainable and unsustainable agricultural practices in LGCSE curriculum. Secondly, teaching of sustainable and unsustainable practices and lastly, teachers' knowledge of the subject matter.

6.2.1 Teachers' understanding and awareness of sustainable and unsustainable practices

The understanding and awareness of sustainable and unsustainable practices in the curriculum is of great importance for teachers particularly because sustainable practices are crucial in schools' agriculture curriculum (William, 2000). According to the results, most teachers understand the concepts of sustainable and unsustainable practices. The richer understanding of the difference between the two practices is needed for better implementation of the curriculum. De Clercq (2009) argue that teachers need competencies such as subject knowledge, pedagogical and societal knowledge that will enable them to understand appropriate nature of curriculum when teaching.

The results show that teachers' conceptions of the practices is categorized into three meanings; namely, meeting the present and the future, sustained and continued production of food. The

findings in the study show that some teachers conceptualize sustainable agriculture practices as the practices that bring about sustained food supply without any damage to the environment and unsustainable agriculture practices as the practices that damage the environment. According to National Research Council (2010), in order to meet growing global food demand, all agriculture systems must become more sustainable. For this goal to be accomplished, tomorrow's farmers must be knowledgeable about sustainable agriculture practices (Zhenmian, Bixia & Nagata 2013).

The teachers' understanding means that they can disseminate the idea of sustainable agriculture to the learners as the future generation. According to Barrick and Garton (2010), agriculture teachers are expected to have both breadth and depth of content knowledge and are often looked to as the content experts in the communities in which they teach.

Some teachers indicated that they understand sustainable practices as the concept that deals with continued production of food. When interviewed, they indicated focusing on techniques like growing crops that can create their own nutrients to reduce the use of chemical fertilizers that will eventually reduce the use of pesticides on the land. Cordell (2011) posits that more sustainable agriculture practices must emerge to conserve and preserve resources. The teachers raised the point of the connection between the conservation agriculture practices and the minimal harm to the environment. They said that if the practices that keep and protect the environment are adopted there will be less disturbance to the environment and the nutrients will be maintained bringing about continued production of food.

The study has found that some teachers refer to sustainable agriculture practices as those practices that meet the present and future needs. According to Brennan and Withgott (2005), the purpose of sustainable agriculture is to ensure healthy and sufficient supply of food for the current and future generations by optimum use of the available natural resources. World Bank (2018) shows that agriculture in Lesotho depends on unsustainable agricultural practices such as mono cropping and overgrazing which result in land degradation. In this case, the future generation will not get a fair share of the natural resources if the practices are continually practiced in the country.

The results indicated that teachers do not observe any contradiction between sustainable and unsustainable practices in the curriculum. Although they understand the differences, teachers have shown that they see each concept as independent of the other. These results indicate that the teachers do not see any contradictions when these practices are both included in the

curriculum. During interview session, some teachers argued that each practice have its own advantages and disadvantages hence they do not contradict. According to Sameipour (2017), teachers have less information about sustainable practices. The teachers less knowledge on the two practices may the reason most of them do not see practices contradicting. Conroy (2000) argue that teachers perceive themselves as having limited knowledge regarding sustainable agriculture.

However, some teachers have shown that there is a contradiction in the curriculum between the two practices. They added that the unsustainable practices bring harm to the environment. When interviewed, the teachers raised a concern of the environmental degradation when unsustainable agricultural practices are employed.

6.2.2 Teaching of sustainable and unsustainable practices

Some studies concerning the teaching of sustainable agriculture by high school agriculture teachers and extension educators had been undertaken (Agbaje et al, 2001; Koralalage, 2001; O'Sullivan, 2000; Udoto & Flowers, 2001; Williams, 2000). The findings indicated different approaches teachers suggested for teaching sustainable and unsustainable practices. These approaches included classroom discussions, farm visits, trips, charts, videos and demonstrations. The selection and use of the said methods or techniques depend on teachers' perceptions and understanding of how to facilitate learning (Cano, 2005; NRC, 2013). This means the teachers may deliver content to learners, modify it to make it interesting or they may collaborate with learners to create activities that align with learners needs. Teachers' knowledge determines their decisions on instructional methods, materials and activities (Skott, Mosvold & Sakonidis, 2018).

The results show that the most used strategy is classroom discussion followed by demonstrations and lastly field trips or farm visits. Some teachers indicated that they use classroom discussions to teach sustainable and unsustainable practices. The claim that this strategy is learner–centered and can help learners to understand better. Shulman (1986) argues that effective teaching involves knowing the appropriate teaching approaches that fit the content, as well as knowing how elements of the content can be arranged for better teaching. According to Denby (2012) teachers self-knowledge together with the belief in the subject will often influence how that subject is taught. During classroom discussion, Teacher 5 and Teacher 15 indicated that the learners are requested to work in groups so that they can come up with answers on the issue being discussed.

From the results, the respondents showed that the learners are taken to the farmers' fields or farms to teach them the concepts of sustainable and unsustainable practices that were introduced in the classroom. The use of the charts and videos are used even though the videos are not usually shown to learners due to lack of the equipment used. The respondents showed that the learners understand better, when they see what is taught. According to Sitinci and Morish (2011) agriculture lessons should include hands-on- activities for easy retention of the concepts. It is good for agriculture to be learned by visiting other places, as it is a practical subject. Harper (2004) assert that agriculture teaching generally takes place not only in a classroom and laboratories but also in the school farm.

6.2.3 Teachers knowledge of subject matter

This study also sought to find out teachers' knowledge of sustainable and unsustainable agricultural practices. The study will also discover how they make use of that knowledge to promote learning during lesson presentation. Knowledge of subject matter has a very important role in teaching because high quality teaching rests on teachers understanding of the subject he or she teaches. According to Gess Newsome and Lederman (1999) subject matter is essential for the selection and evaluation of teaching materials and resources.

The findings of the study revealed that most teachers have adequate knowledge of sustainable and unsustainable practices. According to the findings by Mishra and Koehler (2006), the subject matter knowledge by teachers is important in teaching. They emphasized on the need for teachers to have a good understanding of the topics that they intend to teach. Furthermore, the teachers' adequate knowledge of the subject matter may be linked to their professional qualifications including experience.

Despite the good knowledge from other participants, some teachers did not perform well. According to Kind (2014), teaching without comprehensive understanding of the necessary content knowledge has a negative effect on the teaching and learning process, which also affects the choice of teaching methods to be used. Barrick and Garton (2010) argue that for better teaching, teachers are expected to have in-depth content knowledge of the subject matter for better student learning. Jadama (2014) argues that a teacher who is uninformed about subject content can pass inaccurate ideas to learners.

The justifications teachers gave were categorized into different meanings related to sustainable and unsustainable aspects. The higher number of learners when responding to questions that require them to explain their responses gave meanings related to sustainable practices. The

smaller number of teachers who were giving the meaning related to the combination of sustainable and unsustainable practices.

Rogan and Grayson's theory (2003) of curriculum implementation propose that for effective implementation of the curriculum, teachers' need to be competent. From the results, it is clear that all the teachers are qualified to teach LGCSE agriculture and this means that they have the required knowledge of the subject. The results revealed that some teachers got all the items correct. This shows that more than half of the participating teachers' are able to express their knowledge and skills when teaching. Teachers' knowledge of the curriculum content and pedagogy shapes how teachers execute their tasks of implementing the curriculum (Fullan, Cuttress & Klicher, 2009). When looking at the analysis of LGCSE agriculture results in chapter one from Ecol, the learners' performance is poor even though the teachers portray good SMK.

The reason for poor learners' performance might be brought by teachers' teaching without the comprehensive understanding of the necessary content knowledge which can have a negative effect on the teaching and learning processes that will also affect the choice of teaching methods used (Kind, 2014). The teachers of agriculture must be able to deliver the content of sustainable agriculture to learners effectively as this will indicate that they have the required content knowledge.

6.3 Recommendations

The discussion above necessitates the following recommendations:

- Since the study was carried out in one district, it could be important to carry out a similar study in more than one district
- Teachers need more training on sustainable agriculture before they can teach it in their curriculum
- Future research is required to find out if the teachers from other schools will not see contradictions in the curriculum regarding sustainable and unsustainable practices in LGCSE curriculum.

6.4 Limitations

The covid-19 pandemic lockdowns affected the completion of the study on time. The initial plan was to use questionnaire, observations and follow-up interviews to collect data. Observations were not used to collect data due to the lockdown. This affected the triangulation of data. The

researcher believes that use of observations could have shown exactly the teachers' SMK and PCK.

6.5 Conclusions

This chapter presented the discussion of the results and recommendations. The study focus was on how LGCSE agriculture teachers implement sustainable and unsustainable agricultural practices. The study results revealed that most teachers understand sustainable and unsustainable agriculture practices. The study also revealed that most teachers are not aware of the contradictions in the curriculum and they conduct classroom discussions and demonstrations when teaching learners about sustainable and unsustainable practices.

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APPENDICES

Appendix 1
Consent Form

Master of Science Education (Agriculture) student at National University of Lesotho is conducting this study. You are invited to participate in this study by responding to the questions. The results will be used for academic purposes only. The researcher is making a commitment that names of participants and schools will not be disclosed.

The questionnaire is aimed at investigating how participants teach sustainable and unsustainable agricultural practices in LGCSE Agriculture Curriculum. The findings of the study will help to improve the curriculum mostly concerning sustainable agriculture. Please spend a few minutes of your time to complete the questionnaire as honestly as you can. Your contribution is highly appreciated.

Signed by …….Date……..

Appendix 2

OPEN-ENDED QUESTIONNAIRE

Master of Science Education (Agriculture) student at National University of Lesotho is conducting this study. You are invited to participate in this study by responding to the questions below. The results of the study will be used for academic purposes only. The researcher is making a commitment that names of participants and their schools will not be disclosed.

The questionnaire is aimed at investigating how participants teach sustainable and unsustainable agricultural practices in LGCSE Agriculture curriculum. The findings of the study will help to improve the curriculum mostly concerning sustainable agriculture. Please spend a few minutes of your time to complete the questionnaire as honestly as you can. Your contribution is highly appreciated.

Section A: Personal Details

Name of school: ……Cell: ……...

Write or circle answer for each personal detail questions in the first column of the table below.

Personal details	Write or circle your answer in this column
1. What is your gender?	(i) Male (ii) Female
2. (a) How long have you taught agriculture? (b) Which levels?	Write; …… …… JC only ……. JC and LGCSE …….
3. What is your highest level of qualification?	(i) Diploma (ii) Bsc (Agriculture) (iii) PGDE (iv) Msc Ed (v) Other (please specify) ……

Section B

Please write your answer on the spaces provided

1. Please briefly explain your understanding of sustainable and unsustainable agricultural practices

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2. State examples of sustainable and unsustainable agricultural practices that you know in the curriculum

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3. How do you teach students for understanding of sustainable and unsustainable agricultural practices?

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4. What challenges do you encounter when teaching these practices?

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Section C

Please read the question and select the correct answer

1.(a) Topic A (Land uses including crop rotation, plantation of cover crops, intercropping and agroforestry practices) and Topic B (cropping practices including usage of chemicals or herbicides, monoculture and continuous cropping) are included in LGCSE agriculture syllabus.

Which statement best describe these topics in terms of sustainable and unsustainable practices?

A. In topic B, the practices done on the land enhance environmental quality and resource base on which agriculture depends.

B. In topic A, future food security as well as the livelihoods of poor rural people are threatened causing land resources to degrade

C. Both topics (A & B) are good in maintaining and protecting the natural resources without compromising the future generation

D. Topic A is concerned about practices that enhance the environmental quality and resource base while Topic B is mostly indicating the deterioration of valuable resources making land less productive.

Answer……

Please provide an explanation for the answer you chose

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(b) Do you find the topics in 1 (a) above contradicting?

(i) If yes, please explain how you teach the students the topics above

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(ii) If no, please explain how you teach your students

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2. (a) Land preparation and soil preparation by primary and secondary tillage are done before sowing which make the surface residues to be not easily managed.

Please indicate the best statement that describes the effect of removing crop residues in the field

A. The soil fertility will be improved bringing about high-quality production

B. Reduction of soil organic matter and therefore decline in soil structure

C. Weeds are removed because they are the most costly category in agriculture

D. Soil particles become far apart from each other and infiltration and leaching decreases

Choose your answer below

(i) A

(ii) C

(ii) B

(iv) D and B

Answer ……

Please provide a detailed explanation for the answer you choose

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(b) Currently, there is problem of environmental degradation caused by poor management of natural resources by farmers. How do you teach students to prepare the land and soil during their practical's in crop production?

Answer

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3. For healthy plant growth, plants need to be protected from weeds, pests and diseases. Plants need to be protected when they are still growing, during harvest and storage.

Select the best methods that can be used for controlling weeds, pests and diseases

A. Biological control, chemical control, mechanical control and cultural control

B. Biological control, mechanical control, cultural control and crop rotation

C. Chemical control, biological control, crop rotation and cultural control

D. Integrated Pest Management (IPM)

Answer:

(a)Please explain your choice ……

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(b) How do you teach these control methods?

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4. Soil conservation is an important part of sustainable and food production since it entails prevention of soil loss and increased soil fertility.

Study carefully the descriptions below and indicate what makes soil conservation best concept of sustainable agriculture

Select your answer below and provide an explanation of the answer you choose

A. Response to the decline in the quality of natural base resource

B. Prompt major adjustments in conventional agriculture and make it more environmentally viable

C. Continuous use of chemicals to maintain food production

D. Farming that does not make efficient use of non-renewable resources

(i) A and B

(ii) A and C

(iii) B and D

(iv) C and D

Answer: ……

Explanation:

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Please explain how you teach …….....

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