EFFECTIVENESS OF TEACHING AND LEARNING AGRICULTURAL SCIENCE SUBJECT IN SELECTED SECONDARY SCHOOLS IN TANZANIA

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ABSTRACT

Teaching and learning of Agricultural science subject in secondary schools have flourished over the past decades in many developing countries. The rationale for teaching the subject and the basis for its popularity is to permit students a wider set of future career options particularly farming and farming related careers than is offered by the usual academic or general subjects. Thus, this study was conducted to investigate the effectiveness of teaching and learning Agricultural science subject in selected ordinary level secondary schools in Tanzania. The specific objectives were to: assess the availability and adequacy of resources of teaching and learning; determine the adequacy of process used in teaching and learning; determine students' knowledge, skills and attitudes acquired and determine the potential for improving teaching and learning. Data were collected from 100 student respondents, 20 Agricultural science teachers, 16 key informants and various documentary sources using questionnaires, researcher's diary and checklists. Quantitative data were analysed using Statistical Package for Social Science (SPSS) computer programme and qualitative data were analysed by using content analysis technique. The study found that the process of implementing teaching and learning Agricultural science subject was far from what was intended by the curriculum. It was concluded that shortage of essential human and non-human resources lower teachers' productivity and students' achievement. It was therefore recommended that there is a need to foster the potential for continuing teaching and learning Agricultural science subject more effectively by revitalising Education for Self-Reliance (ESR) Policy which is still relevant in the country. The study also suggested undertaking further studies on effectiveness of teaching and learning Agricultural science subject in ordinary level secondary schools in other regions in order to enable generalisation of the observations.

DECLARATION

I, MARTHA WILLIAM TESHA, do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is my own original work done within the period of registration and that it has neither been nor concurrently being submitted in any other institution.

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LIST OF ABBREVIATIONS

CTLT	Constructivist Teaching and Learning Theory
DAECD	Department of Agricultural Extension and Community Development
EFA	Education for All
ESR	Education for Self-Reliance
ETP	Education and Training Policy
ICT	Information and Communication Technology
MDG	Millennium Development Goals
MoEST	Ministry of Education, Science and Technology
NECTA	National Examinations Council of Tanzania
NICHE	Netherland Initiative for Capacity Building in Higher Education
NS	New Schools
NSGPR	National Strategy for Growth and Poverty Reduction
OS	Original Schools
PO-RALG	President's Office, Regional Administration and Local Government
SC	Students' Counsellor
SEDP	Secondary Education Development Plan
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture
SUALISA	Sokoine University of Agriculture Laboratory for Interdisciplinary Statistical Analysis
TIE	Tanzania Institute of Education
UNESCO	United Nations Educational, Scientific and Cultural Organisation
URT	United Republic of Tanzania

CHAPTER ONE

1.0 INTRODUCTION

This study is on effectiveness of teaching and learning Agricultural science subject in ordinary level secondary schools in Tanzania. Secondary school agricultural learning is believed to play a pivotal role in promoting rapid economic growth by preparing students to enter the world of work or pursue further education and training in agriculture by preparing young people to participate more fully in their own social development and development of society (Laugo, 2009). The purpose of this study was therefore to investigate the effectiveness of teaching and learning Agricultural science subject in selected ordinary level agricultural secondary schools in Tanzania, and draw policy implications on possible ways for improving conditions for teaching and learning Agricultural science subject using existing curriculum and students' achievements of intended objectives in the study area and beyond.

1.1 Background Information

The teaching and learning of Agricultural science as a subject in secondary schools in the world reveals an evolution from vocational basis in the first half of the 20th century (Laugo, 2009). Interest in teaching and learning Agricultural science in secondary schools seems to be growing because many governments are seeking assistance to implement the subject (Laugo, 2009). The World Bank has been investing heavily in the implementation of Agricultural science subject in secondary schools but there have been limited studies on its effectiveness on economic development (World Bank, 2005). Because the Agricultural science subject weds academic or general subjects with some degree of vocational learning, students can develop not only vocational skills in the field of agriculture, but also cognitive skills to prepare them for university studies in agriculture (Yamada, 2001).

The motive behind the introduction of Agricultural science subject in secondary schools lies on the expectation of improving quality of life attached to secondary school education especially in developing countries (Bregman and Stallmeister, 2005). Therefore, the World Bank has encouraged the teaching and learning of Agricultural science as a development strategy and as a means to make the rapid expansion of secondary school education consistent with better match between skills learned in school and those needed in the students' families and societies (Psacharopolous and Zabalza, 1984). On this ground, different governments have introduced Agricultural science subject in their secondary schools to smoothen the transition to work particularly for the benefit of farm employment for those students whose secondary education schooling will be terminal (Benavot, 2006).

In Tanzania, the most important goal of secondary school education is to prepare students for life as adults and to impart knowledge, skills, qualities and attitudes which make them self-supportive individuals and productive citizens without closing their prospects for further education and training (Nyerere, 1967; URT, 1995; URT, 2005a). The goals of education in Tanzania have been aligned to the philosophy of Education for Self-Reliance (ESR) which in turn evolves into specific objectives of educational and subject levels (URT, 2005a). Currently, the education at ordinary level secondary schools in Tanzania is guided by a series of policies including the Education and Training Policy (ETP), Education for All (EFA), Secondary Education Development Plan (SEDP), Tanzania Development Vision, Millennium Development Goals (MDGs) and National Strategy for Growth and Poverty Reduction (NSGPR). These policies have been translated into an implementable form in the curriculum for ordinary level secondary school education of which the specific subjects' syllabi are the component (URT, 2005a).

Teaching and learning of Agricultural science subject in Tanzanian secondary schools is rooted in the philosophy of Education for Self-Reliance (Nyerere, 1967). The subject was introduced into ordinary level secondary schools in 1972 (URT, 1972; Isinika, 2002). There were three categories of agricultural secondary schools, namely; designated, model and other registered agricultural schools (Msuka, 1983). Designated secondary schools were schools assigned to teach Agricultural science subject in implementing the vocationalisation policy in 1972. Model secondary schools were those established in 1976 by the government of Tanzania with assistance from the government of the Republic of Cuba. They included Kilosa, Ifakara, Ruvu and Kibiti secondary schools. Other schools were those registered after 1972 as agricultural secondary schools under the criterion of being located in rural areas (Msuka, 1983).

The general objectives of Agricultural science subject are to: stimulate and sustain students' interest in farming; demonstrate that farming is a dignified and paying occupation; enable students to acquire basic agricultural knowledge, practical skills and attitudes; enable students to integrate agricultural knowledge and skills in solving agricultural problems of their families and societies; prepare students for employment in farming and/or further studies in agriculture (URT, 1997). Since the introduction of the subject in secondary schools in 1972 up to the time data for this study were collected it has been implemented for these intentions.

Agricultural science subject has been taught as a core subject in ordinary level secondary schools since its introduction in 1972 up to 2004 when the government phased it out. The reason for phasing it out was to avoid placing students prematurely into vocational programmes which might not meet their future career preferences as well as the teaching process of the subject which was thought to unable students to master both vocational and

cognitive skills at the end of the teaching and learning cycles, thus rendering them incapable of undertaking self or direct employment in the formal and informal sectors (URT, 2004). The government's decision to phase out the subject met with a lot of resistance from educational stakeholders whether it was appropriate decision or not, thus forced the government to reverse its decision. Consequently, the government through the Ministry of Education and Vocational Training decided to reinstate it as an optional subject in 2006 (URT, 2006). The reasons for reinstating the subject were the government to rescue the following importance suggested by the educational stakeholders: needs for science and technology; open market; globalisation; philosophy of Education for Self-Reliance; job acquisition in private and informal sectors; needs for the society at present; revival of subjects for academic and vocational training; and the need for good academic foundation from primary, secondary to tertiary level (URT, 2006).

For effective teaching and learning of Agricultural science subject in secondary schools, that is the one that will enable attainment of the intended goals and objectives by learners, curriculum for ordinary level secondary school education spelt the following prerequisites: (a) Agricultural science subject teacher who is committed, motivated and qualified in subject matter and pedagogy with 24 to 30 periods of 40 minutes per week and teacher to students ratio not exceeding 1:40; (b) Physical facilities such as well equipped library, Agricultural science laboratory, workshop, school farm and classrooms; (c) Implements and machinery resources such as tractors, ploughs and harrows; (d) Textbooks and other supplementary textual teaching and learning materials; (e) Learner centred teaching and learning approaches which encourage learners to become actively involved and taking responsibility of their learning in call for participatory and interactive teaching and learning techniques in the classroom together with assessment techniques which will probe students' understanding and critical thinking rather than their ability to return memorised

facts; and (f) School timetable which enable the subject to be taught and learnt in 6 periods each of 40 minutes, per week by use of the subject's syllabus (URT, 1997; 2005a).

1.2 Problem Statement and Justification

Education, particularly vocational education, Agricultural science subject inclusive, is seen as a tool for servicing the developmental needs of society. Education philosophers believe that the social, political and economic world outside the school can be changed, if not completely, then partly, by introducing vocational subjects in the content of school education curricula (Nyerere, 1967; Kadenyi and Kariuki, 2011). They also believe that schools' Agricultural science teaching and learning can influence learners positively towards farming and rural life (Isinika, 2002). However, the effectiveness of any teaching and learning is relatively a function of availability of quality teachers, effectiveness of curriculum implementation as well as perceptions and attitudes of learners and other key educational stakeholders towards the relevance of the curriculum (Young and Edwards, 2011; Amadi, 2012).

Attainment of the prerequisites of teaching and learning environment as well as achievement of teaching and learning objectives as a measure of effectiveness serves as a feedback mechanism to the development of educational programme (World Bank, 2012; UNESCO, 2012a). In Tanzania, since establishment, phase-out and reinstatement of Agricultural science subject in ordinary level secondary schools there has been limited studies done to ascertain its effectiveness. On the other hand, observation on achievement of secondary school education indicates that few graduates from agricultural secondary schools go back to villages to become farmers as the subject intends (Mwaikambo, 2011). Other studies such as that by Fundikira (2003) assessed on conditions for effective teaching and learning of Agricultural science subject in secondary schools. The study

found insufficient teaching and learning materials and facilities at Ruvu secondary school. Furthermore, Yauleni (2008) assessed the effectiveness of teaching the subject in five schools in Mbeya Rural District and found that students had some agricultural knowledge and skills and lecture and demonstration were predominant teaching methods. Little is known on assessment of Agricultural science subject in secondary schools and the curriculum itself. Furthermore, there is a doubt that the 2004 changes of phasing out the subject as a core subject and reinstating it in 2006 as an optional subject might have affected the subject's teaching and learning environment as well as stakeholders' needs and interests on the subject; as on phasing out some teaching and learning resources were shifted into other subjects and upon reinstatement it is not known if the subject gained its original momentum. The overall objective of this study therefore was to investigate the effectiveness of teaching and learning Agricultural science in selected agricultural secondary schools in Tanzania.

Currently, some secondary schools, including those which were teaching Agricultural science subject originally as a core subject, that is before phasing out and after reinstatement, as well as those new schools which were formerly not teaching the subject are also teaching it as an optional subject. To investigate the reasons of the government as well as those original and new schools to teach Agricultural science subject, one needs to investigate how the subject's intended objectives are being met in schools. The current study will therefore fill the knowledge gap on the teaching Agricultural science subject for effective learning the subject. Study findings will provide scientific knowledge and information for policy makers and other educational stakeholders for deciding and managing Agricultural science subject in the study schools and beyond.

1.3 Objectives of the Study

1.3.1 Overall objective

To investigate the effectiveness of the teaching and learning Agricultural science subject in selected agricultural secondary schools in Tanzania.

1.3.2 Specific objectives

(a) To assess availability and adequacy of the resources for teaching and learning Agricultural science subject in selected ordinary level secondary schools.

(b) To determine adequacy of the processes used in teaching and learning Agricultural science subject in selected ordinary level secondary schools.

(c) To determine students' knowledge, skills and attitudes acquired from implementing Agricultural science subject in selected ordinary level secondary schools.

(d) To determine the potential for improving teaching and learning of Agricultural science subject in selected ordinary level secondary schools.

1.4 Research Questions

Research questions of the study were as follows:

(a) Are the teaching and learning resources adequate for teaching and learning Agricultural science subject in selected ordinary level secondary schools?

(b) Are the teaching and learning processes used adequate for teaching and learning Agricultural science subject in selected ordinary level secondary schools?

(c) What are the knowledge, skills and attitudes acquired by students who were taught Agricultural science subject in selected ordinary level secondary schools?

(d) What is the potential for improving teaching and learning of Agricultural science subject in selected ordinary level secondary schools?

1.5 Definition of Key Terms

The key terms that will be frequently used in the text are defined here to provide a common basis for conveying meaning. These include secondary school education, Agricultural science subject, teaching and learning resources, teaching and learning processes as well as effectiveness of teaching and learning.

1.5.1 Secondary school education

Secondary school education is the level of education which is normally provided in secondary schools, taking place after elementary or primary education and it may be followed by higher education or vocational training (Mintiz *et al*., 2002). According to URT (1995) secondary school education is used to denote post-primary formal education offered to the persons who have successfully completed seven years of primary education and have met the requisite entry requirement. This study adopted URT's definition of secondary school education which in Tanzania is referred to ordinary level secondary school education.

1.5.2 Agricultural science subject

Agricultural science subject is the course of study which involves teaching about crop production, livestock management, soil and water conservation and various other aspects of agriculture such as nutrition which improves the quality of life for all people by helping farmers increase production, conserve resources and provide nutritious foods (Schultz *et al*., 2008). In this study, Agricultural science subject refers to a course of study in ordinary level secondary schools which is among optional subjects in the pre-vocational subjects' group which mainly deals with crop and livestock production as well as basics of agricultural mechanisation, economics and soil science.

1.5.3 Teaching and learning resources

Teaching and learning resources are all fundamental human resources, materials, equipment and facilities used to enhance effective learning (URT, 2005a). In this study, teaching and learning resources are essential human and non-human resources required to facilitate effective teaching and learning process. It includes textual and non-textual teaching and learning materials, teaching and learning facilities, Agricultural science subject teachers, timetable, and Agricultural science subject syllabus to facilitate teaching and learning Agricultural science subject in selected ordinary level secondary schools.

1.5.4 Teaching and learning processes

Teaching and learning processes are all the observable activities that take place between teachers and students in and out of classrooms in the school (Zhang, 2008). In this study, teaching and learning processes refer to actions necessary to accomplish a goal and objectives of Agricultural science subject in ordinary level secondary schools. It involves clarity of teaching and learning goals to students, strategies used in teaching and learning, interactions in teaching and learning, engagement in teaching and learning, assessment for teaching and learning as well as guidance and counselling with respect to Agricultural science subject in selected ordinary level secondary schools.

1.5.5 Effectiveness of teaching and learning

Effectiveness of teaching and learning is the impact that both classroom and out of classroom factors such as teaching and learning methods, teacher/learner expectations, classroom organisation and use of teaching and learning resources, have on students' achievement (Goe *et al.*, 2008). In this study, effectiveness of teaching and learning refer to the extent of the desired results of teaching and learning Agricultural science subject in terms of knowledge, skills and attitudes produced through the use of the recommended processes and resources.

CHAPTER TWO

2.0 LITERATURE REVIEW

This Chapter reviewed literature of other studies in order to provide a theoretical framework which guided the development of the study model on which analysis of data for the present study was based. It focuses on: empirical literature which includes: secondary school education, Agricultural science subject in secondary schools, Agricultural science subject curriculum, teaching and learning processes as well as teaching and learning resources; theoretical framework; and conceptual framework.

2.1 Empirical Literature

2.1.1 Secondary school education

Globally, education today is widely recognised as the most effective development investment a country can make. According to World Bank (2007), it is one of the critical pathways to promote social and economic development. It is central to the development of a better world. It raises economic development, reduces fertility rate, lowers infant and maternal mortality, improves the wellbeing of families, and ensures better prospects of education for children (Gachukia, 1999). Gachukia asserts that education promotes sound management of environmental resources such as water fuel, and is closely associated with the reduction of absolute poverty. He also argues that education increases participation in community and national affairs and in democratisation of societies. Thus, education has an important influence in the quality of human beings life. The development of human resource fundamentally depends on the level and intensity of formal and informal society but also for building human capabilities and opening up employment opportunities. Without education development can neither be broad based nor sustained (Sherry, 2010; Orodho *et al*., 2013).

There is increasing pressure on Ministries of Education throughout the world to extend additional education to all students (World Bank, 2005). Governments are acutely aware that in today's globalised society, knowledge and skills increasingly hold the key to a country's productive future (World Bank, 2005). However, in many developing countries, young people are held back due to a lack of opportunities to pursue education beyond the primary level (World Bank, 2005). Developing countries will need to turn their attention to expanding and improving secondary education to take advantage of its potentially transformational nature (World Bank, 2005; World Bank, 2007). There is consensus in the literature that secondary school education, long neglected, is now the fastest growing segment of the education sector (World Bank, 2005; World Bank, 2007).

Movement away from seeing primary education as the terminal level of the education towards policies that envisions widespread completion of lower and upper secondary as the goals of education system development are well underway in many Latin American, African, and Southeast Asian countries (World Bank, 2005). The change from the long-standing policy focus on primary education only came in 1995 when the donors' including the World Bank strategic focus began to shift to "basic" education which includes primary and lower secondary (World Bank, 2005). Students today need secondary education to provide them with the vocational, academic, and life skills to contribute to the economic prosperity of their countries. Yet, access to secondary education remains low throughout the developing world with stark regional differences (World Bank, 2005).

2.1.2 Agricultural science subject in secondary schools

According to Morris and Sheffield (1976), teaching of Agricultural science in secondary schools should aim at ensuring that the learner is exposed to and taught the basic principles that are important of agricultural production in the country and exposing and

involving learners in various practical and projects that will help them develop the necessary skills and abilities required in agricultural production. By the end of the Agricultural science course, the student should be able to develop an interest and awareness of opportunities that exist in the agriculture sector, create an understanding of agriculture and its importance at the household and national level, and demonstrate that farming is a profitable and dignified occupation and develop and improve the knowledge and ill basic agricultural practices. Other objectives are to provide a background for further studies in agriculture, develop self-reliance, resourcefulness, problem solving abilities and an occupational outlook on agriculture, promote good agricultural activities to enhance environmental conservation and good health, and take an active part in rural development by integrating agricultural activities in the curriculum. Morris and Sheffield (1976) further noted that despite periodic efforts of introducing Agricultural science into the schools in developing countries, penal and community demand for academic education leading to high status and pay of the modern sector has kept most schools within an academic teaching. Thus, as a means of escaping from agriculture and manual labour, schools remain oriented for the fortunate minority who gain access to the modern rather than to the vast majority who remain in traditional agriculture.

2.1.3 Agricultural science subject syllabus

The major emphasis in the Agricultural science subject syllabi across countries in the world is to enable students to develop positive attitudes towards agriculture so that they can see agriculture as a viable source of occupation that can lead to personal and community development. It aims to equip students with relevant agricultural knowledge, skills and attitudes. This is particularly important because it gives students a clear understanding that agriculture is a viable source of livelihood just like any other job in other sectors (Briseid and Caillods, 2004; Laugo, 2009). Contents in Agricultural science

subject syllabi are more or less similar, however, teaching and learning processes vary widely between and among the continents and countries. Studies in Benin, Burkina Faso, Ethiopia, Kenya, Mozambique and Rwanda revealed that topics in Agricultural science syllabi are mostly concerned with agricultural production, that is crop and livestock production, with few aspects of agricultural entrepreneurship, income-generating activities and agricultural processing and marketing (Vandenbosch, 2006). The studies further reported that the syllabi are always overloaded with classroom lessons on factual knowledge, at the expense of practical applications, especially if the subject is examinable (Vandenbosch, 2006).

The continued emphasis of Agricultural science in secondary schools is a response to tailor the secondary school education to prepare students for the kinds of existing jobs both in rural and urban set up (World Bank, 2008). This was aimed at redefining and restructuring the secondary school education to correspond to the needs of new economic reality. These views gain support from which focuses on qualitative education in which the youths acquire skills for reducing unemployment, poverty and promoting rural economic growth. Evidence from available literature show recognition of Agricultural science as one of the subject which geared towards economic and social realities of the day due to its capacity to generate employment. Bennell (2007) as well as Psacharopoulos (1985), McMahon (2000) and the World Bank (2009) are in the opinion that since 1970s and beyond the need for Agricultural science to harness the energy, skills and aspirations of youths towards the world of work has been recognised. Policy response will require working with stakeholders, households, and communities across the society both rural and urban in implementing an Agricultural science subject which can address the youth employment challenges.

The implementation of sustainable vocational and practical subjects like Agricultural science in secondary schools faces several challenges (World Bank, 2005) including domination of education policy makers by those who value more academic subjects, and relates status with abstention from practical and vocational skills. A major challenge facing Agricultural science is the recognition that evokes hopes for its beneficial effects as well as the cold reception by students and parents for its inclusion in the secondary school education curriculum. Agricultural science in schools should be seen as an avenue for developing vocational skills and preparing students to engage in production agriculture. Similarly as Love (1978) says, agricultural education has several benefits including developing the ability to secure a position which allows advancement in an agricultural occupation through further education.

2.1.4 Teaching and learning process

Process variable examines the actual activities that take place in and out of classrooms in the school. They comprise the observable behaviours of both students and teachers (Handre *et al*., 2009). As often assumed, the success of teaching is in the teachers hands; how and why the teachers behave in class affects teaching and learning of Agricultural science. The methods employed are either teacher-centred or student-centred learning. This refers to all observable activities that takes place between teachers and students in class, how teachers teach, how students respond and so forth. Xiarong and Thomas (2002) review on pedagogy and classroom practices revealed that the teacher-centred and student-centred teaching methods are basic to most theoretical and teaching propositions.

It is widely held that much of the success in teaching in classrooms lies in the teacher's hands because they are responsible in stimulating student's interest and in gearing the mood and flow of the class (Xiarong and Thomas, 2002). This is the final phase where the

outcome depends largely on the nature of the teacher's instructions and on the student's learning. It is the observable changes that come about in students as a result of their involvement in classroom activities with their teachers and other students. The teacher-centred teaching method is inclined to be more traditional where the teacher leads the class most of the time, while the student-centred teaching method takes on the more progressive channel that allows for students maximum participation (Petty, 2004). Process of teaching and learning involves teaching and learning strategies as well as teaching and learning resources. Thus teaching and learning process is therefore an important institutional factor affecting teaching and learning of Agricultural science in secondary schools.

2.1.4.1 Teaching and learning strategies in Agricultural science

Agricultural science subject is special in comparison with other subjects in that it cannot be learned solely in the field or solely in the classroom. Practical teaching and learning such as traditional apprenticeship learning should ideally be complemented by more formal learning to enable many aspects of agriculture and rural development to be seen in their true perspective (Mwangi and Mwai, 2002). Teaching and learning strategies are traditionally referred to as methods of teaching and learning. Modern trends in teaching and learning emphasise certain approaches which determine the strategy to be used. These approaches include; interactive approach, collaborative approach, transmission approach, experiential approach and facilitative approach. Interactive approach is where there is exchange of ideas between the teacher and the learner or among learners themselves as in group work. Collaborative approach is where learners share ideas in groups or projects. Transmission approach, the teacher dominates the lesson by use of lecture. In experiential approach learners life experiences are explored and used as a basis for development of new knowledge, skills and passing judgment. Learning is based on the learner's experiences in the community. In facilitative approach the teacher provides the stimulus

for learner's interaction with the new knowledge and also provides opportunities for the learners to learn. The teacher is merely a guide and director of learning (Petty, 2004).

Based on the above approaches the Agricultural science teacher is the one who determines the strategy to use depending on the content he/she is teaching the learners. The most used strategies in teaching Agricultural science are lectures, demonstrations, discussion, educational visits, projects, question and answers, assignment and practical (Williams and Dollisso, 1998). Lecture as a method of teaching involve transmission of information from teacher to the learner. The teacher reads out the notes to the learners as he/she explains to them. The method is mainly teacher-centred and the learner's activity is listening and taking notes. Demonstration is a practical way of explaining or describing a process or activity. The teacher demonstrates an activity before engaging the class in the same. The teacher may also use one of the learners to demonstrate the activity. Discussion is a form of interaction which involves learners' participation through talking or writing in which merits and demerits of a process or object are considered, it encourages an open exchange of ideas. Educational visits provide learners with an opportunity to explore other environments and make school life more interesting as it provides the learners with exciting experiences that bring joy and satisfaction that would not have been in the experience in the normal classroom interaction. A number of teachers are however, of the opinion that field trips are not well-planned and scheduled (Faulker and Baggett, 2005; McKinney, 2005).

According to Oluwole (1987), the practical orientation and education value of projects make students suitable for implementing the practical aspects of Agricultural science in secondary schools. Assignments are a common practice in most schools. This involves literature review and at times interview or field observations. During a study of literature

students are assisted to learn how to extract facts and figures from books and reports and to prepare a brief written report on their findings. Assignments have become an excellent teaching aid that increases the students' communication skills. Although secondary school Agricultural science teaching and learning had been in existence for many years, teaching and learning methods are still far from satisfactory because they are largely focused on transferring knowledge which is judged to be useful in examinations. Most of information is merely memorised and learners do precisely what they are told by their teachers or trainers (Faulker and Baggett, 2005; McKinney, 2005).

2.1.4.2 Teaching and learning resources in Agricultural science

Teaching and learning resources are all materials and equipment used to enhance effective learning. A teacher selects, develops and recognises teaching and learning resources for effective teaching and learning. A teacher is therefore the most important teaching-learning resource. According to Ogweno (2015) having satisfactory facilities, equipment and materials should not be minimised in establishing the curriculum due to their contribution to the effectiveness of teaching and learning in the school. Their availability will enhance or inhibit the implementation of curriculum. It then follows that facilities, equipment and materials influence the implementation of secondary school Agricultural science subject. Because of the development in modern technology, teachers no longer have to rely solely on words to make their meanings clear.

There is great variety of materials around that can be used to make meaning more vivid and more interesting. These materials are the teaching and learning resources. Ogweno (2015) further observes that, these resources by being presented raw offer stimulating alternative to the conventional textbooks. The latter summarises, explains, interprets and as a consequence subtly structures perception and understanding thus teaching and

learning resources help the learner to learn effectively. A shortage of these useful resources will impede teaching and learning. Teaching and learning resources play a key role as far as teaching and learning is concerned. Ogweno further asserts that good teachers as they teach keep in mind both what they teach and what they teach with. The availability, quality and adequacy of resources such as physical facilities and equipment will establish whether this is the case. According to UNESCO (1999), secondary school syllabus for Agricultural science, as an important teaching resource not only provides the teacher with content, but also suggests appropriate teaching and learning strategies. These teaching strategies include description, discussion, group work, observations, records and reports, visits, videos, brainstorming, demonstrations, project work and practical (UNESCO, 1999; Petty, 2004).

2.2 Theoretical Framework of the Study

As discussed in the previous sub-sections, policy makers of Education for Self-Reliance (Nyerere, 1967) assumed that by learning Agricultural science subject in secondary school education curriculum, students would develop favourable attitudes towards agriculture. Students who had an opportunity to study Agricultural science subject in secondary school education curriculum were also expected to possess key agricultural skills and knowledge through practical learning which in turn increases their interest to engage in farming and farming related career. The study was, therefore, informed by the Constructivist Teaching and Learning Theory (CTLT).

The CTLT is reflected in the developmental theories of Bruner (1961), Piaget (1972), Vygotsky (1978), Dewey (1997), among others. The study's theoretical framework was mainly based on social constructivism whose principal proponent is Vygotsky (1978). The constructivist teaching is based on research about the human brain and what is known

about how learning occurs. The following are the major findings and their implications for effective students' learning: The first is that students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information that are taught, or they may learn them for purposes of a test but revert to their preconceptions outside the classroom (Taber, 2011).

According to Taber (2011) teachers must draw out and work with the pre-existing understandings that their students bring with them which requires that: (a) the model of the student as an empty vessel to be filled with knowledge provided by the teacher to be replaced, instead, the teacher must actively inquire into students' thinking, creating classroom tasks and conditions under which student thinking can be enhanced thereby students' initial conceptions revealed and then used to provide the foundation on which the more formal understanding of the subject matter is built; (b) the roles for assessment must be expanded beyond the traditional concept of testing thus use of frequent formative assessment which helps make students' thinking visible to themselves, their peers, and their teacher hence provides feedback that can guide modification and refinement in thinking; (c) given the goal of learning with understanding, assessments must tap understanding rather than merely the ability to repeat facts or perform isolated skills. The second major finding and its implications in students is that, to develop competence in an area of inquiry require students to have a deep foundation of factual knowledge, understand facts and ideas in the context of a conceptual framework which enable them to organise knowledge in ways that facilitate retrieval and application (Taber, 2011).

McTighe and Seif (2014) have also brought about the key findings relevant to effective teaching for understanding with respect to constructivism. They asserted that learning

must have to focus on the students' understanding and application of knowledge and be guided by generalised principles in order to be widely applicable as transfer most likely occurs when the learner knows and understands underlying concepts and principles that can be applied to problems in new contexts. According to McTighe and Seif (2014) learning with understanding is more likely to promote transfer than simply memorising information from a text or a lecture. They also asserted that experts should first seek to develop an understanding of problems which often involves thinking in terms of core concepts or big ideas as novices' knowledge is much less likely to be organised around big ideas, likewise are more likely to approach problems by searching for correct formulas and pat answers that fit their everyday intuitions. They also emphasised that superficial coverage of many topics in the subject may be a poor way to help students develop the competencies that will prepare them for future learning and work. They added that curricula that emphasise breadth of knowledge may prevent effective organisation of knowledge because there is not enough time to learn anything in depth thus they emphasises curricula that are "a mile wide and an inch deep" run the risk of developing disconnected rather than connected knowledge.

McTighe and Seif (2014) further pointed out that feedback is fundamental to learning, emphasising formative assessments, which provide students with opportunities to revise and improve the quality of their thinking and understanding. Additionally, they pointed out that assessment should focus on understanding hence should seek whether students know when, where, and why to use that knowledge rather than on memory for procedures or facts. As far as CTLT is concerned, teachers should be well versed with mastery of both subject matter and teaching and learning processes, that is, pedagogy with emphasis to learning activities which are characterised by active engagement, inquiry, problem-solving, and collaboration with others (McTighe and Seif, 2014).

Bransford *et al.* (2001) backing the CTLT posits that a constructivist "meta-cognitive" approach to teaching can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them. According to Bransford *et al.* (2001) meta-cognition often takes the form of an internal dialogue of which many students may be unaware of its importance unless the learning processes are explicitly emphasised by teachers. Thus an emphasis on meta-cognition needs has to accompany teaching in each of the disciplines as the type of monitoring required will vary. Bransford *et al.* (2001) emphasised that an integration of meta-cognitive teaching with discipline-based learning can enhance student achievement and develop in students the ability to learn independently. As indicated by Bransford *et al.* (2001) developing strong meta-cognitive strategies and learning to teach those strategies in a classroom environment should be standard features of the curriculum in teachers' training institutions.

Studies including that conducted by Doolittle and Camp (1999) have argued that with CTLT the possibility of engaging students in a learning culture becomes more likely. Implemented effectively, it means that students will be working harder than their teachers and develop the motivation, self-discipline and self-awareness to become successful learners and in terms of outcome thus become effective contributors to the development agenda. This is due to the fact that constructivist teaching and learning helps learners take a responsibility for their own learning and hence competence development. Moreover, it promotes integrated learning and makes the classroom and the school in general an active learning community (Ishemo, 2012).

2.3 Conceptual Framework of the Study

In any educational settings, effectiveness of teaching and learning is the ultimate goal. Educationists are of the opinion that student's learning achievement include

interdependent multiple components which are embedded in a complex political, social, cultural and economic system. In this regard UNESCO (2000a, b) outlined the following components for effective teaching and learning: (a) content that is reflected in relevant curriculum and curriculum materials for the acquisition of basic skills and knowledge; (b) learners who are ready to learn and supported in learning by their families and communities; (c) environments that provide adequate teaching and learning resources; (d) processes through which trained teachers use learner-centred approaches in well-managed classrooms/schools and skilful assessment to facilitate learning; and (e) outcomes or products that encompass attitudes, skills and knowledge which are linked to national goals for education and positive participation in society.

Studies done by UNESCO (2012a, b, c,) and World Bank (2012) on Education for All (EFA) in Sub-Saharan Africa indicate more emphasis on access of education than what students achieved from the implemented curriculum. Different researches have observed the fact that students' achievement is an output or product of educational system which cannot be examined in isolation of students, teachers, curriculum and curriculum materials, teaching and learning resources as well as processes (Young and Edwards, 2011; Oweye and Yara, 2011; Amadi, 2012). For that reason UNESCO (2012b) asserted that effective teaching and learning of the curriculum requires efficient systems that would provide supportive learning environment, motivated teachers with mastery of pedagogy and their subject matter, adequate access to teaching and learning resources as well as students who are ready to learn.

In education, high learning achievement of students in their subjects' curricula is taken as meeting the government curriculum intentions. In Tanzania, achievement of curriculum intentions is to meet the requirements in examination (Malekela, 2000) also to attain high

capabilities or competencies required in society in combating day to day challenges as a result of possessing educational competencies (Rajani, 2007; Komba and Nkumbi, 2008). To succeed in implementing Agricultural science subject, the provision of education should mainly be centred on quality teachers, effective teaching and learning processes as well as adequate teaching and learning resources (Rajani, 2007; UNESCO, 2000a; 2012b). Teachers are reported to affect curriculum implementation in different ways (Adekoya and Olatoye, 2011) and in the most Sub-Saharan African countries, Tanzania included, curriculum implementation depends largely on the quality of teachers and teaching effectiveness (Sumra and Rajani, 2007). Additionally, teaching effectiveness is coupled with authentic learning environment with adequate teaching and learning materials and facilities as well as qualified motivated teachers who are able and willing to use active teaching and learning methods/strategies (Amadi, 2012; Ishemo, 2012).

Teaching effectiveness has been reported to influence students' attitude towards learning (Edwards, 2006, Akiri and Ugborugbo, 2009; Nasr, 2011). According to their studies, students respond to teaching effectiveness by expressing positive or negative attitudes towards learning. With a positive attitude, students learn with high motivation and undoubtedly able to demonstrate better learning achievement or outcomes. It was the conception of this study that the effectiveness of teaching and learning of Agricultural science subject in selected ordinary level secondary schools in terms of students' learning outcomes or achievement should be investigated. The investigation of students' learning achievement went jointly with the assessment of availability and adequacy Agricultural science subject teaching and learning resources as well assessment of adequacy of teaching and learning processes used by Agricultural science teachers in teaching the subject.

In the context of the present study, the purpose of which was to investigate the effectiveness of teaching and learning of Agricultural science subject in selected ordinary level secondary schools in Tanzania, a conceptual framework shown in Fig. 1 was drawn. This conceptual framework is for analysing large volume of data and is oriented towards establishing variables which fulfil the objectives of the study. The framework provides a means of organising and understanding the key variables used in the study which are teachers, students, resources, processes and effectiveness variables. It is comprehensive in that teacher variable is fundamental in understanding classroom problems and challenges using experience of the classroom teacher. Experience of the classroom teacher tends to affect classroom environment such as in interactions between teacher and students and between students and materials (process) and the effects of interaction (effectiveness/product). On the other hand, the non-school factors such as home background and climate may affect students' attitude towards agriculture as a subject which, in turn, affect teaching and learning effectiveness.

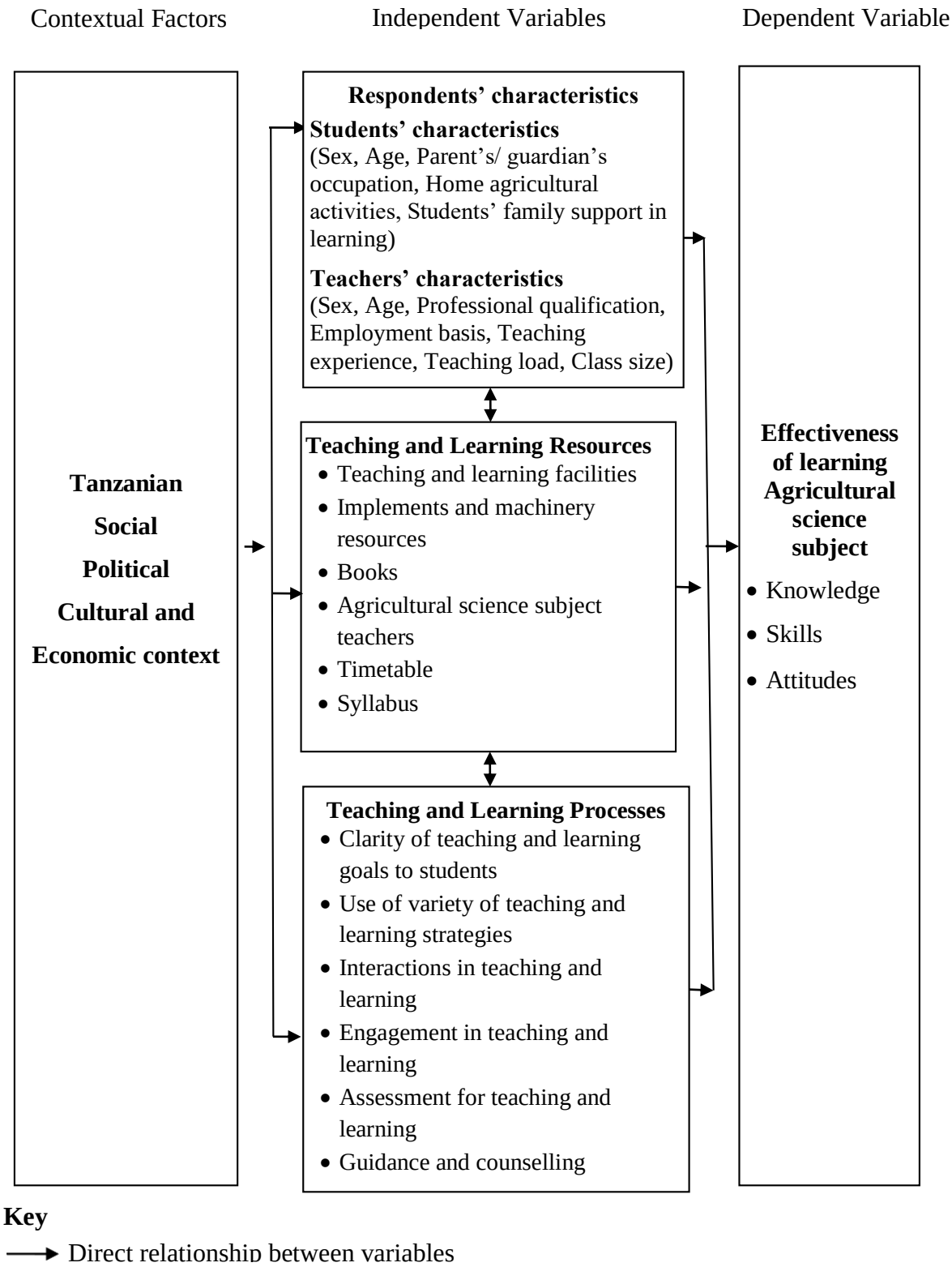

Figure 1: Conceptual framework of the study

CHAPTER THREE

3.0 METHODOLOGY

This study sought to investigate the effectiveness of teaching and learning Agricultural science subject in selected ordinary level secondary schools in Tanzania. The methodology for the study was guided by a conceptual framework (Fig. 1) and includes the following: (a) description of the study area, (b) research design, (c) sampling procedures, (d) sample size, (e) data collection instruments, (f) data collection procedures, (g) data processing and analysis, and (h) limitations of the study.

3.1 Description of the Study Area

The study was carried out in ten selected secondary schools teaching Agricultural science subject in Tanzania (Fig. 2). Five of the schools were among those 104 which originally had taught the subject as compulsory subject after its introduction in 1972 up to 2004 when it was phased out and after its reinstatement in 2006 as an optional subject. These included Pugu, Kibaha, Kilosa, Mvomero and Mkuu secondary schools. On the other hand, the other five schools were among 53 schools which started teaching the subject after its reinstatement from 2006 up to when data for this study were collected as an optional subject, namely: Welwel, Ganako, Gyekrum-Arusha, Kilimatembo and Kainam-Rhotia. The two categories of schools were selected in order to allow detailed study of the parameters of interest and make comparison between them.

3.2 Research Design

A research design is the plan showing the approach and strategy of investigation aimed at obtaining relevant data which fulfils the research objectives and provides answers to the research questions (Cohen *et al.*, 2013). According to Cohen *et al*. (2013), the essence of

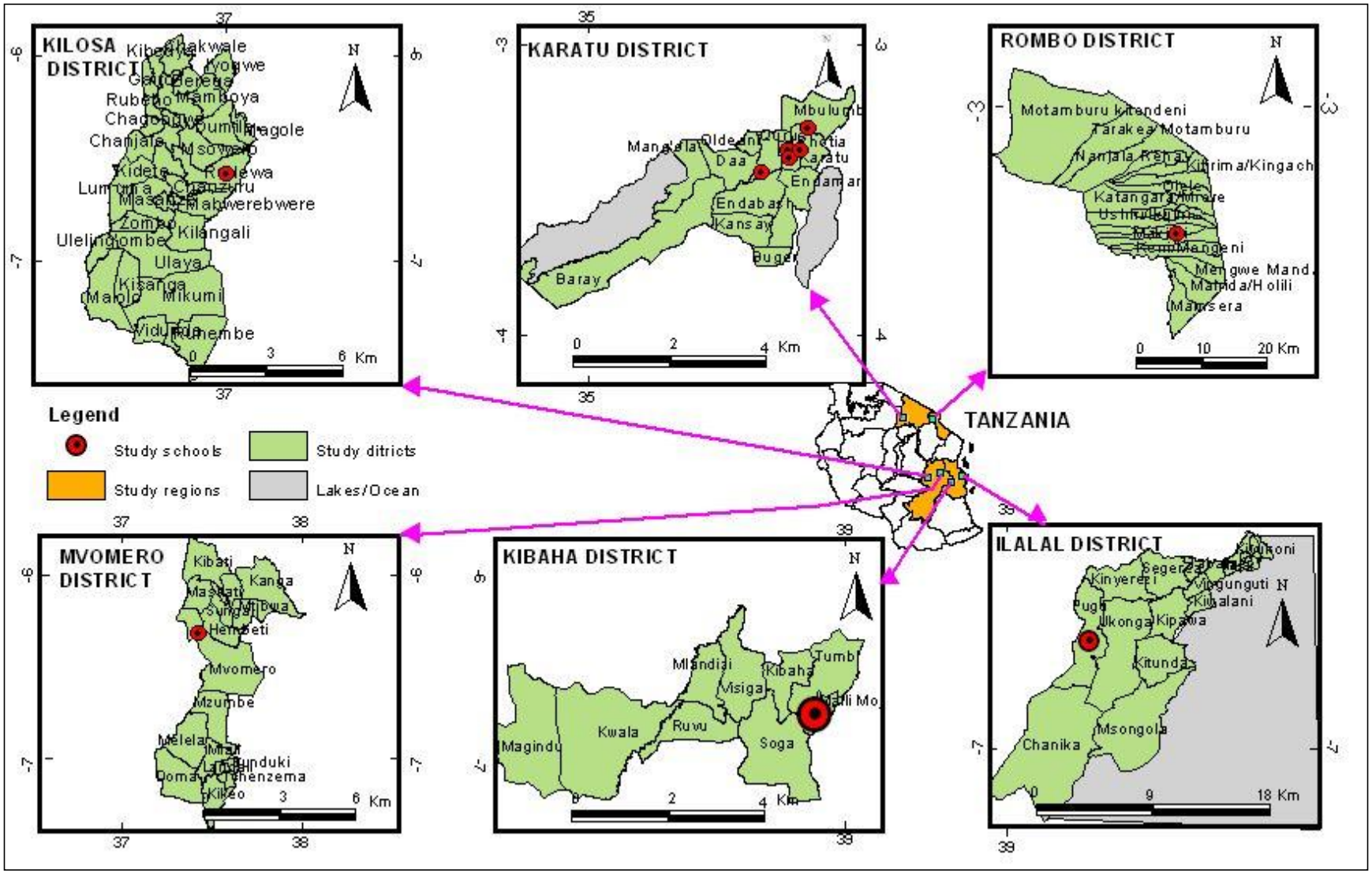

Figure 2: Map of Tanzania showing study Regions, Districts and schools

research design is to control research variables that may distort the expected data. Therefore, the research design differs depending on the purpose of conducting the study. Cohen *et al.* (2013) contend that there is no single blueprint for planning research rather, research design is governed by the notion of 'fitness of purpose' thus the purpose of the research determines the methodology and design of the research. This study adopted a cross-sectional survey design. Under this design variables of interest in a sample of subject are examined once, and the relationship between them determined (Babbie, 2010). It is fast and appropriate in the face of resource and time constraints, and useful in determining the relationship among and between variables. It also allows the use of various survey methods to gather a body of qualitative and quantitative data (Kothari, 2004; Babbie, 2010).

3.3 Sampling Procedures

Sampling procedure involved multistage sampling technique. It mainly involved purposive selection of study area and study respondents based on availability of secondary schools teaching Agricultural science subject. This method allows more than one sampling method to be used and involves sampling in phases. It is also necessary when the population to be sampled is not homogenous in terms of certain required characteristics (Bailey, 1994). The technique was done in two main stages.

***Stage 1*:** The first sampling stage involved stratification of secondary schools into two categories. The first category was original schools (OS). This category involved those schools which had taught the Agricultural science subject after its introduction in 1972 as a compulsory subject up to 2004 when it was phased out, as well as after its reinstatement in 2006 as an optional subject. The second category was new schools (NS). This category involved those schools which started teaching the subject after its reinstatement in 2006.

Purposive sampling technique was used to select five secondary schools from a list of 104 ordinary level secondary schools in the first category namely: Pugu (from Dar es Salaam Region), Kibaha (from Pwani Region), Mkuu (from Kilimanjaro Region), Kilosa and Mvomero (both from Morogoro Region), respectively, and five from a list of existing 53 secondary schools in the second category, namely: Welwel, Gyekrum-Arusha, Ganako, Kilimatembo and Kainam-Rhotia (all from Arusha Region).

***Stage 2*:** Second sampling stage involved selection of study respondents. A sample of 100 students was selected from the 10 selected schools (10 students from each school). To get that sample, stratified and random sampling techniques as recommended by Babbie (2010), were used to obtain student respondents in Form Four classes studying Agricultural science subject in each school as follows: a class list from students' record office comprising names of all students in Form Four class with a minimum of 20 students studying Agricultural science as an optional subject was used as a sampling frame in each selected school. A sample of 10 students from each school was randomly sampled, thus making a sample size of 100 students. Form Four students were assumed to cover more of what is intended in the syllabus than lower Forms.

In addition, one to three Agricultural science subject teachers depending on their availability were purposively selected to make a total number of 20 teachers (10 from original schools and 10 from new schools) and involved in the study. A total of 16 key informants were also purposively selected and involved in the study. The key informants included school administrators (head-masters/mistresses, second-masters/mistresses, academic-masters/mistresses), school teachers not included in the study sample, education officers, school quality assurers and other individuals who were in position to provide

relevant information about the effectiveness of teaching and learning Agricultural science subject in secondary schools in the study schools.

3.4 Sample Size

A total of 100 students, 20 Agricultural science teachers and 16 key informants were selected and involved in the study. A summary distribution of all respondents involved in the study is given in Table 1. This was in line with the guidelines given by Bailey (1994) for minimum sample size. According to Bailey (1994), regardless of the population size, the minimum sample or sub-sample size is 30 cases (respondents) for a research in which statistical data analysis is to be done. Therefore, the sample size of 100 student respondents was large enough for meaningful statistical analysis.

Table 1: Distribution of all respondents involved in the study (n=136)

Type of respondent	Number		Total
	Male	Female	
Agricultural science students	68	32	100
Agricultural science teachers	14	6	20
Key informants	11	5	16
Total	**93**	**43**	**136**

3.5 Data Collection Instruments

Data collection instruments used for the study were questionnaire, researcher's diary and checklists. An observation checklist was used to collect data on the availability of resources for teaching and learning Agricultural science subject in the study schools (Appendix 1). Two types of questionnaires were used to collect primary data from students and teachers in each school as shown in Appendix 2 and 3. Researcher's diary was used to collect secondary data from different sources including books, journals,

official reports, library, school reports, internet, research reports from various institutions such as Sokoine National Agricultural Library (SNAL), National Examinations Council of Tanzania (NECTA), Tanzania Institute of Education (TIE), Ministry of Education, Science and Technology (MoEST), and other relevant literature both within and outside Tanzania. This instrument was also used to record researcher's observations on activities undertaken in teaching and learning Agricultural science subject in the selected study schools. Checklist was used to collect primary data from key informants in order to supplement information gathered through questionnaires and researcher's diary (Appendix 4).

3.6 Data Collection Procedures

Field work was conducted during July to December 2014 in 10 secondary schools in Tanzania. The permit for data collection was obtained from the office of relevant regions, districts and schools after getting an introductory letter from Sokoine University of Agriculture (SUA). In each of the selected schools from different regions, one research team led by researcher was formed to collect primary data. Two research assistants assisted the researcher over a period of six months to collect primary and secondary data. The researcher was responsible for training and guiding the research assistants during data collection.

Structured questionnaires were used as a tool for interviewing Agricultural science students and teachers. The questionnaires were designed to permit acquisition of both qualitative and quantitative information. Open and close-ended questions were used. In the open-ended questions, respondents were supposed to give their own views while in close-ended questions they were supposed to choose among the given alternatives. This was done in order to investigate the effectiveness of teaching and learning Agricultural science subject in selected secondary schools. To ensure the reliability and validity of the

instruments, the first draft of the students and teachers questionnaires were pre-tested in 10 students and two teachers from Nelson Mandela agricultural secondary school situated in Morogoro Rural District. The Cronbach's alpha reliability coefficient for the student's questionnaire was 0.82 while that of teacher's questionnaire was 0.85. The two questionnaires were reliable as their reliability coefficients were in acceptable ranges for social sciences, that is, both were between 0.6 and 1.0. Furthermore, necessary changes were made on the basis of the pre-testing results before the final administration, which included restructuring and omission of some questions. Of the 100 interview schedules meant for student respondents and 20 meant for teacher respondents, all were properly completed, constituting a return rate of 100% each. As far as possible, interviews were conducted in respondents' environment using English and Kiswahili languages. The Kiswahili responses were then translated into English language.

Direct researcher's observations were made on resources for teaching and learning Agricultural science subject in the study schools by use of the resource observation checklist (Appendix 1). In addition, primary data were collected using checklist from key informants through directed discussions. The researcher also collected secondary data through review of documentary information from SUA library, school files and websites using researcher's diary.

3.7 Data Processing and Analysis

3.7.1 Data processing

The data from 100 completed students' questionnaire were coded for computer analysis. Data from teachers' questionnaire, researcher's diary and checklists were summarised manually to single sheets of paper. In summarising the data great care was taken to ensure that it accurately reflected the original meanings of the statements made.

3.7.2 Data analysis

Data processed from student questionnaires were analysed using programme for the Statistical Package for Social Science (SPSS) Version 20 where descriptive statistics computed to determine frequencies, percentages, means, maximum and minimum values of individual variables. The responses between school categories were compared using Chi-square as non-parametric contingency test. In using this test, no category of schools was considered as a control rather it looked at whether one category of schools differ in their response from the other, thus original schools were compared with new schools. Furthermore, data processed from other sources were analysed by grouping it into categories according to emerging themes and then analysed carefully in order for the researcher to interpret the information beyond the data gathered and, hence, make conclusions which are valid and reliable. Detailed analysis by objectives is described hereunder:

(a) **Objective 1**: To assess availability and adequacy of the resources for teaching and learning of Agricultural science subject in selected ordinary level secondary schools.

Data on availability and adequacy of key Agricultural science teaching and learning resources were analysed by grouping the resources according to their availability and their requirements or status condition in each school. Adequacy of physical facilities like library, Agricultural science subject laboratory, Agricultural science subject workshop and school farm were judged according to their status condition. With exception of textbooks, number of periods per week as well as minimum qualification and teaching load of teachers, the curriculum is silent on the standard requirements for the rest of resources, however, for resources such as library, laboratory and workshop, the curriculum stated that they should be well equipped without stating what exactly should be there. Thus, the adequacy of such resources in this study was judged according to the requirements of

teaching most of the skills predetermined by the syllabus. Thus, library condition was judged as adequate or good if it was well stocked with textbooks, reference books, modules, manuals and other supplementary textual teaching and learning materials such as maps, atlases, fliers, booklets, brochures, magazines and newspapers and it is inadequate or poor if it was not stocked with the materials (URT, 2005a). Agricultural science laboratory was judged as adequate or good if it was well stocked with furniture and apparatus such as soil mechanical sieves, flasks, test tubes, petri dishes, watch glasses, measuring cylinders, and storage containers as well as samples and specimens such as soils, fertilisers, herbicides, weeds, pests, parasites, livestock feeds and seeds, and it was inadequate or poor if it was not stocked with the items. Agricultural science workshop was judged adequate if it was well stocked with work benches and tools such as simple field hand tools (for example hand trowel, hand fork, hand hoe, forked hoe, mattock, manure fork, axe, shear, secateurs, sickles, rake, knapsack and hand sprayers), as well as tools for: simple plumbing work; simple carpentry and joinery work; simple sheet metal work; and surveying like chains, ranging poles, arrows, odometer, tripod stands.

An implement and machinery resource was judged as adequate or good if it was working to fulfil its purpose and it was inadequate or poor if it was not working. School farm was judged adequate or good if it was being used in demonstrating varied crop and livestock husbandry practises as per the subjects' syllabus and it was inadequate or poor if it was not being used to demonstrate the practises required by the syllabus. Adequacy of timetable with respect to number of periods of Agricultural science subject was judged according to the curriculum guide which is six periods per week. Adequacy of Agricultural science subject teachers was judged according to the predetermined optimum teaching load of 24 to 30 periods per week per teacher. Adequacy of the syllabus with respect to its relevance, organisation and coverage in a given time was judged according to

Agricultural science subject student and teacher respondents' opinions. Agricultural science subject teacher respondents and key informants' opinions on availability and adequacy of the resources for teaching and learning Agricultural science subject were also collected to complement the information gathered by resources checklist. Qualitative data were summarised according to emerging themes while data from secondary documentary sources were summarised in tables.

(b) **Objective 2**: To determine adequacy of the processes used in teaching and learning Agricultural science subject in selected ordinary level secondary schools

Data on extent respondents were satisfied with the processes involved in teaching and learning Agricultural science subject were investigated mainly using descriptive analysis to generate frequencies and percentages. Respondents' satisfaction with reference to clarity of teaching/learning goals to students, use of variety of teaching and learning strategies, interactions in teaching and learning, engagement in teaching and learning, assessment for teaching and learning as well as guidance and counselling were assessed on 5-point Likert scale (strongly disagree, disagree, no opinion, agree, strongly agree) using an index summated scale which had 14 process statements. Strategies used in teaching and learning as well as in assessment were further examined by use of a 3-point Likert scale (never, sometimes, often) using frequencies and percentages from 20 teaching and learning strategies and 12 assessment strategies, respectively. Strategies in teaching and learning as well as assessment were examined using frequencies and percentage, that is the one with higher frequencies and percentage were considered as the commonly used strategies.

Every respondent was asked to say if he/she agree or disagree with process parameters as strongly disagree (1), disagree (2), no opinion (3), agree (4) or strongly agree (5) with

each item of the scale. If one was strongly disagree (i.e. very dissatisfied) with the teaching and learning process had (1) in each of the 14 process statements, one would have scored 14 (i.e. 1 x 14). If one was strongly agree (i.e. very satisfied) with the teaching and learning process had (5) in each of the 14 process statements, one would have scored 70 (i.e. 5 x 14). Therefore, overall, 14 to 41 scores represented dissatisfaction with teaching and learning processes, 42 represented neutral opinion, and 43 to 70 represented satisfaction with teaching and learning processes in Agricultural science subject. Students' involvement in out of classroom activities was analysed by descriptive analysis in terms of frequencies and percentages of four out of classroom multiple responses. Chi-square was used to test and compare the patterns of responses between the two school categories at $p \leq 0.05$ level of significance. Qualitative data were analysed using content analysis technique and summarised according to emerging themes while data from secondary documentary sources were summarised in tables.

(c) **Objective 3**: To determine students' knowledge, skills and attitudes acquired from implementing Agricultural science subject in selected ordinary level secondary schools.

Data analysis was based mainly on descriptive statistics including frequencies, percentages, means, and cross-tabulations. The results for each main theme were shown as percentages and the Chi-square calculations were carried out using the frequency data. Students' level of knowledge and skills acquired from implementing Agricultural science subject were determined on a 5-point Likert scale (very poor, poor, moderate, good and very good) using an index summated scale which had 57 Agricultural science knowledge and 39 skill statements. Every student respondent was asked to say if he/she rated his/her knowledge/skill as very poor (1), poor (2), moderate (3), good (4) or very good (5) with each item of the scale. Likewise, every teacher respondent was asked to say if he/she rated

his/her students' knowledge and skills as very poor (1), poor (2), moderate (3), good (4) or very good (5) with each item of the scale. If one had had a very poor Agricultural knowledge (1) in each of the 57 knowledge statements, one would have scored 57 (i.e. 1 x 57). If one had had a very good skill (5) in each of the 57 knowledge statements, one would have scored 285 (i.e. 5 x 57). Therefore, overall, 57 to 170 scores represented poor Agricultural science knowledge, 171 represented moderate knowledge, and 172 to 285 represented good Agricultural science knowledge.

If one had had a very poor Agricultural science skill (1) in each of the 39 skill statements, one would have scored 39 (i.e. 1 x 39). If one had had a very good skill (5) in each of the 39 Agricultural science skill statements, one would have scored 195 (i.e. 5 x 39). Therefore, overall, 39 to 116 scores represented poor Agricultural science skills, 117 represented moderate skills, and 118 to 195 represented good Agricultural science skills.

Students' attitudes acquired from implementing Agricultural science subject were determined on 5-point Likert scales (strongly agree, agree, no opinion, disagree, and strongly disagree) using an index summated scale, which had seven statements. Scoring of the items by students in favour of the subject and farming was: strongly agree-5 marks, agree-4 scores, no opinion-3 scores, disagree-2 scores and strongly disagree-1 score. If one had had an extremely unfavourable attitude (1) towards each of the seven statements, one would have scored 7 (i.e. 1 x 7). If one had had an extremely favourable attitude (5) towards each of the seven statements, one would have scored 35 (i.e. 5 x 7). Therefore, overall, 7 to 20 scores represented negative attitude, 21 represented neutral attitude, and 22 to 35 represented positive attitude acquired from implementing Agricultural science subject. Chi-square was used to test and compare the patterns of responses between school categories at $p \leq 0.05$ level of significance. Qualitative data were analysed by grouping

them into categories according to emerging themes and then analysed objectively while data from secondary documentary sources were summarised in tables.

(d) **Objective 4**: To determine the potential for improving teaching and learning of Agricultural science subject in selected ordinary level secondary schools.

Potential for improving teaching and learning Agricultural science subject were determined by thorough analysis of strengths, challenges and opportunities existing in study schools. Student respondents' opinions concerning strengths, challenges, and opportunities available in schools for teaching and learning Agricultural science subject were listed from all respondents, grouped thereafter coded and entered into SPSS. Strengths were sought to find the most valuable and interesting lessons learnt from the subject, good things teachers portrayed to students in teaching/learning process, interested observations pertaining teaching/learning resources as well as things most helped students learn Agricultural science in their school. Challenges facing teachers and students in teaching and learning Agricultural science subject as well as opportunities available in the schools were also listed and grouped from all respondents. Respondents were also asked to give suggestions which they thought that if they worked upon, the subject might be more interesting, enjoyable and beneficial as far as teaching and learning resources as well as processes are concerned. All these were listed from student respondents, grouped, coded and entered into SPSS, thereafter analysed as multiple responses to generate frequencies and percentages. Qualitative data were analysed by grouping it into categories according to emerging themes and then analysed objectively while data from secondary documentary sources were summarised in tables.

3.8 Limitations of the Study

In carrying out this study, the major challenges were:

(a) The questionnaires were prepared in English language with the hope that English language is known to respondents as it is the teaching and learning language in secondary schools, however, student respondents were not very conversant with English language hence their responses were translated from Kiswahili to English.

(b) It was difficult to take stock of each and every teaching and learning resource for Agricultural science subject in the study schools. Only key teaching and learning resources, for the sake of convenience, were observed by use of observation checklist. Agricultural science subject teachers' opinions were taken and used to complement the information on availability and adequacy of the resources.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

This Chapter presents and discusses major findings arising from the study primary and secondary data analysis. The Chapter is organised based on the research objectives except the first section which explores the respondent characteristics. The respondents' characteristics were considered bearing in mind that every target population has its own characteristics which affect the way information is perceived and interpreted (Creswell, 2012). The study was conducted to investigate the effectiveness of teaching and learning Agricultural science subject with specific reference to selected agricultural secondary schools in Tanzania. The study had four specific objectives. The first objective was to assess availability and adequacy of resources for teaching and learning of Agricultural science subject in selected ordinary level secondary schools. The second objective was to determine adequacy of the processes used in teaching and learning Agricultural science subject in selected ordinary level secondary schools. The third objective was to determine students' knowledge, skills and attitudes acquired from implementing Agricultural science subject in selected ordinary level secondary schools. Finally, the fourth objective was to determine the potential for improving teaching and learning of Agricultural science subject in selected ordinary level secondary schools.

4.1 Respondents' Characteristics

Analysis of the respondents' characteristics is of great importance because it helps in data interpretation and determining factors that affect social, economic and cultural activities of the study area. These involved personal and situational characteristics of both students' and teachers' respondents which were expected to influence teaching and learning effectiveness in Agricultural science subject. This section is therefore organised under two categories, that is, the student and teacher respondents' characteristics.

4.1.1 Student respondents' characteristics

The student respondents' characteristics investigated were personal and situational. The student respondents' personal characteristics included sex and age whereas situational characteristics were parents'/guardians' occupation, students' home involvement in agricultural activities, students' expectation after school completion and students' family support in learning, as given in Table 2.

Table 2: Distribution of student respondents' characteristics (n=100)

Characteristics	Original schools (n=50) %	New schools (n=50) %
Sex		
Female	20	44
Male	80	56
Age (years)		
18	84	86
19	16	10
20	0	4
Parents'/guardians' occupation		
Farmer	58	70
Formally employed	32	14
Informally employed	10	16
Students' home agricultural activities		
Crop production	26	16
Livestock production	6	8
Crop and livestock production	52	72
Not engaged in agriculture	16	4
Students' family support in learning		
Supported for learning materials	10	4
Moral encouragement to study the subject	20	26
Not supported	70	70

4.1.1.1 Sex

The results in Table 2 show that student respondents' sample from original schools included 20% and 80% female and male respondents, respectively, as compared to 44% and 56% female and male respondents, respectively, from new schools. This was attributed to the fact that 60% of original schools were not co-schools, that is, were boys only.

4.1.1.2 Age

The age distribution of student respondents was between 18 and 19 years old in original schools whereas in new schools was between 18 and 20 with mean of 18 years old in both original and new schools, as given in Table 2. These results reveal that the majority of students in both school categories were 18 years old, which constitute 84% and 86% of all student respondents in original and new schools, respectively. This shows that majority of students respondents in the study schools were in expected age for their study as per Tanzania's Ministry of Education, Science and Technology (MoEST) guideline as they started standard one at the age of seven years old (URT, 1995).

4.1.1.3 Student respondents' parents/guardians occupation

The results on respondents' parents/guardians occupation in Table 2 indicate that farming was the predominant occupation of the students' parents/guardians, higher responses in new schools with 70% than original schools which were 58%. However, this indicates that farming was an important occupation for student respondents parents/guardians' in both categories of the study schools. Formal and informal sectors employ small portion of students' parents, employing 32% and 10% original schools whereas in new schools is 14% and 16%, respectively. These results suggest that parents/guardians would encourage the learners to opt for agriculture, if for them it appears a profitable occupation.

4.1.1.4 Students' home involvement in agricultural activities

Students' home involvement in agricultural activities showed that in original schools 26% were involved in crop, 6% in livestock and 52% in both crop and livestock production whereas in new schools 16% were involved in crop production, 8% in livestock and 72% in both crop and livestock production. These results indicate that crop, livestock and both crop and livestock production activities, altogether engaged 84% families of students from original schools and 96% families of students from new schools. This implies that students with farming background are willing to study Agricultural science subject in secondary schools. Further investigation from key informants revealed that schools focus on preparing youth for their lives and job opportunities very different from the environment where they live. This indicates why parents would encourage learners to opt for something different from what they do in their homes, which is diverting from agriculture if for them it appears not a profitable occupation.

4.1.1.5 Student respondents' family support

The results on student respondents' family support in learning in Table 2 indicate that majority (70%) of respondents in both original and new schools had neither material nor moral support from their families to learn the subject. While 20% and 26%, of the respondents in original and new schools, respectively, had moral support from their families to learn Agricultural science subject, only 10% and 4% of respondents in original and new schools, respectively, had a support on materials to learn the subject. These results suggest that the schools had to play a great role for students to learn Agricultural science subject.

4.1.2 Teacher respondents' characteristics

The teacher respondents' personal and situational characteristics were investigated. The teacher respondents' personal characteristics included sex, age, professional qualification,

employment basis and teaching experience, whereas situational characteristics were teaching load and an average class size, as shown in Table 3.

Table 3: Distribution of teacher respondents' characteristics (n=20)

Characteristics	Original schools (n=10) %	New schools (n=10) %
Sex		
Female	30	30
Male	70	70
Age (years)		
22 - 35	30	60
36 - 60	70	40
Professional qualification		
Master in Science	30	0
Bachelor in Science	20	30
Diploma	50	70
Employment basis		
Permanent	80	50
Temporary	20	50
Teaching experience (years)		
1 - 5	30	50
6 - 10	10	40
11 - 20	30	0
21 - 30	30	10
Teaching load (number of periods per week)		
< 24	20	20
24 - 30	30	50
> 30	30	30
Class size (average number of students per class)		
< 40	20	20
40	30	30
> 40	50	50

4.1.2.1 Sex

Results in Table 3 show that there were more than two times as many male teachers as females. There were 70% male Agricultural science teachers and 30% female teacher respondents in both original and new schools. This could be attributed to the fact that more males study Agriculture than females due to the societal notion that agriculture is for men.

4.1.2.2 Age

It can be seen in Table 3 that 30% of teacher respondents in original schools were between 22 to 35 years of age while in new schools were 60%. The age between 36 to 60 years constituted 70% of teacher respondents in original schools and 40% of teacher respondents in new schools. The majority (70%) of teacher respondents in original schools were between 36 and 60 years of age while in new schools majority (60%) of teacher respondents were between 22 to 35 years of age. The mean age was approximately 44 years for teacher respondents of original schools and 32 years for teachers of new schools. These results generally suggest that teacher respondents were drawn from different age groups in both school categories. However, the results suggest that involvement of respondents above 35 years was rich source of information on effectiveness of teaching and learning Agricultural science subject in the study schools.

4.1.2.3 Professional qualification

Table 3 shows that most (50% and 70%) of teacher respondents in original schools and new schools, respectively, had diploma in Agriculture as their highest professional qualification. Teacher respondents with bachelors Degree in Agriculture constituted 20% in original schools and 30% in new schools. While there were no teacher respondents with Masters Degree in Agriculture in new schools while original schools had 30%. These

results imply that Agricultural science teaching force in the study schools was dominated by holders of diploma. Diploma is the minimum professional qualification that one could possess to qualify to teach in an ordinary level secondary school in Tanzania.

4.1.2.4 Teaching experience

Teaching experience of Agricultural science teacher respondents was measured in this study as the total number of years the teacher had taught the subject. Results in Table 3 show that teaching experience of Agricultural teacher respondents ranged from one year to 30 years. In the area of teaching experience as shown in Table 3, it was found that majority (60%) of Agricultural science teacher respondents in original schools had taught for not less than 10 years, which could mean that they had acquired some level of experience. This suggests that when provided with the needed teaching resources, these teachers could deliver as expected due to having bank of experience under their belt. With regard to new schools where the majority (90%) had an experience of 10 years and below, could easily be mentored by 10% of the teaching force who had experience of above 10 years.

4.1.2.5 Teaching load

Teaching load in this study was measured as the total number of periods per week the teacher was teaching. Results in Table 3 indicate that 20% of Agricultural science teacher respondents in both original and new schools were teaching less than 24 periods per week while 30% in both school categories were teaching more than 30 periods per week. In original schools, 30% of Agricultural teacher respondents were teaching between 24 to 30 periods per week while in new schools were 50%. According to the recommended teaching load of 24 to 30 periods per week by secondary school education curriculum guideline (URT, 2005a), these findings show that 30% of Agricultural science teacher

respondents in both original and new schools were overloaded. This could be attributed to shortage of Agricultural science teachers in some of the study schools which result in too much teaching load for the available teachers.

4.1.2.6 Class size

Class size in this study was measured as the average number of students in a class which Agricultural science teacher is responsible to teach. Results in Table 3 indicate that 20% of Agricultural science teacher respondents in both original and new schools were found to handle an average class size below 40 students per class. While 30% of Agricultural science teacher respondents in both original and new schools were handling an average class size of 40 students per class, on the other hand, 50% of the teacher respondents in both school categories handled an average class size of above 40 students per class. These results imply that a half of the teacher respondents in both original and new schools had too large classes to handle, that is, above 40 students per class. This was too large class size because the ideal class size specified by the curriculum for ordinary secondary school education for effective teaching and learning is 40 students per class (URT, 2005a). Class size above 40 would make teaching and learning difficult, particularly class control and employing interactive teaching and learning strategies will be cumbersome for a teacher. This would also be a problem if important resources such as teachers, teaching and learning materials and school facilities will not be increased. Hence, it will negatively affect access to quality agricultural education because students will not be attentive as teaching is in progress.

It can generally be concluded from this section that students from rural and farming background studied Agricultural science subject in their secondary school education for both original and new schools. Agricultural science teachers in original schools are older

with permanent employment than those of new schools, though both with heavy teaching loads and too large classes to handle. Rural background of students could provide rich opportunity for students to transfer school agricultural learning to their rural families and communities. Less employment permanency of teachers in new schools renders high risks of quitting whereas too large classes and high teaching loads of teachers in both school categories hinders effective teaching and ultimately poor students' achievement. To alleviate these problems, both school categories should be equipped with enough and permanent Agricultural science teachers.

4.2 Teaching and Learning Resources for Agricultural Science Subject

Availability and adequacy of resources used in teaching and learning Agricultural science subject were assessed for the first objective of the research. By use of a resource observation checklist, availability of resources for teaching and learning Agricultural science subject was investigated. Agricultural science teachers and key informants were also asked to provide additional information on availability and adequacy of resources as described under six parts, namely: Physical facilities; Implements and machinery resources, Textual materials; Teachers; Timetable; and Syllabus.

4.2.1 Physical facilities

The physical facilities assessed in this study were the availability and adequacy of Agricultural science laboratory, Agricultural science workshop, school farm and library as presented in Table 4. The results indicate that all new schools had no Agricultural science laboratory and workshop. On the side of original schools, the study found that two of five had neither Agricultural science laboratories nor workshop, one had workshop but had no laboratory while the rest two had laboratories and workshops though all of the Agricultural science laboratories and workshops found in the study schools were dilapidated. Almost

all materials recommended by the syllabus for teaching and learning in Agricultural science laboratory were not available in the schools. Specimens or samples of actual materials, for instance, which can easily be collected by teachers and students, were completely unavailable in new schools' science rooms and insufficient in original schools. In one of the two original schools, the laboratory was used as a normal classroom for Agricultural science students. These results suggest that students will hardly learn certain aspects in Agricultural science that cannot be easily put into words as most of learning senses wouldn't be engaged and real life experience will be missing. The workshops were being used to store scrap tools, tables, desks and beds with very few tools for identification purpose. In some schools, workshops were also being used as a store for farm produce after harvesting.

The key informants were in agreement that availability and adequacy of physical facilities for teaching and learning Agricultural science subject is a great problem. One school quality assurer said that:

> *"I think you remember that all designated schools had an agricultural unit which contain laboratory, workshop and a yard for machines and implements such as tractors and ploughs. During the phase out period, most of the workshops and laboratories in the schools were modified to normal classrooms. On reinstatement, government efforts to revive teaching and learning environment seems to be minimal".*

The above explanation indicate phase out of the subject to a certain extent magnify the inadequacy of physical facilities observed in study schools especially in original schools. Key informants also showed greater shortage of these resources in new schools than in original schools. This was revealed by academic master of one of the new schools, who said the following while showing the researcher a single science room in the school:

> *"Our school had not only Agricultural science laboratory but we are running short of laboratories for all science subjects. Meanwhile we have this single science room which serves the purpose of very important practicals for all science subjects".*

Table 4: Distribution of physical facilities for teaching and learning Agricultural science subject in study schools

Resource	School	Availability	Condition* (Good/Poor)
Agricultural science laboratory	OS 1. Pugu	✓	Poor
	OS 2. Kibaha	✓	Poor
	OS 3. Kilosa	×	
	OS 4. Mvomero	×	
	OS 5. Mkuu	×	
	NS 1. Welwel	×	
	NS 2. Ganako	×	
	NS 3. Gyekrum-Arusha	×	
	NS 4. Kilimatembo	×	
	NS 5. Kainam-Rhotia	×	
Agricultural science workshop	OS 1. Pugu	✓	Poor
	OS 2. Kibaha	✓	Poor
	OS 3. Kilosa	✓	Poor
	OS 4. Mvomero	×	
	OS 5. Mkuu	×	
	NS 1. Welwel	×	
	NS 2. Ganako	×	
	NS 3. Gyekrum-Arusha	×	
	NS 4. Kilimatembo	×	
	NS 5. Kainam-Rhotia	×	
School Farm	OS 1. Pugu	×	
	OS 2. Kibaha	×	
	OS 3. Kilosa	✓	Poor
	OS 4. Mvomero	✓	Poor
	OS 5. Mkuu	✓	Good
	NS 1. Welwel	✓	Poor
	NS 2. Ganako	✓	Poor
	NS 3. Gyekrum-Arusha	✓	Poor
	NS 4. Kilimatembo	✓	Poor
	NS 5. Kainam-Rhotia	✓	Poor
Library	OS 1. Pugu	✓	Poor
	OS 2. Kibaha	✓	Good
	OS 3. Kilosa	✓	Poor
	OS 4. Mvomero	✓	Poor
	OS 5. Mkuu	✓	Poor
	NS 1. Welwel	×	
	NS 2. Ganako	✓	Poor
	NS 3. Gyekrum-Arusha	×	
	NS 4. Kilimatembo	×	
	NS 5. Kainam-Rhotia	×	

✓ = Available, × = Unavailable, OS = Original school, NS = New school, * = Standard requirements not stated clearly by the curriculum.

All new schools had a farm which they used to grow annual crops once a year. In original schools, three of five schools had school farm which they also grew annual crops once a year with exception of only one school (Mkuu secondary school) which cultivated leafy vegetables throughout a year. Two of the five original schools had no school farm as it was observed in Pugu and Kibaha secondary schools. Livestock enterprises in study schools were rare with exception of Pugu which had few cattle as well as Mkuu and Welwel which had few goats. Lack or poor condition of school farms suggest that there would be little possibility for students trying what they learned in classroom about crop and livestock husbandry.

The study further observed that, of the five original schools, two had no library at all. Of the three remaining, two had libraries which were used as study rooms because there were no current books while one school had a good library facility due to its location advantage. That is because the regional library was in compound of the school hence it was to serve the students. On the other hand, four of five new schools had no library. One new school had a very good library building donated by one proprietor of neighbour tourist hotel, however, had no relevant books and other textual materials for students' learning hence it served students as a reading room.

Agricultural science subject teachers in both school categories were in agreement that physical facilities for teaching the subject were inadequate. One Agricultural science subject teacher in new schools' category said the following concerning Agricultural teaching and learning facilities:

> *"We thank God that Agricultural science is a subject which students can partly learn by using home experiences but for sure apart from classrooms in this school, we have no any other special physical facility for teaching the subject".*

On the other hand, one Agricultural science teacher respondent in original school had this to say on the availability of the materials needed in Agricultural science laboratory and workshop:

> *"These materials were available in schools very early, on introduction of the subject in school when the subject was valued but nowadays and particularly after it was phased out then reinstated there is almost nothing. It looks as if that after phasing out the materials also gone away. Most of them had been worn out during the phasing-out period and on reinstatement they were neither replaced nor maintained".*

The above statement suggests that before phasing out the subject, teaching and learning materials were more available and maintained than at reinstatement where the materials are not replaced or maintained, something which perceived by the teachers as negligence to the subject. The above explanations suggest that learning will be negatively affected as the conditions for physical facilities fall short of those required by the curriculum.

4.2.2 Implements and machinery resources

The study investigated the availability and adequacy of implements and machinery resources for teaching and learning Agricultural science subject in the study schools as presented on Table 5. The resources included tractor, ploughs and harrows. Results in Table 5 show that three out of five original schools had tractors, ploughs and harrows which were not working while the rest two original schools and all new schools had no tractor, plough or harrow. These implements and machinery resources are intended for teaching and learning agro-mechanics matters and simplifying work in schools' farms. Unavailability and/or poor condition of these implements and machinery resources could lower the effectiveness of teaching and learning as skills such as those requiring to be operated by tractors would not be easily learnt. Furthermore, lack of tractor and implements increases drudgery to students working in schools' farms which, in turn, hinders students to realise value of machines and modern implements in simplifying farm activities.

Table 5: Distribution of availability and adequacy of machines and implements for teaching and learning Agricultural science subject in study schools

Resource	School	Availability	Condition* (Working/Not working)
Tractor	OS 1. Pugu	✓	Not working
	OS 2. Kibaha	✓	Not working
	OS 3. Kilosa	✓	Not working
	OS 4. Mvomero	×	
	OS 5. Mkuu	×	
	NS 1. Welwel	×	
	NS 2. Ganako	×	
	NS 3. Gyekrum-Arusha	×	
	NS 4. Kilimatembo	×	
	NS 5. Kainam-Rhotia	×	
Ploughs	OS 1. Pugu	✓	Not working
	OS 2. Kibaha	✓	Not working
	OS 3. Kilosa	✓	Not working
	OS 4. Mvomero	×	
	OS 5. Mkuu	×	
	NS 1. Welwel	×	
	NS 2. Ganako	×	
	NS 3. Gyekrum-Arusha	×	
	NS 4. Kilimatembo	×	
	NS 5. Kainam-Rhotia	×	
Harrows	OS 1. Pugu	✓	Not working
	OS 2. Kibaha	✓	Not working
	OS 3. Kilosa	✓	Not working
	OS 4. Mvomero	×	
	OS 5. Mkuu	×	
	NS 1. Welwel	×	
	NS 2. Ganako	×	
	NS 3. Gyekrum-Arusha	×	
	NS 4. Kilimatembo	×	
	NS 5. Kainam-Rhotia	×	

✓ = Available, × = Unavailable, OS = Original school, NS = New school, * = Standard requirements not stated clearly by the curriculum.

4.2.3 Books

The availability of books investigated for teaching and learning Agricultural science subject included textbooks and reference books, as indicated in Table 6 and 7, respectively. Results in Table 6 indicate that Agricultural science textbooks seemed to be a

rare resource in all of the study schools despite the SEDP objective of one textbook in every subject for every student before or by 2009. According to the curriculum for ordinary level secondary school education, a textbook is the one containing all the subject matters specified by the subject's syllabus and they should be provided at book to student ratio of 1:1.

Table 6: Distribution of availability of textbooks for teaching and learning Agricultural science subject in study schools

School	Quantity	
	Required	Available
OS 1. Pugu	400	0
OS 2. Kibaha	400	0
OS 3. Kilosa	600	0
OS 4. Mvomero	500	0
OS 5. Mkuu	550	0
NS 1. Welwel	500	0
NS 2. Ganako	500	0
NS 3. Gyekrum-Arusha	330	0
NS 4. Kilimatembo	400	0
NS 5. Kainam-Rhotia	100	0

OS = Original school, NS = New school

In all of the study schools there were no such books for teaching and learning Agricultural science subject. A teacher in original school said the following concerning textbooks for teaching and learning Agricultural science.

> *"It is quite upsetting and embarrassing that Agricultural science is being taught and learnt in our secondary schools since independence up to now but we had no even a single textbook while other subjects such as Chemistry, Biology, Physics and others had. We have few reference books but most of them have been worn out and there is no replacement. I can't see the place of agriculture in our country! We use to teach the subject in a very horrible situation".*

Despite the fact that curriculum was silent on standard requirement of reference books as they are supplementary textual material, study noted that some reference books found in the study schools with exception of Pugu and Kibaha secondary schools were not adequate as indicated with too large book to students' ratio especially in new schools as indicated in Table 7.

Table 7: Distribution of availability of reference books for teaching and learning Agricultural science subject in study schools

School	Quantity available	Book: Student ratio*
OS 1. Pugu	220	1:2
OS 2. Kibaha	210	1:2
OS 3. Kilosa	112	1:6
OS 4. Mvomero	50	1:10
OS 5. Mkuu	100	1:6
NS 1. Welwel	15	1:33
NS 2. Ganako	10	1:50
NS 3. Gyekrum-Arusha	10	1:32
NS 4. Kilimatembo	32	1:13
NS 5. Kainam-Rhotia	10	1:10

OS = Original school, NS = New school, * = Standard requirements not stated clearly by the curriculum.

The reference books available in study schools for teaching and learning Agricultural science subject included the following titles: Basic agricultural economics published 1990, Outline to soil science published 1986, Introductory soil science published 1979, Principles and practices of crop production published 2004, Principles and practices of livestock production published 2004, Introduction to agro-mechanics published 1988, An introduction to agricultural economics published 1981, East African agriculture published 1990. According to the curriculum for ordinary level secondary education, the reference books are required in schools to supplement the textbooks and adequacy is not predetermined. The study noted from all Agricultural science teacher respondents in both school categories that reference books for some subject matters such as agriculture and environmental management; farm survey and mapping; agro-forestry production; and fisheries and fish production were completely missing in the study schools. This suggests that the subject might be ineffectively taught and learnt in the schools.

4.2.4 Teachers

The study searched for the information about status of Agricultural science teachers in the study schools. Heads of schools were asked to indicate the number of teachers available in schools and those required for effective teaching of Agricultural science subject thereafter deficit/excess computed as it is shown in Table 8.

Table 8: Distribution of Agricultural science teachers in study schools

School	Required	Available		Deficit	Excess
		Permanent	Temporary		
OS 1. Pugu	4	5	0	0	1
OS 2. Kibaha	4	0	2	4	0
OS 3. Kilosa	4	3	0	1	0
OS 4. Mvomero	4	2	0	2	0
OS 5. Mkuu	4	1	1	3	0
NS 1. Welwel	4	2	0	2	0
NS 2. Ganako	4	2	1	2	0
NS 3. Gyekrum-Arusha	2	0	1	2	0
NS 4. Kilimatembo	3	1	1	2	0
NS 5. Kainam-Rhotia	2	0	2	2	0

OS = Original school, NS = New school

Results in Table 8 indicate that with exception of Pugu secondary school, the rest of study schools, that is, four original and all five new schools there were deficits of Agricultural science teachers. Discussions with heads of the studied schools on availability and adequacy of Agricultural science in their schools revealed that the deficit was more severe in new schools to the extent that two of the five new schools had had never permanent Agricultural science teachers since they started offering the subject. Deficit of Agricultural science teachers forced the schools to engage temporary teachers to teach the subject in their schools on local arrangement basis. Temporary teachers found in the study schools

included retired teachers, ex-diploma candidates who were not yet posted in working stations and Form six ex-Agricultural science students.

The study also noted that some study schools had qualified Agricultural science teachers but they were assigned to teach other subjects especially science subjects such Physics, Chemistry and Biology while Agricultural science left being taught by Form six ex-Agricultural science students who were mentored by those qualified Agricultural science teachers. This tendency suggests that the subject is less valued. Although original schools had better status of Agricultural science teachers as compared to new schools, yet there were some schools like Kibaha which affected adversely by phasing out of the subject. The study noted that during the phasing out the teachers were allocated other responsibilities whereby on reinstatement it was not easy to get them back, thus leaving temporary teachers to teach the subject.

One of the key informants (a school quality assurer) when talking about availability and adequacy of Agricultural science teachers had the following to say:

> *"The shortage of Agricultural science teachers seen in schools these days was emanated about a decade earlier, during its phasing out era. Agricultural science teachers are so versatile in that they are able to teach several subjects depending on the background of their studies. They can teach subjects such as Chemistry, Physics, Mathematics, Biology, Economics and others. Following the phasing out of the subject in 2004 most of them were shifted to teach these other subjects, moreover, some have quitted the teaching job as they thought that the subject is not valued and their future was somehow blunt, consequently you can find now Agricultural science teachers are so scarce".*

In discussions with heads of study schools on allocation of Agricultural science teachers in teaching other subjects, one head of school said the following:

> *"Sometimes you may find that in school you want four teachers to teach Agricultural science and you have only one. Instead of using that one teacher teaching unproductively it is better to shift the teacher(s) to join other subject teachers teaching other subject(s) more productively. In some instances we use to do this because among the tasks of administrators is to use the scarce resources*

efficiently to produce. After all teaching Agricultural science these days is so challenging in terms of teachers and other resources, perhaps that is why on reinstatement the subject was made optional".

The two statements above imply that the versatility working nature of Agricultural science subject teachers renders them being shifted to teach other subjects. Moreover, the subject being optional lowered its value among schools and other education administrators. These observations suggest ineffective teaching and learning of Agricultural science in schools. The shortage of Agricultural science teachers compounded with severe deficiency of textbooks, physical facilities, implements and machinery resources as observed in previous sub-sections suggests that student's learning will hardly be effected.

4.2.5 Timetable

The study also sought to assess the adequacy of timetable used in teaching and learning Agricultural science in terms of number periods allocated on the school timetable as presented in Table 9.

Table 9: Distribution of number of Agricultural science subject periods in timetable of the study schools

School	Required number of periods per week	Number of periods allocated per week	Deficit (number of periods)
OS 1. Pugu	6	6	0
OS 2. Kibaha	6	4	2
OS 3. Kilosa	6	5	1
OS 4. Mvomero	6	6	0
OS 5. Mkuu	6	3	3
NS 1. Welwel	6	4	2
NS 2. Ganako	6	6	0
NS 3. Gyekrum-Arusha	6	3	3
NS 4. Kilimatembo	6	6	0
NS 5. Kainam-Rhotia	6	6	0

OS = Original schools, NS = New schools

Results in Table 9 indicate that number of Agricultural science periods per week varies among original and new schools, ranging from three to six periods. It was also found that although six periods per week was predetermined by the curriculum yet the number of Agricultural science periods per week were reduced in some study schools' timetable as observed in Kibaha, Kilosa, Mkuu, Welwel and Gyekrum-Arusha secondary schools. The study found that in some of the schools this was taken as means of relieving Agricultural science teachers from extremely high teaching loads associated with shortage of teachers. This was captured from one of the original school academic master's explanation when asked on the reasons for the reducing the number of periods from the six stated by the curriculum for ordinary level secondary school education. He said:

> *"It is quite true that the number of periods we allocate for Agricultural science in our school timetable is less than the recommended ones but we use to reduce them so as to match with the shortage of Agricultural science teachers. Meanwhile, in our school we have only one teacher teaching the subject from Form One to Six. The teacher cannot manage that extremely heavy teaching load".*

On the other hand, in other study school, reduction in number of periods was due to situation that the subject runs together in their timetable with other optional subjects which were allocated less number of periods than Agricultural science and therefore, it was a means to create an opportunity for students learn other additional optional subjects. This was revealed by explanation from one of new schools' academic mistress regarding reduction of the number of periods for Agricultural science subject in her school timetable by saying that:

> *"It has not been easy to allocate in our school timetable all the six recommended periods by the Ministry of Education due to many subjects which students are supposed to be taught. This forced us to reduce the number of Agricultural science periods so that they fit to run parallel with other optional subjects in our school timetable".*

One teacher respondent when talking about the timetable with reference to number of periods, he said that:

> *"It looks as if the Ministry of Education doesn't value Agricultural science subject. How happens that it prepared the syllabus for teaching and learning in eight periods per week, yet the same Ministry redirect the same syllabus to be taught and learnt for reduced number of six periods per week! The way Agricultural science subject is managed in this country doesn't make sense".*

This trend is controversial due to the fact that even the six recommended periods were not enough because the syllabus in use initially was designed for eight periods per week before phasing out the subject, of which on reinstatement the number of Agricultural science periods was reduced without amending the syllabus to fit six periods per week. These findings suggest that, with all the severe shortages of other resources as it has been observed in the previous sub-sections, the subject will be ineffectively learnt.

4.2.6 Syllabus

The availability of syllabus booklet for teaching and learning Agricultural science subject was investigated as shown in Table 10.

Table 10: Distribution of availability of syllabus booklet for teaching and learning Agricultural science subject in study schools

School	Quantity available
OS 1. Pugu	4
OS 2. Kibaha	2
OS 3. Kilosa	1
OS 4. Mvomero	1
OS 5. Mkuu	1
NS 1. Welwel	1
NS 2. Ganako	1
NS 3. Gyekrum-Arusha	1
NS 4. Kilimatembo	1
NS 5. Kainam-Rhotia	1

OS = Original schools, NS = New schools.

Results in Table 10 indicate that every study school had Agricultural science syllabus booklet which guided teaching of the subject. The study found that there was a scarcity of original syllabus booklets in both original and new schools, however, the schools tackled the scarcity by producing the photocopied booklets hence they were sufficient for teaching the subject.

The study further required to seek out respondents' opinions on relevance, organisation and coverage of the syllabus in their schools. The findings indicate that student respondents considered the syllabus to be appropriate only for improvement of their agricultural knowledge but not skills because they were taught theoretically than practically. Students from both school categories were in opinion that subject matters in the syllabus are not well balanced hence the syllabus was inappropriate to them as well as their families and communities as they were lacking practical skills in soil, agro-mechanisation, crop and livestock husbandry as well as those required in creating, developing and maintaining farming and farming related enterprises. One student had the following to say on the Agricultural science content they are taught.

> *"So much of what we are taught in Agricultural science is uninteresting because they are not showing us practically how to handle issues in agriculture; it is not related to our everyday lives. Agriculture in media is often exciting, but that is not an aspect of the Agricultural science we hear and see about it in school. There are topics and skills that would be interesting like enterprising skills in various fields of agriculture but they are not taught".*

The above explanation implies that Agricultural science students are not being taught what they were intended or expected hence the subject might be less valued by students as well as their families and communities.

The student respondents' opinions on organisation of Agricultural science syllabus indicate that student respondents in original and new schools were in agreement that

difficulty of topics in syllabus/curriculum complies with their levels of mastering them but inappropriately sequenced to facilitate acquiring of agricultural skills as they had not been taught what they were expecting.

The student respondents' opinions in new and original schools on coverage of Agricultural science syllabus indicate that Agricultural science syllabus is not covered on time. One student in original school had the following to say on length and coverage of Agricultural science syllabus:

> "*There are too many topics to cover in Agricultural science subject in a given time. When comparing the amount of notes we write for Agricultural science you can find that they are like for that of the three science subjects altogether, that is Physics, Chemistry and Biology though Agricultural science is a bit easier subject compared to them. Sometimes our teachers use to teach us at our private preparation time during the evening so as to cover the topics required. To be frank, learning Agricultural science is very tedious in terms of writing notes".*

These findings suggest that the learning intended to students by the syllabus will partially be taught hence partially be achieved by students.

The study further sought to investigate teacher respondents' opinions on relevance, organisation and coverage of Agricultural science syllabus in their schools. It was found that the teacher respondents from original and new schools considered the syllabus to be relevant to their students, however, they were in view that the conditions of teaching and learning resources in their schools won't allow it to be properly effected. One teacher respondent said that:

> *"The syllabus is not bad, it has many relevant subject matters which can acquaint our students with broad body of knowledge and skills relevant to their daily life but the major obstacle is the ill situation of teaching and learning resources facing schools; there are no enough resources for students to learn what they are supposed to learn".*

The teacher respondents' opinions on organisation of Agricultural science syllabus indicate that the teachers from both school categories were in opinion that crop, livestock,

soil, agro-mechanisation and agro-economy matters in the syllabus are not well organised as the spiral arrangement was not adhered. One teacher respondent said that:

> *"The organisation of the syllabus is not proper; you find for instance that soil physical properties are supposed to be taught in Form Four while the student is required to learn crop production since Form Two. It will be difficult for a student understanding growing of crops without baseline knowledge of soil properties".*

The above explanation indicates that lack of logical organisation in the syllabus might impede the students learning the required knowledge and skills in coherent manner. Teacher respondents' opinions on coverage of Agricultural science syllabus indicate that all of teacher respondents from both original and new schools were in agreement that Agricultural science syllabus is not covered on time. One teacher respondent in new school had this to say on coverage of the syllabus.

> *"To be sincere this version of syllabus is not covered on time. Sometimes we afford to cover it but by using extra time. As you can remember, this syllabus was initially meant for eight periods per week, however, on reinstatement the same syllabus was returned to be learnt using only six periods per week. This real is a problem".*

The key informants particularly academic masters/mistresses and school quality assurers were in agreement that Agricultural science syllabus was the bulkiest syllabus among syllabuses of ordinary secondary school they have seen. An academic master of one original school said that:

> *"Sincerely speaking I have never seen a very bulk syllabus like that of Agricultural science subject. I think even the university syllabuses are not bulky as the one. I wonder how it can be taught effectively".*

These results suggest partial teaching and learning of the intended matters which in turn could lower learning effectiveness.

It can generally be concluded from this section that resources for teaching and learning Agricultural science subject were either completely missing or not adequate in study schools, new schools being more deficient than original schools. Shortage of these

resources consequently could lead into lack of practical teaching and poor students' achievement. To alleviate this, MoEST, PO-RALG, Municipals and Councils responsible for education in ordinary level secondary school education should adequately equip schools with all human and non-human resources predetermined by the syllabus/curriculum.

4.3 Teaching and Learning Processes for Agricultural Science Subject

Processes used in teaching and learning Agricultural science subject were investigated for the second objective of the study. Student and teacher respondents were asked questions which required them to indicate their level of satisfaction on process factors, namely: clarity in teaching and learning goals to students, use of variety of teaching and learning strategies, interactions in teaching and learning, engagement in teaching and learning, assessment for teaching and learning, as well as guidance and counselling in learning.

4.3.1 Students' opinions on teaching and learning processes for Agricultural science subject

Student respondents' opinions on: clarity in teaching and learning goals to students, use of variety of teaching and learning strategies, interactions in teaching and learning, engagement in teaching and learning, assessment for teaching and learning, as well as guidance and counselling in learning for Agricultural science subject were investigated and findings are presented in Table 11.

4.3.1.1 Clarity of teaching and learning goals to students

The study sought to seek students' opinion on whether they were satisfied with the way they let to know the goals in teaching and learning Agricultural science as it is presented in Table 11. Results in Table 11 indicate that majority (72% and 87%) of student respondents in original and new schools, respectively, were in opinion that lessons'

learning objectives were not made clear to them by their teachers during teaching. On the other side minority (24% and 9%) of student respondents in original and new schools, respectively, were satisfied that their teachers let them know the learning goals whereas 4% in both school categories had no opinion.

Table 11: Distribution of student respondents' opinions on teaching and learning processes for Agricultural science subject (n=100)

Statement	Original schools (n=50)			New schools (n=50)		
	D %	NO %	S %	D %	NO %	S %
Clarity of teaching and learning goals to students	72	4	24	87	4	9
Use of variety of teaching and learning strategies	86	0	14	100	0	0
Interactions in teaching and learning	62	1	37	84	6	10
Engagement in teaching and learning	90	0	10	100	0	0
Assessment for teaching and learning	74	0	26	91	0	9
Guidance and counselling	48	0	52	84	2	14

D = Dissatisfied, NO = No opinion, S = Satisfied

The study noted that student respondents felt that the goals and objectives for which the learning is being carried out were not clear both in theory and practical situations which make them unable to reflect how far they achieved what they were supposed to learn during the learning tasks. This was revealed in the following explanation from one of student respondent, who said that:

> *"We are neither told by our teachers what we are supposed to achieve at the end of lessons nor at the end of the entire course of Agricultural science. They just tell us the topic or sub-topic we are going to learn in a particular period. We do not know even all the topics and sub-topics we are required to learn in a year or for the entire course. I heard that the goals for learning are shown in syllabus but I haven't even seen the image of Agricultural science syllabus. Sometimes we know what we are supposed to learn by comparing with what our friends in other schools have learnt. In the prevailing situation, how can I reflect my learning if at all I don't know exactly what I'm supposed to achieve? When we do tests and*

examinations we think that what we are being asked in the tests and examinations are the subject matters we are supposed to learn and achieve".

The findings from this study were in contrast with those of Campbell *et al.* (2004) who found that in order to develop constructive learning, students, must be helped to comprehend what goals are expected to achieve so as to influence them appreciate and develop interest on particular learning as this helps them know how, when and where to apply the facts and concepts learnt.

4.3.1.2 Use of variety of teaching and learning strategies

The study examined student respondents' opinions on use of variety of teaching and learning strategies in Agricultural science as shown in Table 11. Results in Table 11 indicate that majority of the respondents (86% and 100% in original and new schools, respectively), were dissatisfied while minority of the respondents (14% in original and none in new schools) were satisfied with the way teachers were using variety of strategies in teaching Agricultural science.

The study further examined student respondents opinions on frequency at which the variety of methods and strategies used in teaching and learning Agricultural science subject in the study schools. Student respondents were asked to respond as to how frequently specific teaching and learning strategies were used by their teachers. The results of teaching and learning strategies used indicate that strategies which were often used in teaching and learning Agricultural science subject in both original and new schools were lecture and one student writing notes on the chalk board for others to copy. Both categories of schools were sometimes taught through experiential learning, however, original schools were sometimes taught and learnt through group work to co-produce reports and presentations, classroom based problem-solving and enquiries, demonstrations,

agricultural exhibitions and supervised practicals at school workshop/tool shed while new schools had never experienced them. The study also noted that there was a tendency of students copying notes from ex-students exercise books and not synthesised from text and reference books as it is supposed to be (URT, 2005a) due to lack Agricultural science textbooks.

The trend found in these results is in contrast with the methods and strategies recommended by the Agricultural science syllabus and Curriculum for ordinary level secondary school education which insists active participatory student-centred teaching and learning methods and strategies to be used frequently in secondary schools (URT, 1997; 2005a). To mention some, these includes: group work to co-produce report and presentations, classroom based problem-solving and enquiries, summarising readings, posing problems as well as solving those set by the teacher, library search, debate, supervised laboratory and farm practicals, questions and answers, role play, project, peer tutoring, experiential learning and brainstorming (URT, 1997; 2005a).

4.3.1.3 Interactions in teaching and learning

The study sought students' opinions on whether they were satisfied with interaction in teaching and learning Agricultural science as it is shown in Table 11. Considering that interaction is two way traffic, that is, between teacher and students as well as student and student, both were explored from student respondents in this study. On average, student respondents' opinions indicate that majority (62% and 84%) from original and new schools, respectively, were dissatisfied with interactions. Smaller proportions (37% and 11%) of student respondents, in original and new schools, respectively, were satisfied with interactions. The minimal interactions in teaching and learning Agricultural science observed in this study schools might be caused by lecture strategy which was reported to

be often used as it couldn't be able to create an opportunity for interaction. One student respondent when explaining her opinions on interaction in teaching and learning Agricultural science, she said that:

> *"We are given little opportunity to share thoughts among ourselves as well as with teachers. For students, learning Agricultural science is simply swallowing the agricultural knowledge as it comes from our teachers".*

The above explanation implies that teaching Agricultural science in the schools is predominantly transmissive of which hinders interactions and ultimately renders ineffective learning. These findings are in disagreement with Pintrich and Schunk (2002) and Ishemo (2012) who were in view that optimal interactions are means to allow students to demonstrate competences they have learnt in a realistic situation.

4.3.1.4 Engagement in teaching and learning

The study sought students' opinions on whether they were satisfied with engagement in teaching and learning Agricultural science, as it is shown in Table 11. Results in Table 11 indicate that majority (90% and 100%) of the respondents in original schools and in new schools, respectively, reported to stay idle in Agricultural science lessons. Smaller proportion (10% and none) of the student respondents in original and new schools, respectively, were satisfied with engagement in teaching and learning Agricultural science. The least engagement in teaching and learning Agricultural science observed in this study schools was linked by students respondents with the shortages of teaching and learning materials and facilities as it could not allow them being engaged well in hands-on activities throughout lessons. This was revealed by one student when he said the following:

> *"We are always engaged in listening and writing notes. Sometimes we do cultivate crops in school but the way we are doing in school is not very different from the way we do at home therefore we feel that there is nothing new to learn. For sure, it is more a production than teaching and learning. We are not doing any practical until near final examinations".*

The study also sought to seek engagement of students in out-classroom agricultural activities while attending their studies at secondary school and whether or not helped them in learning Agricultural science. The activities included Agricultural science subject club, horticulture, field crop and livestock husbandry projects in school premises. Student respondents' responses to their involvement in these activities indicate that major out of classroom activity the respondents participated in schools were crop husbandry which involved 64% and 84% of the respondents from original and new schools, respectively. Other out of classroom activities which student respondents participated in schools included Agricultural science subject clubs and livestock husbandry, respectively, new schools being lowly participated as compared with original schools.

Discussions with key informants in study schools revealed that there were some constraints which hinder schools establish agricultural projects. These include lack of land and water supply. In spite of shortage of land one of the original schools had at least horticultural project where all students including agricultural and non-agricultural, had a piece of vegetable bed of which every student use to care. A headmaster of this school said the following about near future situation of the school's horticultural project:

> *"Although you see students gardening, after sometimes this project will vanish because we want to use that piece of land to build dormitories for students who stay far away from the school".*

Unlike that school which required gardening even at shortage of land, another old school had plenty of land and all-a-year water supply but their students were not benefiting much from out of classroom agricultural learning activities such as horticultural production. One key informant in one of original schools when giving reasons as to why the schools don't engage their students in manual agricultural activities said that:

> *"Nowadays educational administrators don't want to involve students in out of classroom agricultural activities. They prefer leaving students to concentrate much on paper and pen classroom activities".*

The above explanation suggests that attitude of some school administrators are not in favour of engaging students in such activities or projects like horticulture. One of the original schools, for instance, which had plenty of land and water supply throughout the year was only engaging in subsistence maize production once per year. The rest of the study schools had school farms although water supply was a constraint therefore they relied on rainfall in producing some annual crops like maize, pigeon peas, cow peas and beans once in a year. Livestock projects in the studied schools were rare as most of them were not keeping livestock with exception of two original schools and one new school. Of the two original schools, one had few cattle and the other had few goats while the one new school had few goats. All of the studied schools had neither crop museum nor pot plants for at least studying the wide range of crop plants as it is intended in the syllabus.

Student respondents were further asked whether the out of classroom activities participated in school have helped them learning Agricultural science. In spite of limited participation of student respondents in agricultural related out of classroom activities, nevertheless, most of the respondents from original and new schools, agreed that experience obtained enrich their school Agricultural science learning and their interest in agriculture. Engagement of students in learning connects them to their own lives. Students usually reject school agriculture that is disconnected from their lives, that is, where there is no space for themselves and their ideas. Thus, minimal students' engagement observed in this study implies that the intended skills and attitudes would poorly be achieved as Agricultural science learning nature requires complementarities between in and out classroom teaching. These findings are in disagreement with Adeyemo (2010) who noted that both in and out classroom activities should be strengthened so as to allow students to develop various essential skills and attitude for their school and after school life.

4.3.1.5 Assessment for teaching and learning

The study assessed teaching and learning Agricultural science subject in study schools with respect to purpose, frequency, strategies used and feedback of assessment. Student respondents' opinions on assessment for teaching and learning Agricultural science presented in Table 11 indicate that the majority (74% and 91%) of the respondents from original and new schools, respectively, were dissatisfied while small proportion (26% and 9%) of the respondents from original and new schools, respectively, were satisfied. Reasons revealed by this study for student respondents' dissatisfaction included the following: assessment neither focus upon skills mastery nor applications in real-life settings, teachers not letting students know the objectives they will gain from assessment, lack of individual corrective feedback and frequent follow-ups by teachers to improve students' learning.

Student respondents were further asked as to how frequently specific assessment strategies were being used by their teachers. The respondents' responses show that locally/school developed tests and examinations were often used in both original and new schools. Class exercises, take-home assignments, externally developed tests/examinations, project work and oral presentations were infrequently used while practical tasks to demonstrate performance, portfolios as well as checklists, rating scales and rubrics were never being used in both original and new schools. These results indicate that assessment method and strategies suggested by the Curriculum for ordinary level secondary school education (URT, 2005a) were not properly being used in the study schools. According to URT (2005a), assessment methods and strategies found often used in the study schools are not capable in probing student' understanding and critical thinking as it is demanded by the curriculum. The recommended methods and strategies by URT (2005a) for assessing subjects, Agricultural science inclusive, for Tanzanian schools include: practical tasks,

oral presentations, project work, portfolios, written essays or reports, quizzes, class exercises and assignments, take-home assignments, examinations, checklists, rating scales and rubrics.

These results are also contrary to the observation made by Braum and Kanjee (2006) who emphasises that assessment should focus on understanding, meaning and consolidating what is learnt for life-long settings rather than for retrieving factual memory of what it has been learnt. These study results are also in disagreement with Campbell *et al*. (2004) who were of the view that individual feedback, corrective instructions and frequent follow-ups should always be done to ensure that students achieve the intended teaching and learning subject objectives.

4.3.1.6 Guidance and counselling

The study sought to search out student respondents' opinions on guidance and counselling service they receive with respect to opting subjects they learn in secondary schools as well as on farming and farming related career as presented in Table 11. Results in Table 11 indicate mean opinion that about half (52%) of the respondents in original schools were satisfied with guidance and counselling service they receive in their schools in opting subjects they learn in secondary schools as well as on farming and farming related career while 48% were dissatisfied. On the other side, their counterparts in new schools, situation was worse as only 14% of the respondents were satisfied with guidance and counselling service they receive in choosing optional subjects as well as career guidance while majority (84%) of the respondents were dissatisfied.

Better guidance and counselling in original schools than new schools could be attributed to the fact that students in these schools were less eager to study Agricultural science as

compared to those in new schools. It was observed by this study that this students' tendency awake Agricultural science teachers in original schools guiding and counselling their students in taking the subject as compared to new schools. Discussions with key informants revealed that guidance and counselling in subjects and career was a rare service in study schools. In most of study schools, career guidance and counselling was performed by Students' Counsellor (SC) masters/mistresses who were normal classroom teacher appointed by the head of school. It was observed that in the tasks of SC masters/mistresses in schools there was tension between discipline control and career guidance and counselling duties or responsibilities since most of them were found to deal much with discipline issues than career guidance and counselling. In most of study schools the need for discipline control as well as normal classroom teaching becomes stronger hence SC masters/mistresses usually invest more time for that. Even when SC master/mistress finds time for career guidance and counselling tasks, there remains tension between their discipline control function on the one hand and their guidance and counselling on subjects and career function on the other.

Inadequate guidance and counselling in study schools could be attributed to poor implementation of the objectives indicated in the Tanzania Education and Training Policy which emphasises that, every secondary school in Tanzania should have career masters/mistress who will be responsible in guiding students about career choice and supervising different career services (URT, 1997b, URT, 2005a).

An overall student respondents' opinions on the processes used in teaching and learning Agricultural science subject was assessed on a 5-point Likert scale (strongly disagree, disagree, no opinion, agree and strongly agree) to generate overall maximum and minimum values using 70-point index summated scale as described in section 3.7.2 (b). The maximum points scored were 59 and 37 for original schools and new schools,

respectively, while minimum points scored were 31 and 22 for original schools and new schools, respectively. On the basis of the point ranges on the index summated scale, an overall extent of student respondents' satisfaction on the teaching and learning processes was computed as shown in Table 12.

Table 12: Distribution of overall assessment of student respondents' opinions on teaching and learning processes for Agricultural science (n=100)

Extent of satisfaction	Original schools (n=50) %	New schools (n=50) %	χ^2
Satisfied	16	0	8.696**
Neutral	0	0	(p=0.003)
Dissatisfied	84	100	

** = significant at ($p \leq 0.01$)

Results in Table 12 indicate that for original schools, overall, 84% of student respondents were dissatisfied and 16% satisfied with teaching and learning processes in Agricultural science while in new schools it was much worse, all 100% respondents were dissatisfied. This is because the points for satisfaction were 43 to 70, the points for neutral were 42, and points for dissatisfaction were 14 to 41. On the basis of the above point ranges, student respondents from new schools were significantly ($p \leq 0.01$) extra dissatisfied in the teaching and learning processes used in Agricultural science compared with those from original schools.

4.3.2 Teachers' opinions on teaching and learning processes for Agricultural science subject

In spite of the student respondents' findings, the study sought to seek teacher respondents' opinions on processes for teaching and learning Agricultural science subject for the intention of comparing them with those of student respondents in section 4.3.1. Teacher respondents were asked to respond to the same specific statements given to student

respondents with reference to clarity in teaching and learning goals, use of variety of teaching and learning strategies, interactions in teaching and learning, engagement in teaching and learning, assessment for learning as well as guidance and counselling. The teacher respondents' responses were summarised in terms of percentages, as given in Table 13, were compared with those of student respondents shown in Table 11, as described under main six parts hereunder.

Table 13: Distribution of teacher respondents' opinions on teaching and learning processes for Agricultural science subject (n=20)

Statement	Original schools (n=10)			New schools (n=10)		
	D %	NO %	S %	D %	NO %	S %
Clarity of teaching and learning goals to students	70	0	30	90	0	10
Use of variety of teaching and learning strategies	80	0	20	90	0	10
Interactions in teaching and learning	60	0	40	90	0	10
Engagement in teaching and learning	90	0	10	90	0	10
Assessment for teaching and learning	80	0	20	90	0	10
Guidance and counselling	50	0	50	80	0	20

D = Dissatisfied, NO = No opinion, S = Satisfied

4.3.2.1 Clarity of teaching and learning goals to students

The study wanted to seek teachers' opinion on whether students were informed the goals of teaching and learning Agricultural science as it is presented in Table 13. Results in Table 13 indicate that majority (70% and 90%) of teacher respondents in original and new schools, respectively, were in opinion students were not informed the lessons' learning objectives by their teachers during teaching. On the other side, small portion (30% and 10%) of teacher respondents of original and new schools, respectively, were in view that

students are informed the learning goals whereas none of teacher respondents, in both school categories had no opinion.

When these results compared with those of students in Table 11 concerning clarity in teaching and learning goals in face of students show that what was found from student respondents is what was reported by the teacher respondents, hence justifies that students are learning without knowing teaching and learning goals and objectives intended to be achieved. Teacher respondents were in opinion that it is not very important to inform students the intended teaching/learning goals and objectives as they are much important for teachers only in assessing their teaching. This was captured from a statement made by one of the teacher respondents in one of the new study schools when he said that:

> *"Teaching goals and objectives are crucial for teacher in preparing scheme of work and lesson plans so that he/she is able to assess as to what extent a student has achieved. I don't think that it is must for students to be informed about these goals and objectives, perhaps a teacher wants their students to assess him/her".*

Low clarity among students on goals and objectives for teaching and learning Agricultural science observed in this study when considered from the Constructivist Teaching and Learning theoretical perspective, suggest low metacognitive skills builds upon students which indicate ineffective learning as it cannot direct one's own thinking.

4.3.2.2 Use of variety of teaching and learning strategies

Teacher respondents' opinions on use of variety of teaching and learning strategies in Agricultural science were sought as shown in Table 13 and compared with those of student respondents' given in Table 11. Results in Table 13 show that majority (80% and 90%) of teacher respondents from original and new schools, respectively, were disagreed while 20% and 10% of teacher respondents from both original and new schools, respectively, agreed that variety of strategies were used in teaching and learning the

subject. These results are more or less similar with those of students in Table 11. The results in both original and new schools seem to reflect the fact that traditional lecture strategy is still dominating in study schools, new schools being more predominant than in original schools. One teacher respondent from new schools when discussing on the use of variety of teaching and learning strategies had the following to say:

> *"Sometimes, is very difficult to implement variety of teaching and learning strategies especially those said student-centred. I just heard about student-centred teaching, however, I didn't know exactly how they should be applied in the classroom. I have not been taught these in my teachers' college and since the Ministry of Education start advocating them up to this moment I had not been trained how to implement it. I am just teaching as I was trained in my teachers college".*

Another teacher respondent from original schools further said that:

> *"I think the implementation of variety of strategies in teaching and learning Agricultural science is very difficult in my side, as you know this need an environment which allows students to explore concepts independently and at their own pace. For example, it needs enough class space for group working and sufficient teaching and learning materials as well as facilities like textbooks, functional library and other resources. Currently these materials are highly deficient and I am teaching Form One to Six so I have extremely high teaching load. This coupled with insufficiency of books and other materials make it nearly impossible".*

This was emphasised by another teacher when discussing the issue of students spending some lesson time writing notes frequently had following to say:

> *"We usually use to prepare notes for students because they can't do it on their own due to deficiency of books. This for sure, makes teaching Agricultural science subject very boring"*

Analysing the above three explanations three inferences are obvious. The first is that teacher preparation is not meeting the standard required to work by the Ministry of Education. Second is that capacity building to cover the gap observed in teachers preparation is negligible to Agricultural science teachers and third is that for those teachers who are somehow aware of the importance of using variety of teaching strategies, lack of resources for teaching and learning hampers its implementation. These, in turn, render ineffective learning of students in Agricultural science as not all students might be reached due to failure to stimulate the multiple intelligence nature of human learning.

4.3.2.3 Interactions in teaching and learning

The study sought to seek teacher respondents' opinion on whether or not they were agreed with the extent of teacher-students and student-student interactions in teaching and learning Agricultural science as it is shown in Table 13. On average, teacher respondents' opinions indicate that majority (60% and 90%) of the respondents in original and new schools, respectively, were dissatisfied with interactions in Agricultural science lessons. Lesser percentages (40% and 10%) of teacher respondents in original and new schools, respectively, were satisfied with interactions in Agricultural science lessons. These results compared with those of student respondents in Table 11, they are not very different hence justifies what was observed in student respondents.

Discussions with Agricultural science teacher respondents of both original and new schools revealed that there was no enough time for interactions partly due to shortage of teaching and learning materials and facilities and partly due to few periods allocated to the subject as compared with the lengthy of the syllabus. This was revealed by one of the teacher respondents when discussing about limited interactions in teaching and learning Agricultural science. He said that:

> *"Teachers normally like to interact with students also allowing students to interact among themselves during the Agricultural lessons though this is restricted with the length of the syllabus to cover within a given time. As I have told you earlier that we have lots of topics to cover in this subject. So if teachers allow much interactions in the lessons they won't go far as the syllabus and examinations are concerned".*

The above explanation implies that teachers know the importance of interactive teaching and learning though they are bound to neglect it at the expense of covering the syllabus for examination purpose. The less interaction observed in this study, in turn, may render less interest to students learning the subject, which could lead to ineffective learning.

4.3.2.4 Engagement in teaching and learning

The study required teachers' opinion on whether they were satisfied with engagement in teaching and learning Agricultural science as it is shown in Table 13. Results in Table 13 show that majority (90%) of teacher respondents in both original and new schools were dissatisfied with the extent their students are engaged in learning the subject. Smaller proportion (10%) of teacher respondents in both original and new schools, were satisfied with engagement in teaching and learning Agricultural science. The slightest engagement in teaching and learning Agricultural science observed in this study schools was correlated by teacher respondents with shortage of resources like books, functional library, laboratory, workshop, as well as funds to implement strategies like study trips to teach matters which can't easily be learnt effectively in schools. One teacher respondent when explaining the extent students are engaged in teaching and learning stated that:

> *"These days engagement in teaching and learning Agricultural science is minimal. Students are learning the subject like the way they are learning History because schools have no materials and facilities for teaching it practically. Had it been books and other materials were available we would assign students varied tasks to perform during the lessons. Schools have no garden and livestock projects partly due shortage of water and funds. After all, this is a computer era, students prefer to be book wormers than engaging in tedious agricultural enterprises and sometimes schools administrators' use to keep it up".*

The above explanation confirms the findings noted from students and key informants that little engagement in and out classroom in teaching and learning Agricultural science is not only limited by inadequate resources but also both students' and schools administrators' attitudes. Lack of field trips coupled with ill school environment in terms of resources, interactions and engagement in learning hinder students seeing the beauty of agriculture. Likewise, less doing hinders development of competencies in agriculture. This tendency is unhealthy to effective learning as candidates will not be able to build up a sense reality and appreciation on the value of work with the hands. This in turn hinders promotion of complete and harmonious development of favourable farming attitude in students.

4.3.2.5 Assessment for teaching and learning

The study investigated teacher respondents' opinions on assessment for teaching and learning Agricultural science subject in study schools with respect to purpose, frequency, strategies used and feedback. Average teacher respondents' opinions on assessment for teaching and learning Agricultural science are presented in Table 13. Results in Table 13 indicate that majority (80% and 90%) of teacher respondents from original and new schools, respectively, were dissatisfied while small proportion (20% and 10%) of teacher respondents in original and new schools, respectively, were satisfied with assessment for teaching and learning. These results when compared with those of student respondents on assessment for teaching and learning in Table 11 they are not very different hence justifying the student respondents' opinions. Of the major reasons for dissatisfaction in teacher respondents is an assessment system of the country which attaches little value of school assessments. This fact was revealed by one teacher respondent who had this to say:

> *"Let me tell you the killing syndrome of assessment and the entire teaching and learning for Agricultural science subject. Common agricultural practicals such as field crop, horticultural crop and livestock production has no academic status as they are not reflected in student's marks in final examinations. This makes students and some parents often see that engaging students in those learning activities is like making them as simple manual labour while they are sharing school running costs. This trend is risky as students, parents and teachers lose interest. In a situation where certification is important like Tanzania, examination status is almost essential to any activity carried out in school. In most cases crop and livestock production is neglected in schools in favour of passing examinations and a great deal of practical work is actually not taken into account as it is not assessed. Come on the Form Four final practical examination is real embarrassing. It is set in the way that people usually term it as the examination of paying last respects because it involves much of identification of plants and tools. If there are no funds for running crop and livestock projects to engage students while teaching and learning where the funds for buying tools and searching for plant samples comes from, near the national examinations? No matter how the tool required for the examination is expensive or the plant is rare it should be bought, hired or searched at any cost. How it comes schools won't even secure funds for running mini crop and livestock projects for students to learn practically. In addition, Agricultural science intends to modify student's attitude towards agriculture but worse enough neither the national examinations nor schools assessing it. I am telling you for sure, without strong and appropriate assessment, Agricultural science will never be taught and learnt practically in the near future".*

This respondent's explanation to a great extent elucidated inadequate assessment system as the major source of negative attitude among schools and educational administrators in allocating funds and have a strong supervision of practical teaching and learning in Agricultural science. The prevailing assessment system of Agricultural science which focuses on recall of information is likely to reinforce to students the notion that the subject is transmissive. Assessment being transmissive it would not match the long and short term purposes for learning Agricultural science particularly that of attitude modification attached to value of agriculture.

4.3.2.6 Guidance and counselling

The study sought to search out teacher respondents' opinions on guidance and counselling students given with respect to opting subjects to learn in secondary schools as well as on farming and farming related career as shown in Table 13. Results in Table 13 indicate that majority (50% and 80%) of the teacher respondents from original and new schools, respectively, had negative mean opinion as far as guidance and counselling was concerned. Results in Table 13 show that 50% and 20% of the respondents from original and new schools, respectively, were satisfied with guidance and counselling students given in their schools in opting subjects they learn in secondary schools as well as on farming and farming related career. These results are more or less similar with those of students in Table 11 indicating poor guidance and counselling services in the studied schools.

Teacher respondents when asked about guidance and counselling services on career opportunities admitted that there were no such service in their schools as emphasis is put more on discipline than career issues. The study found that teacher respondents from original schools were sometimes used to guide and counsel their students about

agriculture career in the normal lessons particularly for Form One and Two classes so as to reduce rate of their students dropping out the subject in Form Three and Four.

An overall teacher respondents' opinions on the processes used in teaching and learning Agricultural science subject was assessed on a 5-point Likert scale (strongly disagree, disagree, no opinion, agree and strongly agree) to generate overall maximum and minimum values using 70-point index summated scale described in section 3.7.2 (b). The maximum points scored were 56 and 48 for original schools and new schools, respectively, while minimum points scored were 28 for both original schools and new schools. On the basis of the point ranges on the index summated scale, an overall extent of teacher respondents' satisfaction on the teaching and learning processes was computed as presented in Table 14.

Table 14: Distribution of overall examination of teacher respondents' opinions on teaching and learning processes for Agricultural science subject (n=20)

Extent of satisfaction	Original schools (n=10)	New schools (n=10)
Satisfied	20	10
Neutral	0	0
Dissatisfied	80	90

Results in Table 14 indicate that for original schools, overall, 80% of teacher respondents were dissatisfied while 20% satisfied with the teaching and learning processes in Agricultural science. In new schools, 90% of teacher respondents were dissatisfied while only 10% satisfied with the teaching and learning processes in Agricultural science. This is on the ground that the points for satisfaction were 43 to 70, the points for neutral were 42, and points for dissatisfaction were 14 to 41. These results when compared with those of student respondents in Table 12 they are almost similar. All the same, basing on the above point ranges, teacher respondents from new schools were slightly more dissatisfied

in teaching and learning processes in Agricultural science than their counterparts from original schools.

Generally, it can be concluded from this section that Agricultural science teaching and learning processes in this study with respect to clarity in teaching and learning goals to students, use of variety of teaching and learning strategies, interaction, engagement, assessment as well as guidance and counselling in teaching and learning were far different from what was intended by the syllabus/curriculum. Dissatisfaction in these processes can result into poor students' achievement. Interactive teaching should therefore be strengthened into schools by the ministries, municipals and councils responsible for managing education in secondary school education curriculum. This should be done through ensuring conditions for practical teaching and assessment as well as guidance and counselling so as to facilitate meaningful or fruitful learning in Agricultural science subject. Schools should also be encouraged and enabled to start and maintain demonstration plots, botanical gardens and some few livestock species as well as capacity building in Agricultural science teachers for practical and more interactive teaching and learning of the subject.

4.4 Knowledge, Skills and Attitudes Acquired from Implementing Agricultural Science Subject

It was assumed that Agricultural science subject which involves the study of science and technology underlying the principles and practise of agriculture aims to develop the knowledge, skills and attitudes that promote sustainability and use of agricultural resources. Student and teacher respondents' opinions were therefore sought on knowledge, skills and attitudes acquired from implementing Agricultural science subject as discussed hereunder.

4.4.1 Knowledge acquired from implementing Agricultural science subject

This sub-section presents and discusses student and teacher respondents' opinions on knowledge acquired from implementing Agricultural science subject under two main points as follows:

4.4.1.1 Student respondents' opinions on knowledge acquired from implementing Agricultural science subject

This part presents and discusses student respondents' opinions on their knowledge as they assess themselves to acquire by learning Agricultural science subject while pursuing their secondary school education under seven major themes as given in Table 15. The themes as per the subject's syllabus were: (a) Fundamentals of agriculture, (b) Crop production, (c) Livestock production, (d) Soil and its agricultural utilisation, (e) Agro-mechanics, (f) Farming business economics and agricultural extension, and (g) Agriculture and environmental management.

Table 15: Distribution of student respondents' opinions on their knowledge acquired in Agricultural science (n=100)

Statement	Original schools (n=50)			New schools (n=50)		
	P %	M %	G %	P %	M %	G %
Fundamentals of agriculture	28	44	28	44	50	6
Crop production	20	64	16	23	75	2
Livestock production	9	70	21	38	61	1
Soil and its agricultural utilisation	2	62	36	34	59	7
Agro-mechanics	15	50	35	50	46	4
Farming business economics and agricultural extension	12	54	34	50	46	4
Agriculture and environmental management	11	70	19	60	40	0

P = Poor, M = Moderate, G = Good

(a) Fundamentals of agriculture

The study sought to seek student respondents' opinions on the extent they rate their knowledge in matters comprised in fundamentals of agriculture as required by the subject syllabus. These matters comprised agriculture as a science, scientific procedures in Agricultural science, the Agricultural science laboratory, contribution and role of agriculture to the economy of Tanzania as well as agricultural development in Tanzania. Results in Table 15 indicate mean knowledge rating in fundamentals of agriculture as 28% poor, 44% moderate and 28% good for student respondents from original schools. In new schools, student respondents self rating in knowledge of fundamentals of agriculture were 44% poor, 50% moderate and 6% good. These results indicate that most (44% and 50%) of the respondents in original and new schools, respectively, were moderately knowledgeable in fundamentals of agriculture. However, considering the percentages of poor, moderate and good knowledge in the matter, the respondents from new schools had relatively low ratings than their counterparts from original schools.

The study observed that, of the matters which are required to be taught/learnt under fundamentals of agriculture, some are not taught at all while some are taught partially. Students in both original and new schools reported that they haven't been taught scientific procedures in Agricultural science. This was supported by one of key informants, the school quality assurer, that the matter is always not taught partly due to the fact that a Form One student is not very much capable of grasping the procedural methods used in the scientific process and partly due to failure of some teachers to teach the matter as it needs someone who is knowledgeable with research procedures.

Most of the key informant further explained that some subject matters particularly the Agricultural science laboratory is also not always taught as most of schools have no

functional Agricultural science laboratory and sometimes some teachers pretend that students have already learnt matters as the concept of laboratory and first aid in other science subjects. The key informants added that most of Agricultural science teachers also didn't teach types of apparatus in an Agricultural science laboratory because of not only they are scarcely found in schools but also by assuming that it has to be taken care of in other science subjects like Chemistry, Biology and Physics. These results suggest that fundamentals of agriculture won't be taught/learnt effectively unless the syllabus is revised so as to comply it with level of students to handle, teachers' capacity are built and schools are provided with functional Agricultural laboratory and encouraged to avail with it.

(b) Crop production

The study required to find out opinions of student respondents' on their knowledge level various building matters in crop production as per Agricultural science syllabus. These matters consisted of: introduction to crop science and production, classification of crop plants grown in Tanzania, distribution of major crop plants of economic importance in Tanzania, factors affecting crop production in Tanzania, farming systems, cropping systems and planting patterns, principles of crop production, crop protection, horticultural production, handling and processing of crop products, crop storage structures, annual field crops' production, forest crops' production, and perennial field crops' production.

Results in Table 15 indicate mean knowledge rating in crop production was (20% and 23%) poor, (64% and 75%) moderate and (16% and 2%) good in original and new schools, respectively. These results show that majority (64% and 75%) of respondents in both original and new schools, respectively, had moderate knowledge in crop production. This was attributed to the fact that majority of students had a chance to learn some aspects

of Crop production in their homes as majority had farming home background. This was revealed by one student respondent from new school who said that:

> *"There are so many aspects to learn in crop production and sometimes teachers are rushing with time and some are not taught at all, but prior knowledge from our home makes it easier for us to grasp many of them".*

The above respondent's statement suggests that knowledge of student respondents obtained by learning crop production in secondary is not very much effective due to bulkiness of subject matters to cover in a limited time and to other schools particularly new schools they aren't taught effectively due to lack of the subject teachers.

(c) Livestock production

The student respondents' knowledge in livestock production determined in this study was that acquired from the twelve subject matters specified in the subject syllabus. The subject matters included: introduction to livestock science and production, factors affecting livestock production in Tanzania, livestock farming systems in Tanzania, principles of livestock production, poultry farming, livestock feeds and feeding, pig farming, goat farming, sheep farming, dairy cattle farming, improvement of livestock breeds as well as fisheries and fish production.

Results in Table 15 indicate mean knowledge rating in livestock production as 9% poor, 70% moderate and 21% good for student respondents in original schools. On the other hand, 38% of student respondents in new schools rated their livestock production knowledge as poor, 61% moderate and 1% good. These results in Table 15 indicate that majority (70% and 61%) of the respondents in both original and new schools, respectively, had moderate knowledge in livestock production. This was attributed to the fact that student respondents had a chance to learn some aspects of livestock production in their homes as most of them had farming home background. The results further indicated

that there were more than four (38%) times as many as student respondents with poor livestock production knowledge in new schools as compared to original schools, which was 9%. Likewise, student respondents with good livestock production knowledge were about twenty (21%) times as many in original as compared to new schools, which were only 1%. This could be attributed to unfavourable resource and process conditions in new schools as compared with original schools.

(d) Soil and its agricultural utilisation

Knowledge in soil and its agricultural utilisation determined in this study were for nine subject matters specified by the subject syllabus. These subject matters comprised of: the concept of soil, soil constituents, weathering, soil formation, physical properties of soil, types of soils found in Tanzania, soil plant nutrients, soil fertility and productivity as well as soil reaction. Mean student respondents rating for their knowledge in soil and its agricultural utilisation were presented in Table 15. Results in Table 15 show that 2% and 34% of student respondents in original and new schools, respectively, were in opinion that their mean knowledge rank in soil and its agricultural utilisation was poor. The 62% and 59% of student respondents in original and new schools, respectively, were in opinion that their mean knowledge rank in soil and its agricultural utilisation was moderate while 36% and 7% in original and new schools, respectively, perceived that they had good knowledge in soil and its agricultural utilisation. These results indicate that majority (62% and 59%) of student respondents from both original and new schools had moderate knowledge in soil and its agricultural utilisation, however, student respondents in new schools were relatively poorer (34%) than those of original schools which was 2%. This could closely be linked with low teaching effectiveness in new schools as compared with original schools.

(e) Agro-mechanics

Student respondents' opinions on their knowledge rank in the concept of agro-mechanics, farm workshop, farm power and machinery, agricultural mechanisation, farm surveying and mapping as well as soil and water conservation were determined for the agro-mechanics. Mean opinion on knowledge rank for the agro-mechanics as they were perceived by student respondents are presented in Table 15. Results in Table 15, show that in original schools, 15% of student respondents were in opinion that their knowledge in agro-mechanics were poor, 50% perceived that were moderate while 35% judged themselves as they had good knowledge. On the side of new schools, half (50%) of student respondents perceived that they had poor knowledge in agro-mechanics, 46% were moderate and 4% were in opinion that they were good in the matter. These findings indicate low achievement in new schools in almost all aspects as compared with original schools.

In addition, the study noted very poor achievement in farm surveying and mapping in almost all student respondents of both school categories. The study found the fact that this subject matter was not taught in almost all study schools partly due lack of teaching and learning materials and partly due to failure of most of teachers to teach the subject matter as it is difficult for them as well as lacking creativity in improvising teaching and learning materials. This was revealed from one of the key informants, a long serviced Agricultural science teacher, who said that:

> *"Farm surveying and mapping is not taught in almost all schools for long time. I have been working with National Examinations Council of Tanzania for long but this subject matter is among the matters which are not assessed due to the fact that it is almost not taught in schools at all. Materials for teaching and learning the topic are not available in schools. Moreover, there are very few teachers who can handle the matter in secondary schools. There are however, simple surveying methods such as measurement of area and volume which didn't need very rare materials but teachers have already attuned in their mind that the teaching and learning materials are not available".*

(f) Farming business economics and agricultural extension

The study sought to determine student respondents' opinions on their knowledge in farming business economics and agricultural extension. There were nine specific subject matters which were determined for farming business economics and agricultural extension. These included: the concept of farming business economics, agricultural economics, price and its determinants, factors of production, farm records and accounts, risks and uncertainty in farming business, specialisation and diversification in production, agricultural marketing and agricultural extension.

Student respondents' mean opinions on their knowledge in farming business economics and agricultural extension were as indicated in Table 15. The results in Table 15 show that 12% and 50% of student respondents from original and new school, respectively, were in opinion that their knowledge in farming business economics and agricultural extension was poor. While 50% of student respondents in original schools were in opinion that their knowledge in farming business economics and agricultural extension was moderate, in new schools were 46%. In original schools 35% of student respondents have opinion that their knowledge in farming business economics and agricultural extension was good while in new schools were only 4%.

These results suggest that student respondents in original schools were more knowledgeable in farming business economics and agricultural extension than those of new schools, however, most of student respondents in both school categories showed to possess poor knowledge in agricultural marketing. Student respondents were considering it as tough matter to grasp. On the part of key informants, this was associated with low teaching effectiveness due to the fact that most of Agricultural science teachers were not properly prepared. They are prepared by specialisation according to themes of agriculture

while in schools a teacher is supposed to teach all the subject matters in the syllabus. This was revealed from one of the subject's school quality assurer who said that:

> *"It is quite challenging for one Agricultural science teacher teaching all the subject matter specified by the syllabus simply because most of them have been taught Agriculture under themes. Sincerely there are few Agricultural science teachers who are experts in all the themes that is why some subject matters can be taught effectively while others not".*

These results suggest that Agricultural science teachers are ill prepared in the way that they do not meet the secondary school curriculum purpose. This was also linked with lack of capacity building for Agricultural science teachers.

(g) Agriculture and environmental management

The subject matters determined for agriculture and environmental management included environmental degradation and pollution. Mean student respondents' opinion on their knowledge in agriculture and environmental management as they were perceived themselves are presented in Table 15. Results in Table 15 indicate mean knowledge rating in agriculture and environmental management as 11% poor, 70% moderate and 19% good for student respondents in original schools. In new schools, student respondents' self rating in agriculture and environmental management was 60% poor, 40% moderate and none good. These results indicate that majority (70%) of the respondents in original schools were moderately knowledgeable in agriculture and environmental management while in new schools majority (60%) had poor knowledge in the matter.

The study further noted that large part of students in new schools has not taught these matters. It was observed from key informants that these matters are also taught in some other subjects such as Geography, Biology and Chemistry therefore most of teachers teach them if at all there is enough time to do so, otherwise, they assumed that the way they have already taken care of in other subjects is enough to enlighten students on it. These

findings imply that when same subject matters are placed in different subjects there is a risky of students not to be taught the matters at all due to the fact that teachers shirk their responsibilities which ultimately lower teaching and learning effectiveness.

An overall student respondents' opinions on knowledge acquired in Agricultural science subject was determined on a 5-point Likert scale (very poor, poor, moderate, good and very good) to generate overall maximum and minimum values using 285-point index summated scale as described in section 3.7.2 (c). The maximum points scored were 215 and 174 for original schools and new schools, respectively, while minimum points scored were 162 and 128 for original schools and new schools, respectively. On the basis of the ranges on the index summated scale, an overall extent of Agricultural science knowledge acquired by student respondents as assessed by themselves was computed as shown in Table 16.

Table 16: Distribution of overall determination of student respondents' opinions on knowledge acquired in Agricultural science subject (n=100)

Extent of knowledge acquired	**Original schools (n=50) %**	**New schools (n=50) %**	χ^2
Good	30	4	28.356***
Moderate	38	12	(p=0.000)
Poor	32	84	

*** = significant at ($p \leq 0.001$)

Results in Table 16 indicate that for original schools, overall, 32% of student respondents had poor, 38% moderate and 30% good Agricultural science knowledge. On the other hand, in new schools 84% had poor, 12% moderate and 4% good Agricultural science knowledge. This is because the points for poor knowledge were 57 to 170, the points for moderate knowledge were 171, and points for good knowledge were 172 to 285. On the

basis of the above point ranges, student respondents from new schools were significantly ($p<0.001$) poorer in Agricultural science knowledge than those from original schools.

Generally, knowledge of student respondents in original schools was better than that of their counterparts from new schools. This could be attributed to low teaching effectiveness observed in resource and processes of teaching Agricultural science. In resource section, for instance, it was observed that 40% of new schools have no permanent Agricultural science teachers and some other schools were using ex-Form Six students teaching the subject while an expert subject teachers being shifted to teach other science subjects like Chemistry, Biology and Physics. This might have affected teaching of the subject adversely and consequently lowering students' achievement in new schools as compared with original schools.

4.4.1.2 Teacher respondents' opinions on the students' knowledge acquired in implementing agricultural science subject

This part presents and discusses teacher respondents' opinions on their students' knowledge as they assess them on an average majority basis. Teacher respondents were asked to rate their students' knowledge acquired by learning Agricultural science subject while pursuing their secondary school education. Mean rating of teacher respondents on their students' knowledge in the seven major themes as per the subject's syllabus were determined, as presented in Table 17. Results in Table 17 were compared with those of student respondents shown in Table 15 as described and discussed hereunder.

(a) Fundamentals of agriculture

The study sought teacher respondents' opinions on the extent they rate their students' knowledge in the subject matters comprised in fundamentals of agriculture as required by

Table 17: Percentage distribution of teacher respondents' opinions on their students' knowledge in Agricultural science subject (n=20)

Statement	Original schools (n=10)			New schools (n=10)		
	P %	M %	G %	P %	M %	G %
Fundamentals of agriculture	30	40	30	40	50	10
Crop production	20	60	20	20	70	10
Livestock production	10	70	20	30	70	0
Soil and its agricultural utilisation	0	60	40	10	70	20
Agro-mechanics	10	50	40	40	60	0
Farming business economics and agricultural extension	10	60	30	20	70	10
Agriculture and environmental management	10	70	20	40	60	0

P = Poor, M = Moderate, G = Good

the subject syllabus. The subject matters included: agriculture as a science, scientific procedures in Agricultural science, the Agricultural science laboratory, contribution and role of agriculture to the economy of Tanzania as well as agricultural development in Tanzania. Results in Table 17 indicate mean knowledge rating in fundamentals of agriculture as 30% poor, 40% moderate and 30% good for teacher respondents from original schools. In new schools, teacher respondents rating on their students' knowledge in fundamentals of agriculture were 40% poor, 50% moderate and 10% good. When these results are compared with what is presented in Table 15 on students responses, show that they are not very different in terms of distribution of percentages of responses regarding students' knowledge in fundamentals of agriculture.

These results indicate that most (40% and 50%) of teacher respondents' in both original and new schools, respectively, rated their students as moderately knowledgeable in fundamentals of agriculture. Teacher respondents were in opinion that some of the subject matters in fundamentals of agriculture are not taught well in the schools due to lack of facilities particularly functional Agricultural science laboratory and first aid kits. In

addition, teacher respondents especially those from new schools were in opinion that some of the subject matters were difficult for them to handle especially "scientific procedures in Agricultural science" due to poor preparation in their teachers' college. One teacher respondent from the original schools said that:

> *"Knowledge in fundamentals of agriculture cannot easily be taught/learnt without practicals, however, due to lack of resources particularly functional Agricultural science laboratory and first aid kits, some of the subject matters are improperly taught and learnt. Since some of the subject matters in fundamentals of agriculture are also taught in other science subjects like Chemistry, Physics and Biology we left them to be taken care of in these subjects. After all other science subjects' labs are much better than ours. Sometimes we leave our students to learn these subject matters there because they are very much similar, there is no difference in first aid taught in Agricultural science and those in other subjects".*

On the other hand, in new schools, one teacher respondent said the following:

> *"Sincerely speaking, "fundamentals of agriculture" is somehow a tough matter not only to students but also to teachers. Imagine that, in my teachers college I was taught only the methodology of teaching Agricultural science without academic part but when I come in school I am supposed to teach a lot of subject matters of which myself I haven't even learnt them not only in my teachers college but also in my secondary school, because I didn't take Agricultural science. It would be better if the Agricultural science teachers' curriculum be changed so as to prepare teachers in a more favourable manner than it is currently used to be".*

These statements confirm the results found from student respondents and key informants. In addition, the statements suggest that the subject is somehow neglected in terms of provision of teaching and learning resources as compared with other subjects in secondary school education curriculum. The observed ill preparation of Agricultural science teachers, in turn, affects teaching and learning effectiveness negatively.

(b) Crop production

The study wanted to find out opinions of teacher respondents' on their students' knowledge level in various building subject matters in crop production as per Agricultural science syllabus. These subject matters consisted of: introduction to crop science and production, classification of crop plants grown in Tanzania, distribution of major crop

plants of economic importance in Tanzania, factors affecting crop production in Tanzania, farming systems, cropping systems and planting patterns, principles of crop production, crop protection, horticultural production, handling and processing of crop products, crop storage structures, annual field crops' production, forest crops' production, and perennial field crops' production.

Results in Table 17 indicate mean knowledge rating of students in crop production as perceived by their teachers. In original schools, 20% of teacher respondents rated their students' knowledge in crop production as poor, 60% moderate and 20% good. On the other hand, in new schools, 20% of teacher respondents rated their students' knowledge in crop production as poor, 70% moderate and 10% good. These results show that majority (60% and 70%) of teacher respondents in both original and new schools, respectively, rated their students' knowledge in crop production as moderate. When these results are compared with what is presented in Table 15 on students' responses, show that the crop production knowledge achievement by students self rating was not very different from that judged by their teacher respondents in terms of distribution of percentages. This, therefore, confirms what was found from student respondents and key informants a far as students' knowledge achievement in Agricultural science subject in secondary school education curriculum is concerned.

(c) Livestock production

The students' knowledge in livestock production determined in this study was that acquired from the twelve subject matters specified in the Agricultural science subject syllabus. The subject matters included: introduction to livestock science and production, factors affecting livestock production in Tanzania, livestock farming systems in Tanzania, principles of livestock production, poultry farming, livestock feeds and feeding, pig

farming, goat farming, sheep farming, dairy cattle farming, improvement of livestock breeds as well as fisheries and fish production.

Results in Table 17 indicate mean students' knowledge rating in livestock production as was determined from teacher respondents' point of view. In original schools, 10% of teacher respondents rated their students' knowledge in livestock production as poor, 70% moderate and 20% good. On the other hand, in new schools, 30% of teacher respondents rated their students' knowledge in livestock production as poor, 70% moderate and none good. These results show that majority (70%) of students in both original and new schools were judged by their teachers to possess moderate knowledge in livestock production. When these results are compared with student respondents' responses shows that teacher respondents' rating is not very different in terms of distribution of percentages of knowledge in livestock production rating. This confirms the results found from student respondents and key informants as far as knowledge achievement in livestock production in Agricultural science subject in ordinary level secondary school education is concerned.

(d) Soil and its agricultural utilisation

Knowledge in soil and its agricultural utilisation determined in this study were for nine subject matters specified by the subject syllabus. These subject matters comprised of: the concept of soil, soil constituents, weathering, soil formation, physical properties of soil, types of soils found in Tanzania, soil plant nutrients, soil fertility and productivity as well as soil reaction. Mean teacher respondents rating for their students' knowledge in soil and its agricultural utilisation were presented in Table 17.

Results in Table 17 showed in that none and 10% of teacher respondents in original and new schools, respectively, rated their students' knowledge in soil and its agricultural

utilisation as poor. The 60% and 70% of teacher respondents from original and new schools, respectively, were in opinion that their students' mean knowledge rank in soil and its agricultural utilisation were moderate while 40% and 20% of teacher respondents from original and new schools, respectively, perceived that their students had good knowledge in the matter. Results in Table 17 for teachers' responses when compared with those students' responses in Table 15 are more or less similar, indicating that majority of student respondents in both original and new schools had moderate knowledge in soil and its agricultural utilisation, original schools being better than new schools.

(e) Agro-mechanics

Teacher respondents' opinions on their students' knowledge rank in the concept of agro-mechanics, farm workshop, farm power and machinery, agricultural mechanisation, farm surveying and mapping as well as soil and water conservation were determined for the agro-mechanics. Mean rating on the students' knowledge rank in the agro-mechanics as they were perceived by teacher respondents are presented in Table 17. Results in Table 17, show that in original schools, 10% of teacher respondents were in opinion that their students' knowledge in agro-mechanics were poor, 50% perceived that were moderate while 40% judged their students as they had good knowledge. On the side of new schools, 40% of teacher respondents perceived that their students had poor knowledge in agro-mechanics, 60% moderate and none good in opinion that their students were good in the matter. When these results are compared with those of student respondents in Table 15 they are relatively similar, indicating low achievement in new schools in almost all aspects as compared with original schools. This therefore substantiates what was observed from student respondents and key informants indicating that majority of student respondents in both original and new schools had moderate knowledge in agro-mechanics, new schools being worse than original schools.

(f) Farming business economics and agricultural extension

The study wanted to determine teacher respondents' opinions on their students' knowledge in farming business economics and agricultural extension. This was determined in nine specific subject matters which build the knowledge for farming business economics and agricultural extension as they were set by Agricultural science syllabus. These included: the concept of farming business economics, agricultural economics, price and its determinants, factors of production, farm records and accounts, risks and uncertainty in farming business, specialisation and diversification in production, agricultural marketing and agricultural extension.

Teacher respondents' mean opinions on their students' knowledge in farming business economics and agricultural extension were as indicated in Table 17. Results in Table 17 showed that 10% and 20% of teacher respondents from original and new school, respectively, had an opinion that their students' knowledge in farming business economics and agricultural extension was poor. While 60% of teacher respondents in original schools was in opinion that their students' knowledge in farming business economics and agricultural extension was moderate, in new schools was 70%. In original schools 30% of teacher respondents had opinion that their students' knowledge in farming business economics and agricultural extension was good while in new schools was 10%.

These results indicate that in view of teacher respondents, majority (60% and 70%) of students in original and new schools, respectively, were moderately knowledgeable in farming business economics and agricultural extension. When these results are compared with those in students' part in Table 15, for original schools they are more or less similar, however, for new schools teacher respondents were over ambitious about their students. While majority (70%) of teacher respondents in new schools perceived their students as

moderately knowledgeable farming business economics and agricultural extension, lower percentage (50%) of their students perceived themselves as poor in the subject matter. This may be attributed to inefficient assessment in the side of teacher respondents from new schools.

(g) Agriculture and environmental management

The study wanted teacher respondents' opinions on their students' knowledge in agriculture and environmental management which consisted of environmental degradation and pollution. Mean teacher respondents' opinion on their students' knowledge in agriculture and environmental management are presented in Table 17. Results in Table 17 indicate mean knowledge rating of teacher respondents upon their students' knowledge in agriculture and environmental management as 10% poor, 70% moderate and 20% good for original schools. In new schools, teacher respondents rating upon their students' knowledge in agriculture and environmental management was 40% poor, 60% moderate and none good. These results indicate that majority (70% and 60%) of teacher respondents in original and new schools, respectively, perceived their students as moderately knowledgeable in agriculture and environmental management. When these results are weighed against those in students' part in Table 15, for original schools they are comparatively similar, however, for new schools teacher respondents were relatively more inspirational than their students. While majority (60%) of teacher respondents in new schools perceived their students as moderately knowledgeable in agriculture and environmental management, majority (60%) of their students perceived themselves as poor.

An overall teacher respondents' opinions on students' agricultural knowledge was determined on a 5-point Likert scale (very poor, poor, moderate, good and very good) to

generate overall maximum and minimum values using 285-point index summated scale as described in section 3.7.2 (c). The maximum points scored were 218 and 177 for original schools and new schools, respectively, while minimum points scored were 166 and 134 for original schools and new schools, respectively. On the basis of the point ranges on the index summated scale, an overall extent of teacher respondents' assessment upon their students' knowledge was as shown in Table 18.

Table 18: Distribution of overall determination of teacher respondents' opinions on students' agricultural knowledge (n=20)

Extent of knowledge acquired	Original schools (n=10) %	New schools (n=10) %
Good	30	10
Moderate	40	10
Poor	30	80

The results in Table 18 show that for original schools, overall, 30% of teacher respondents perceived their students as poor in Agricultural science, 40% moderate and 30% good. On the other side, in new schools 80% of teacher respondents perceived their students as poor in Agricultural science, 10% moderate and 10% good. This is on the ground that the points for good were 172 to 285, the points for moderate were 171, and points for poor were 57 to 170. These findings when compared with those of student respondents in Table 16 they are not very different. Nevertheless, basing on the above point ranges, teacher respondents from new schools showed that their students were to a great extent poorer than students from original schools in Agricultural science knowledge.

4.4.2 Skills acquired in implementing Agricultural science subject

This section presents and discusses student and teacher respondents opinions on skills acquired in implementing Agricultural science subject under two main parts, as follows.

4.4.2.1 Student respondents' opinions on skills acquired in implementing agricultural science subject

This part presents and discusses student respondents' opinions on their skills acquired by learning Agricultural science subject while attending their secondary school education basing on their self assessment under seven major themes as given in Table 19. Mean skills of student respondents' in the major seven themes as per the subject's syllabus were determined and presented in Table 19 and described under seven areas, namely: (a) Fundamentals of agriculture, (b) Crop production, (c) Livestock production, (d) Soil and its agricultural utilisation, (e) Agro-mechanics, (f) Farming business economics and agricultural extension, and (g) Agriculture and environmental management.

Table 19: Distribution of student respondents' opinions on their skills learnt in Agricultural science subject (n=100)

Statement	Original schools (n=50)			New schools (n=50)		
	P %	M %	G %	P %	M %	G %
Fundamentals of agriculture	35	55	10	75	25	0
Crop production	52	44	4	56	44	0
Livestock production	73	23	4	77	23	0
Soil and its agricultural utilisation	67	33	0	83	17	0
Agro-mechanics	55	35	10	65	35	0
Farming business economics and agricultural extension	100	0	0	100	0	0
Agriculture and environmental management	100	0	0	100	0	0

P = Poor, M = Moderate, G = Good

(a) Fundamentals of agriculture

Student respondents were required to rate themselves in four predetermined skills in the fundamentals of agriculture as per subject syllabus. The skills included: demonstrating safety precautions in using Agricultural science laboratory, conducting simple Agricultural

science laboratory experiments, using Agricultural science laboratory apparatus and equipment as well as identifying apparatus and equipment used in Agricultural science laboratory. Results in Table 19 indicate mean skills rating in fundamentals of agriculture was 35% poor, 55% moderate and 10% good for student respondents in original schools. On the other hand, in new schools, student respondents self rating in fundamentals of agriculture was 75% poor, 25% moderate and none good. These results indicate that majority (55%) of the respondents in original schools were moderately skilled in fundamentals of agriculture while in new schools majority (75%) had poor skills.

The study found that of the four areas of basic practicals required to be taught and learnt under fundamentals of agriculture only identification of apparatus and equipment used in Agricultural science laboratory had been done in most of study schools leaving the rest three uncovered, which are demonstrating safety precautions in using Agricultural science laboratory, conducting simple Agricultural science laboratory experiments and using Agricultural science laboratory apparatus and equipment. This was revealed by one key informant who was a head of Agricultural science department in one of the original schools when discussing on the students skills, she said that:

> *"As I have told you earlier, schools are running short in most of basic resources to perform these practicals. As you know, most of our schools have no Agricultural science laboratories and those had the laboratories they are not functional because of shortage of apparatus and equipment, then how do you expect students to acquire these particular skills? Therefore they are mostly concentrating on identification of the few available laboratory tools. After all, even in final practical examinations they are commonly assessed on identification skills".*

These results imply that ill conditions of resources and processes especially assessment lead to low teaching and learning effectiveness in Agricultural science, therefore without improving these conditions students skills in fundamentals of agriculture would not be promising in near future.

(b) Crop production

The study needed to find out opinions of student respondents' on their skill level in various aspects in crop production as per Agricultural science syllabus. These aspects were demonstrating the general principles of: horticultural, annual, perennial and pasture crop production including hay and silage making as well as performing agro-forestry cultural practices. Results in Table 19 indicate mean skill rating in crop production as 52% poor, 44% moderate and 4% good for student respondents from original schools. On the other hand, in new schools, student respondents rating in crop production skills were 56% poor, 44% moderate and none good.

These results show that majority (52% and 56%) of respondents in both original and new schools, respectively, had poor skills in crop production. Even though some crops were produced in studied school farms, students felt that they were being used as casual labour for production rather than learning. This was confided in by one of student respondents who said that:

> *"We usually produce some crops in our school farm, however, the way we are producing the crops is like to provide casual labour. Normally farm works in our school are supervised by the prefect of self-reliance being assisted by class monitors. We rarely see teachers (both Agricultural science and others) in school farm activities teaching us what we are supposed to learn. Sometimes we have several things to ask for like why we did the way we did but there is no room for that".*

These results imply that the subjects' intention for skills in crop production would not be achieved if at all production will not be demarcated from school demonstration plots and later on production be used to complement what was demonstrated.

(c) Livestock production

The student respondents' skills in livestock production determined in this study were those acquired from the six areas specified in the subject syllabus. These were skills in

demonstrating principles of: dairy cattle, goat, sheep, swine, poultry and fish pond production. Results in Table 19 indicate an average skill rating in livestock production as 73% poor, 23% moderate and 4% good for student respondents in original schools. On the other hand, 77% of student respondents in new schools rated their livestock production skills as poor, 23% moderate and none good.

These results indicate that about three quarters (73% and 77%) of student respondents in both original and new schools, respectively, had poor skills in livestock production. The study found that this was attributed to the fact that livestock projects in study schools were rare and where present only few students who were performing a special duty in caring the animals had a chance to learn from them. In addition, there were no study school which had at least few livestock of the required range, that is, dairy cattle, goat, sheep, swine, poultry and fish for demonstrations. These results suggest that contrary to syllabus/curriculum expectations, Agricultural science candidates will neither benefit to engage in livestock farming activities nor at advantage to their families/societies as they have poor skills necessary for running them.

(d) Soil and its agricultural utilisation

Student respondents' skills in soil and its agricultural utilisation determined in this study were the six predetermined by the subject syllabus. These consists of: carrying out experiments to demonstrate that soil contain mineral matter, organic matter, water, air and living organisms, improving soil structure, identifying deficiency symptoms caused by lack of soil nutrients, preparing compost, storing manure and fertilisers as well as reclaiming acid, alkaline and saline soils. An average student respondents rating for their skills in soil and its agricultural utilisation were presented in Table 19. Results in Table 19 show that 67% and 83% of student respondents in original and new schools, respectively,

were in opinion that on average their skills in soil and its agricultural utilisation was poor. The 33% and 17% of student respondents in original and new schools, respectively, were in opinion that on average their skill rank in soil and its agricultural utilisation were moderate while there were none of the respondents had good skills in soil and its agricultural utilisation in both of the school categories. These results indicate that majority (67% and 83%) of student respondents in both original and new schools, respectively, had poor skills in soil and its agricultural utilisation, though student respondents in new schools were relatively poorer than those of original schools. This suggests that by majority of students being far from the syllabus/curriculum intention, most of these candidates would not be able to utilise soil efficiently for sustained crop production.

(e) Agro-mechanics

Student respondents were required to rate themselves in twelve skills in the agro-mechanics predetermined by the subject syllabus. The skills included: identifying, using and caring for field hand tools and farm workshop tools; demonstrating simple: plumbing, carpentry and joinery and sheet metal work; operating two-wheeled tractor, applying various survey methods in school farm as well as controlling various forms of erosion. An average opinion on skill rating for the agro-mechanics as they were perceived by student respondents were as presented in Table 19. Results in Table 19 show that in original schools, 55% of student respondents were in opinion that their skills in agro-mechanics was poor, 35% perceived that was moderate while 10% judged themselves as they had good skills. On the side of new schools, 65% of student respondents perceived that they had poor skills in agro-mechanics, 35% was moderate and there was no student with good skills. These results indicate poor skills in majority (55% and 65%) of student respondents from both original and new schools, respectively. However, the mean skill achievement

for agro-mechanics in new schools was relatively inferior as compared with original schools.

The study found that with exception of identifying and using field hand tools, the rest of the skills were rarely taught in both original and new schools due to ill conditions in the schools as most of the tools and facilities for teaching and learning them were missing. The skills might be taught by resourcing external experts or sending students in study visits, however, this was constrained by lack of funds for teaching the subject. This was revealed by one of the key informants (a head of Agricultural science department) in one of the original schools, who said that:

> *"Students' skills in using and caring workshop tools, demonstrating simple plumbing, carpentry, joinery and sheet metal works as well as operating two-wheeled tractor and applying survey methods are very much low. This is because tools and facilities for teaching these skills are not available in schools. Even if they were there, there are no Agricultural science teachers in our schools who are experts for all these skills. Alternatively, these skills may be learnt outside schools but when we enquire our students to go for study trips where they can learn these skills the reply from school administration is as usual, the ordinary song, that is, there are no funds".*

These findings suggest that without improving teaching and learning conditions especially in provision of enough materials and facilities as well as Agricultural science teacher preparation, students will not achieve the subject's objectives.

(f) Farming business economics and agricultural extension

The study required to determine students' opinions on their skills in farming business economics and agricultural extension. There were two specific skills which were determined for farming business economics and agricultural extension. These were keeping various school farm records and accounts. Student respondents' mean opinions on their skills in farming business economics and agricultural extension were as indicated in Table 19. Results in Table 19 show that all (100%) student respondents in both original and new schools were in opinion that they had poor skills.

These results indicate indifference between original and new schools signifying that the skills are poorly taught in the study schools. Student respondents were in view that they were not involved keeping these records; moreover, they haven't even seen them in their schools. One student respondent revealed this when he said that:

> *"Students are usually not involved in keeping school farm records and accounts. They had never even seen them. Myself I have only seen vegetable production records because I am a prefect of self-reliance. I use to keep production records when vegetables are harvested and brought to the school kitchen. It is me who is supposed to supervise harvesting of vegetables and hand them over to the dinning prefect".*

On the side of key informants, especially school administrators, were in view that it is not possible for all students to be involved in keeping school records that is why schools use students representatives' such as class monitors and prefects to do so on behalf. This was revealed from a head of one study school who said that:

> *"I think there is no logic for all students to keep school farm records, rather we use to engage students' leaders to do so on behalf thereafter the reports are presented in school self-reliance committee meetings otherwise running of the school might be very tedious".*

These results suggest that the practices to build the intended skills required by the syllabus/curriculum are either not workable in real situation in the schools or they are misinterpreted by school administrators. This, in turn, hinders students acquiring the intended skills hence low effectiveness of the Agricultural science curriculum.

(g) Agriculture and environmental management

The skills determined for agriculture and environmental management included practising measures which prevent occurrence of degradation on land at school or nearby community village(s) and on water bodies and pollution on land and water bodies as well as of the atmosphere. Mean student respondents' opinion on their agriculture and environmental management skills as they were perceived themselves are presented in Table 19. Results in

Table 19 on mean skill rating indicate that all (100%) student respondents in both original and new schools had poor skills in agriculture and environmental management.

The study found that as it was observed in knowledge sub-section that agriculture and environmental management is rarely taught in study schools, even their skills are not taught. It was found from key informants that these skills were improperly placed in syllabus that is why they cannot easily be taught in isolation with crop and livestock production. This was revealed by a head of Agricultural science department of one of the original schools who said that:

> *"Skills on Agriculture and environmental management are the skills which should essentially be embedded while teaching production of various crops and livestock. They are unnecessarily put in syllabus alone. They can easily be taken care of while teaching principles of crop and livestock production rather than teaching them in isolation".*

These results imply that improper placement of these skills in the syllabus makes these skills not be taught in schools hence low teaching and learning effectiveness in Agricultural science subject in secondary school education curriculum.

An overall student respondents' opinions on skills acquired in Agricultural science subject was determined on a 5-point Likert scale (very poor, poor, moderate, good and very good) to generate overall maximum and minimum values using 195-point index summated scale as described in section 3.7.2 (c). The maximum points scored were 99 and 87 for original schools and new schools, respectively, while minimum points scored were 87 and 85 for original schools and new schools, respectively. On the basis of the point ranges on the index summated scale, an overall extent of student respondents' Agricultural science skills acquired was computed as shown in Table 20. The results in Table 20 indicate that all (100%) of student respondents in both original and new schools had poor Agricultural science skills. This is because the points for poor skills were 39 to 116, the points for moderate skills were 117, and points for good skills were 118 to 195.

Since there was no difference between original and new schools in extent of the Agricultural science skills acquired, Chi-square analysis was not carried out.

Table 20: Distribution of overall determination of student respondents' opinions on skills acquired in implementing Agricultural science (n=100)

Extent of skills acquired	Original schools (n=50) %	New schools (n=50) %
Good	0	0
Moderate	0	0
Poor	100	100

4.4.2.2 Teacher respondents' opinions on the students' skills acquired in implementing Agricultural science subject

This part presents and discusses teacher respondents' opinions on their students' skills acquired by learning Agricultural science subject while attending their secondary school education on an average majority basis under seven major themes as given in Table 21. Mean skills of student respondents' as perceived by their teachers in the major seven themes specified by the subject's syllabus were determined and presented in Table 21. Results in Table 21 were compared with those of student respondents shown in Table 19, as described under the following seven areas: (a) Fundamentals of agriculture, (b) Crop production, (c) Livestock production, (d) Soil and its agricultural utilisation, (e) Agro-mechanics, (f) Farming business economics and agricultural extension, and (g) Agriculture and environmental management.

(a) Fundamentals of agriculture

Teacher respondents were required to rate their students in four predetermined skills in the fundamentals of agriculture as per the subject syllabus. The skills included: demonstrating

Table 21: Distribution of student respondents' opinions on their students' skills acquired in implementing Agricultural science subject (n=20)

Statement	Original schools (n=10)			New schools (n=10)		
	P %	M %	G %	P %	M %	G %
Fundamentals of agriculture	20	50	30	60	40	0
Crop production	30	60	10	40	60	0
Livestock production	60	30	10	70	30	0
Soil and its agricultural utilisation	30	70	0	80	20	0
Agro-mechanics	50	40	10	70	30	0
Farming business economics and agricultural extension	100	0	0	100	0	0
Agriculture and environmental management	100	0	0	100	0	0

P = Poor, M = Moderate, G = Good

safety precautions in using Agricultural science laboratory, conducting simple Agricultural science laboratory experiments, using Agricultural science laboratory apparatus and equipment as well as identifying apparatus and equipment used in Agricultural science laboratory. The mean opinions of teacher respondents on their students' skills are presented in Table 21. Results in Table 21 indicate that 20% of teacher respondents in original schools rated their students as poorly skilled in fundamentals of agriculture, 50% moderate and 30% good. On the other hand, in new schools 60% of teacher respondents rated their students as poorly skilled in fundamentals of agriculture and 40% rated them moderate whereas there was no teacher who rated them good.

The results in Table 21 on skills in fundamentals of agriculture indicated that while most (50%) of teacher respondents in original schools perceived their students as moderately skilled, in new schools majority (60%) perceived them as poorly skilled. When these results are compared with those in students' part in Table 19 in terms of percentages, show that even if there were slight differences between teacher and student respondents' rating,

yet trends were more or less similar. Of the major barriers for teaching these skills given by teacher respondents in original and new schools was lack of conducive teaching/learning environment in their schools, particularly unavailability or presence of dilapidated Agricultural science laboratories. These teacher respondents' results therefore confirm what was found from student respondents and key informants as far as students' skills in fundamentals of agriculture is concerned.

(b) Crop production

The study sought to find out teacher respondents' opinion on their students' skill position in various aspects in crop production as per Agricultural science syllabus thereafter compared with student respondents' self rating. These aspects were demonstrating the general principles of: horticultural, annual, perennial and pasture crop production including hay and silage making as well as performing agro-forestry cultural practices. Results in Table 21 indicate that in original schools, 30% of teacher respondents rated their students as poorly skilled in crop production, and 60% moderate while only 10% stated that they were good. On the other hand, in new schools, 40% of teacher respondents rated their students as poorly skilled in crop production, and 60% moderate while there was no teacher stated that they were good.

Basing on teacher respondents' results, majority (60%) of students in original and new schools were judged by their teachers as moderately skilled in crop production. One Agricultural science teacher in one of the new schools said the following:

> *"Majority of our students had moderate to good skills in crop production because they are involved in crop husbandry regularly in schools and in their homes".*

These results were contrary to that of students' in Table 19 where by majority (52% and 56%) of student respondents in original and new schools, respectively, judged themselves

to possess poor skills in crop production. While teacher respondents were over ambitious that their students had an ample opportunity to acquire various skills in crop production, the case was different for student respondents as it has been observed that they felt to be used as cheap casual labour because they were not shown or directed as what to learn in everything they did while producing crops. The study also noted that crop and livestock husbandry activities in school farm were not solely meant for Agricultural science practical rather they were simply self-reliance activities of which the entire schools, that is, all students and teachers were responsible to involve in. This, in turn, led to poor supervision of these activities by teachers to the extent that students did not consider them as a part of teaching and learning Agricultural science.

(c) Livestock production

Teacher respondents' opinions on their students' livestock production skills were sought after in this study. Livestock production skills determined were those twelve specified in the subject syllabus. These were skills in demonstrating principles of: dairy cattle, goat, sheep, swine, poultry and fish pond production. Results in Table 21 indicate that on average majority (60% and 70%) of teacher respondents in original and new schools, respectively, considered their students as poor in demonstrating livestock production skills. While a relatively small portion (30%) of teacher respondents in original and new schools, considered their students as moderately skilled in livestock production, only a meagre portion (10% and none) of teacher respondents in original and new schools, respectively, considered their students as good in livestock production skills.

These results when compared with those of student respondents for livestock production skills in Table 19 they are not very different hence justifying the student respondents' opinions. The rationale of poor students' skills in livestock production from teacher

respondents' point of view in both schools categories was lack of livestock projects in the schools which hinders demonstration of the skills specified by the syllabus.

(d) Soil and its agricultural utilisation

Teacher respondents' opinions on their students' skills in soil and its agricultural utilisation determined in this study were those six predetermined by the subject syllabus. These consisted of: carrying out experiments to demonstrate that soil contain mineral matter, organic matter, water, air and living organisms, improving soil structure, identifying deficiency symptoms caused by lack of soil nutrients, preparing compost, storing manure and fertilizers as well as reclaiming acid, alkaline and saline soils as presented in Table 21. Results in Table 21 indicated that on average, students' skills in original schools for soil and its agricultural utilisation were rated poor by 30% of teacher respondents, 70% moderate and none good. On the other hand, in new schools, 80% of teacher respondents rated their students' skills in soil and its agricultural utilisation as poor, 20% moderate while none rated them good.

These results showed that majority (70%) of teacher respondents in original schools rated their students' skills in soil and its agricultural utilisation moderate while their counterparts in new schools, majority (80%) judged their students as poorly skilled. These results when compared with those of student respondents on soil and its agricultural utilisation in Table 19, they are equally indifferent for new schools. Teacher respondents in original schools were, however, more optimistic than their students. While majority (67%) of student respondents in original schools judged themselves as poor in soil and its agricultural utilisation, majority (70%) of their teacher respondents considered them as moderately skilled because to some extent they demonstrated to them the specified

practicals. This was revealed by one teacher respondent from original schools who said the following:

> *"Our students' skills in soil and its agricultural utilisation are not bad simply because to some extent we demonstrated to them some important soil practicals like experiments to demonstrate that soil contain organic matter, inorganic, water and air. They also did some practicals of improving soil structure in crop husbandry activities in school farm".*

The discrepancy between student and teacher respondents' judgement on the same issue could be attributed to insufficient assessment and follow-ups of learning activities so as to let students reflect what to learn in every activity done in school in conjunction with classroom teachings.

(e) Agro-mechanics

Teacher respondents were required to rate their students in twelve skills in the agro-mechanics intended by the subject syllabus. The skills comprised the following: identifying, using and caring for field hand tools and farm workshop tools; demonstrating simple: plumbing, carpentry and joinery and sheet metal work; operating two-wheeled tractor, applying various survey methods in school farm as well as controlling various forms of erosion. An average opinion on students' skills in agro-mechanics as perceived by their teacher respondents were as presented in Table 21. Results in Table 21 show that in original schools, 50% of teacher respondents was in opinion that their students' skills in agro-mechanics were poor, 40% perceived that was moderate while 10% considered them as they had good skills. On the side of new schools, 70% of teacher respondents perceived that their students had poor skills in agro-mechanics and 30% was moderate while none considered them to possess good skills.

These results indicate that most (50% and 70%) of teachers respondents in original and new schools, respectively, judged their students as poor in agro-mechanics. When these

results are observed against those of student respondents on agro-mechanics in Table 19 they are more or less similar, hence substantiating the student respondents' opinions. Teacher respondents in both school categories were in agreement that most of their students had poor skills in agro-mechanics as most of predetermined practicals were not conducted due to severe shortage of resources in the schools.

(f) Farming business economics and agricultural extension

The study wanted to determine teacher respondents' opinions on their students' skills in farming business economics and agricultural extension which was judged in two specific skills which predetermined by the subject syllabus. These were keeping various school farm records and accounts. Teacher respondents' mean opinions on their students' skills in farming business economics and agricultural extension were as presented in Table 21. Results in Table 21 show that all (100%) teacher respondents both school categories judged their students to possess poor skills. These results when compared with those of student respondents on farming business economics and agricultural extension in Table 19 were similar, therefore confirms the student respondents' opinions. The study found from teacher respondents in both school categories that students were being taught by use of hypothetical records since schools were usually not having a wide variety of records and accounts as intended by the subject syllabus. One teacher respondent revealed this when giving additional comments, he said the following:

> *"Teaching these skills by use of real school records and accounts is something which is nearly impossible. You know why? It is not easy to get a wide range of records and accounts in our schools as intended by the syllabus, therefore we usually use examples from books".*

Analysing the above statement, it could be very hard to teach the skills as intended by the syllabus unless teachers are innovative enough to find other sources of live examples apart from depending on schools.

(g) Agriculture and environmental management

The study sought to determine teacher respondents' opinions on their students' skills in agriculture and environmental management. These skills included: practising measures which prevent occurrence of degradation on land at school or nearby community village(s) and on water bodies and pollution on land and water bodies as well as of the atmosphere. Mean teacher respondents' opinion on their students' skills in agriculture and environmental management are shown in Table 21. Results in Table 21 indicated that all (100%) teacher respondents in both original and new schools judged their students to possess poor skills in agriculture and environmental management.

The teacher respondents in both school categories were in opinion that the skills were rarely taught on its own, however, they argued that for clever students might acquire the skills in various activities which they always did in school farms and in their homes. A very long and extensive syllabus to cover in a limited time was of the major reasons given by teacher respondents as to why these skills were not taught as they were intended by the syllabus.

An overall teacher respondents' opinions on their students' skills acquired in Agricultural science subject was determined on a 5-point Likert scale (very poor, poor, moderate, good and very good) to generate overall maximum and minimum values using 195-point index summated scale. The maximum points scored were 111 and 91 for original schools and new schools, respectively, while minimum points scored were 95 and 87 for original schools and new schools, respectively. On the basis of the point ranges on the index summated scale, an overall extent of teacher respondents' judgement on their students Agricultural science skills was computed as shown in Table 22.

Table 22: Distribution of overall determination of student respondents' opinions on skills acquired in Agricultural science subject (n=20)

Extent of skills acquired	Original schools (n=10) %	New schools (n=10) %
Good	0	0
Moderate	0	0
Poor	100	100

The results in Table 22 indicate that all (100%) of teacher respondents in both original and new schools judged their students to possess poor skills in Agricultural science. This is for the reason that the points for poor skills were 39 to 116, the points for moderate skills were 117, and points for good skills were 118 to 195. These results when compared with those of overall student respondents' determination of Agricultural science skills given in Table 20 are similar. Teacher respondents from both categories of schools judged their students to possess poor Agricultural science skills.

4.4.3 Attitudes towards Agricultural science subject, farming and farming related careers

This sub-section presents and discusses student and teacher respondents' opinions on attitudes towards Agricultural science subject, farming and farming related careers as they were predetermined by the syllabus/curriculum under two main parts, as follows.

4.4.3.1 Student respondents' attitudes towards Agricultural science subject, farming and farming related careers

Student respondents' attitudes as intended to be learnt in Agricultural science were determined. Student respondents were given attitudinal statements which required them to indicate their agreement or disagreement with reference to attitude modification as intended in Agricultural science syllabus/curriculum. Student respondents' responses were summarised in terms of percentages as it presented in Table 23, and described under

five major parts, namely: (a) Students' interest in Agricultural science subject, (b) Studying Agricultural science as a preparation for self-employment in farming, (c) Agriculture as a dignified and paying occupation (d) Secondary school agricultural experiences as preparation for candidate's knowledge and skills for their family and society, and (e) Students' willingness to pursue further studies in agriculture.

Table 23: Distribution of student respondents' opinions on their attitudes towards Agricultural science subject, farming and farming related careers (n=100)

Attitudinal statement	Original schools (n=50)			New schools (n=50)		
	D %	NO %	A %	D %	NO %	A %
Students interest in Agricultural science subject	80	0	20	80	0	20
Studying Agricultural science subject as a preparation for self-employment in farming	88	0	12	88	0	12
Agriculture as a dignified and paying occupation	97	0	3	94	0	6
Secondary school agricultural science experiences as preparation for candidates' knowledge and skills to their family/society						
- Knowledge preparation	0	0	100	20	0	80
- Skills preparation	100	0	0	100	0	0
Students' willingness to pursue further studies in agriculture	4	0	96	8	0	92

D = Disagree, NO = No opinion, A = Agree.

(a) Students' interest in Agricultural science subject

Student respondents were asked as to whether they were interested to take an opportunity to study Agricultural science subject in their secondary school education as shown in Table 23. Results in Table 23 showed that 20% agreed with the statement while 80% disagreed in both original and new schools. The results indicated that majority (80%) of students from both original and new schools were not interested with the subject. Although the subject is optional in secondary school education curriculum yet only 20% of students from both original and new schools had a chance to opt for the subject while the rest (80%) were forced to study the subject through school's internal arrangements and

regulations enacted by individual schools. One of key informants, a head of one of the original study schools, said that:

> *"Sometimes our country policies are so frustrating! Previously when teaching and learning of the subject was directed by the vocationalisation policy of year 1972, the subject was learnt smoothly in our schools. Nowadays the situation is so tense and for sure if students are let free to opt for the subject, many might not do so therefore in our school we do not offer students a room to opt for it. All students are supposed to take Agricultural science because our school is the agriculture biased"*.

Picking from study schools' administrators, it was observed that, of the 10 schools studied, only two schools (Mkuu and Welwel) let their students opt for the subject freely. Probably, what students experienced on the teaching and learning the subject in Form One to Two classes didn't convince most of them to continue with the subject in Form Three to Four. Unfortunately the study found that even if school administrators were claiming that their students have no opportunity to opt for the subject yet some students were not studying the subject and the schools were not able to hold them back.

The extent to which students were willing to learn the subject was consequently investigated through documentary review by looking into enrolments in Form One to Two and drop-outs after Form Two as it is indicated in Table 24. Results in Table 24 indicate higher drop-outs in schools such as Kibaha (OS2) and Pugu (OS1) which their administrators claimed that they won't give an opportunity for their students to opt for the subject than schools such as Mkuu (OS5) and Welwel (NS1) which their students had an opportunity to opt. Discussions by academic masters/mistresses of the study schools revealed that Agricultural science subject supported students to raise their average performance in National Form Two Examination in the way it was taken into account in calculating the average performance, that is, if a student sat for 10 subjects examinations, Agricultural science inclusive, her/his average performance was calculated by taking total marks of 10 subjects including that of Agricultural science but was divided to nine

Table 24: Trend of students' drop-outs in Agricultural science subject in different teaching and learning cycles

Teaching/ learning cycle	Number of students	Original schools					New schools				
		OS1	**OS2**	**OS3**	**OS4**	**OS5**	**NS1**	**NS2**	**NS3**	**NS4**	**NS5**
2008	Enrolled in F.1-2	112	104	NE	151	136	105	NE	76	93	28
to	Sustained to F.3+4	16	16		148	29	54		74	92	28
2011	Dropped-out	96	88		3	107	51		2	1	0
	% Dropped-out	**86**	**85**		**2**	**79**	**49**		**3**	**1**	**0**
2009	Enrolled in F.1-2	105	107	NE	172	192	137	NE	107	113	47
to	Sustained to F.3+4	74	15		169	43	78		103	113	47
2012	Dropped-out	31	92		3	149	59		4	0	0
	% Dropped-out	**30**	**86**		**2**	**78**	**43**		**4**	**0**	**0**
2010	Enrolled in F.1-2	111	97	NE	146	181	116	146	91	104	18
to	Sustained to F.3+4	101	13		146	36	87	139	88	104	18
2013	Dropped-out	10	84		0	145	29	7	3	0	0
	% Dropped-out	**9**	**87**		**0**	**80**	**25**	**5**	**3**	**0**	**0**
2011	Enrolled in F.1-2	124	103	114	30	97	98	116	53	59	20
to	Sustained to F.3+4	119	17	77	29	44	35	116	53	59	20
2014	Dropped-out	5	86	37	1	53	63	0	0	0	0
	% Dropped-out	**4**	**84**	**33**	**3**	**55**	**64**	**0**	**0**	**0**	**0**
2012	Enrolled in F.1-2	109	116	201	119	116	146	138	88	107	29
to	Sustained to F.3+4	90	42	145	116	100	34	138	88	107	29
2015	Dropped-out	19	74	56	3	16	112	0	0	0	0
	% Dropped-out	**17**	**64**	**28**	**3**	**14**	**77**	**0**	**0**	**0**	**0**

OS1=Pugu, OS2=Kibaha, OS3=Kilosa, OS4=Mvomero, OS5=Mkuu, NS1=Welwel, NS2=Ganako, NS3=Gyekrum-Arusha, NS4=Kilimatembo, NS5=Kainam-Rhotia, NE=Not studied Agricultural science at all in particular teaching and learning cycle, F.1-2=Form One up to Two, F.3+4=Form Three and Four.

subjects only. This implies that Agricultural science in this way contributed to raise the numerator and lowering the denominator, consequently raise an average student's performance. This, in turn, appears as a kind of motivation to both schools and students especially for low academic achievers especially the new schools.

(b) Studying Agricultural science as a preparation for self-employment in farming

Student respondents were asked as to whether by studying Agricultural science subject in secondary school enables them to employ themselves in agricultural sector as presented in Table 23. The results in Table 23 indicate that majority (88%) of students from both original and new schools disagreed with the statement while small proportion (12%) in both school categories agreed with the statement. The study noted from key informants particularly school administrators that one of the strongest arguments they had used to persuade their students to take the subject was to give them confidence that under the global crisis of unemployment they can employ themselves in agriculture or use it as an income supplementing activity for those who will not be employed fully in agriculture after their studies. Yet under this influence, it appeared that majority (88%) of students were still not in favour of employing themselves in farming due to the fact that they lack necessary skills for business farming and in addition they view farming as among very hard task as compared to most other white collar jobs. On the other side, small proportion (12%) of student respondents who thought that they were not competitive enough to secure the white collar jobs in the current global economic crisis were the ones who believed that they could employ themselves in agriculture/farming. This was revealed by one of the student respondents from new schools, when he said that:

> *"Since I have more agricultural knowledge than my parents and in my home we have plenty of water and land, I think it is possible to employ myself in farming especially in horticultural production. There is nearby market centre where I can sell vegetables and earn some money rather than staying at jobless corners while awaiting for other job opportunities."*

These results suggest that majority of students were not considering agriculture as it is intended by the syllabus/curriculum, probably due to ill resources and process conditions prevailing in schools which hinder students to achieve the intended subject's objectives.

(c) Agriculture as a dignified and paying occupation

Student respondents were asked to agree or disagree with statements that agriculture is a dignified occupation as well as farming is a paying job as presented in Table 23. The results in Table 23 indicate that almost all (97% and 94%) student respondents from both original and new schools, respectively, disagreed, that is agriculture is not a dignified and paying occupation. A major reason given for disagreement was that farming is a risky activity due weather hazards and lack of good prices of agricultural produces. The respondents also felt that farming is not valued by the government that is why the government cannot control the price fluctuations to safeguard farmers. Those who agreed with the statement contended that they have been brought up in their families by farming and therefore they felt that after being more educated than their parents they can carry out more improved farming. Most of the key informants were in consensus that farming is not very much dignified and paying occupation though under shortage of more rewarding occupations, farming can serve the candidates living. These results indicate that the intended objective of the Agricultural science curriculum to inculcate in students' mind that agriculture is dignified and paying occupation (URT, 1997) has been imperceptibly achieved because the candidates were not viewing the value attached to agriculture as the curriculum/syllabus expected them.

(d) Secondary school agricultural experiences as preparation for candidates' knowledge and skills for their family and society

Student respondents were asked as to whether the experiences they acquired from learning Agricultural science subject in their secondary school acquainted them with fundamental knowledge and skills for their families and societies as shown in Table 23. The results in Table 23 show that in all (100%) student respondents in original and new schools perceived that they didn't acquired the fundamental skills for their families and societies. In case of knowledge, all (100%) of the student respondents in original schools

agreed that they have acquired substantial agricultural knowledge for their families and societies. On the side of new schools, majority (80%) agreed to acquire agricultural knowledge for their families and societies but 20% disagreed.

Generally, the results indicate that secondary school Agricultural science was able to prepare candidates for knowledge but not for skills to improve farming in their families and societies. One of the key informants who was an education officer had this to say when discussing the issue of attitudes of Agricultural science candidates towards farming and farming related careers:

> *"Let me tell you one important secret behind attitude modification of our youths towards agriculture or farming, whatever, you can call it. The day our Tanzanian peasants' status becomes an economically desirable one, it will start attracting Agricultural science candidates and other youths to engage in farming but without assurance of profit and desirable standards of living out of agriculture, I am telling you for sure, even if students be acquainted with all the basic knowledge and skills for farming, it would be utopian to think that those youths including Agricultural science and non-Agricultural science candidates would value agriculture and engage in farming".*

Even though studies such as that of Vandenbosch (2009) suggests that enabling candidates with appropriate knowledge and skills related to their family and society needs is important to influence students learning positively and consequently develop favourable attitude towards the Agricultural science subject and farming, yet the above explanation showed that modification of students' attitudes is a function of multiple interrelated school and non-school factors which are inherent the country's systems.

(e) Students' willingness to pursue further studies in agriculture

Student respondents were asked as to whether they were eager to go for further studies in agriculture, if at all they had a chance to do so as presented in Table 23. Results in Table 23 were not bad, indicating that majority (96% and 92%) of the respondents in original

and new schools, respectively, were willing. The study found that this willingness was twofold, partly was attributed to the fact that they wanted to be employed in agriculture related sectors and partly to the easiness attached to the subject as compared to other science subjects. This was revealed from one of the key informants (a head of school) from new schools who said that:

> *"When I was seeking on how other nearby schools afforded to raise their general school performance and sending their candidates to advanced level secondary schools in science subjects' combinations, I advised to teach Agricultural science subject in the school. Our school took the advice seriously, looked for Agricultural science teacher and started teaching our students at the beginning of Form Two in that year. Yet, our candidates afforded to get good results in Form Four examinations and one student afforded to go Form Five science with Agricultural science being among the subjects of the combination, something which hasn't happened earlier. This motivated the school and students to continue teaching and learning Agricultural science subject regardless of shortages resources for teaching and learning the subject".*

The motive behind Agricultural science subject in boosting schools' and students' average performance was also applicable in this case. These results suggest that student respondents taking Agricultural science were more interested with further education in agriculture so that they will be employed in agriculture related careers than employing themselves in farming. This trend, in turn, implies that the subject's intention was partly achieved as among the subjects' objectives is to enable candidates achieve all other objectives without closing their opportunities for further education in agriculture.

An overall student respondents' attitudes towards the subject itself as well as farming career was determined by using a 35-point Likert-type summated scale as explained in section 3.7. 2 (c). The aim was to obtain information on attitude of students towards the subject itself and find out whether students have favourable attitude towards farming career as it is intended in the Agricultural science subject syllabus/curriculum. Maximum and minimum points of the scale scored by student respondents were computed which

was 22 for both original and new schools while minimum points scored were 15 and 14 for original schools and new schools, respectively. On the basis of the point ranges on the index summated scale, an overall student respondents' attitude on agriculture as a subject as well as a career was computed as presented in Table 25.

Table 25: Distribution of overall determination of student respondents' attitudes on Agricultural science subject, farming and farming related careers (n=100)

Students' attitude	Original schools (n=50) %	New schools (n=50) %	χ^2
Positive	10	8	0.122^{ns}
Neutral	0	0	(p=0.727)
Negative	90	92	

ns = not significant at ($p > 0.05$)

Results in Table 25 indicate that overall, 10% and 8% of respondents for original and new schools, respectively, had positive or favourable attitude towards Agricultural science subject as well as farming career. This is because the points for positive or favourable attitude were 22 to 35, the points for neutral attitude were 21, and points for negative or unfavourable attitude were 7 to 20. However, not all of the respondents had negative attitude, though the majority (90% and 92%) for original and new schools, respectively, had such attitude as opposed to the subject's intention. On the basis of the above point ranges, there were no significant ($p>0.05$) difference in attitude between students from original and new schools towards the subject and farming as a career.

4.4.3.2 Teacher respondents' opinions on their students' attitudes towards Agricultural science subject, farming and farming related careers

The study required to seek teacher respondents' opinions on their students' attitudes as intended to be learnt in Agricultural science subject and eventually compared with that of student respondents. Teacher respondents were given the same attitudinal statements as

student respondents which required them to indicate their agreement or disagreement with reference to their students' attitude modification as intended in Agricultural science subject syllabus. Teacher respondents' responses were summarised in terms of percentages as shown in Table 26, thereafter described under five major parts, namely: (a) Students' interest in Agricultural science subject, (b) Studying Agricultural science as a preparation for self-employment in farming, (c) Agriculture as a dignified and paying occupation (d) Secondary school agricultural experiences as preparation for candidates' knowledge and skills for their family and society, and (e) Students' willingness to pursue further studies in agriculture.

(a) Students' interest in Agricultural science subject

Teacher respondents were asked as to whether their students were willingly took an opportunity to study Agricultural science subject in their secondary school education as shown in Table 26.

Table 26: Distribution of teacher respondents' opinions on their students' attitude towards Agricultural science subject, farming and farming related careers (n=20)

Attitudinal statement	Original schools (n=10)			New schools (n=10)		
	D %	NO %	A %	D %	NO %	A %
Students interest in Agricultural science subject	80	0	20	80	0	20
Studying Agricultural science subject as a preparation for self-employment in farming	80	0	20	90	0	10
Agriculture as a dignified and paying occupation	90	0	10	90	0	10
Secondary school agricultural science experiences as preparation for candidates' knowledge and skills to their family/society						
- Knowledge preparation	0	0	100	20	0	80
- Skills preparation	100	0	0	100	0	0
Students' willingness to pursue further studies in agriculture						
Students interest in Agricultural science subject	0	0	100	0	0	100

D = Disagree, NO = No opinion, A = Agree.

Results in Table 26 show that 80% of teacher respondents disagreed with the statement while 20% agreed in both original and new schools, respectively. The results indicated that majority (80%) of teacher respondents from both original and new schools showed that their students were not interested with the subject. When these results compared with the results in Table 23 on students responses show that they are alike.

The study found from teacher respondents that willingness of students especially those of original schools to opt for Agricultural science was low due to little value attached to it among students. This was revealed from one teacher respondent who said that:

> *"Status of Agricultural science subject after reinstatement is no longer good therefore if students are let free to opt for the subject, many might not choose it. Most of our students felt that if Agricultural science is important like other subjects, it would not been made optional while previously before reinstatement was a compulsory subject. All the same, most of our students are not interested with the subject as they felt that there is a lot to learn while it had a dull future due to fewer opportunities in terms of subject combinations in advanced level secondary education as compared with other subjects which have several combinations as opposed to Agricultural science which had only one combination. All the same, the background of our Agricultural science candidates are not given special consideration in joining intermediate colleges for certificate courses such as those of agriculture and others. Had this been considered, perhaps the future of this subject in students' viewpoint could be more favourable".*

The above explanation indicates that for Agricultural science subject to possess the value intended by the curriculum, its future value among the candidates who will opt for it should be assured by the ministries responsible for that.

(b) Studying Agricultural science as a preparation for self-employment in farming

Teacher respondents were asked as to whether by their students studying Agricultural science subject in secondary school enables them to employ themselves in agricultural sector as presented in Table 26. The results in Table 26 indicate that majority (80% and 90%) of teacher respondents in original and new schools, respectively, disagreed with the statement while only 20% and 10% in original and new schools, respectively, agreed with the statement. These results compared with students' responses in Table 23 were not very

different in terms of distribution of percentages of responses concerning studying Agricultural science as a preparation for self-employment in farming. Teacher respondents were doubtful on the certainty of enabling their candidates on this due to ill conditions prevailing in their schools in teaching and learning agriculture which was coupled with risks and uncertainties facing agricultural sector. This was deduced by one teacher respondent from original schools who said the following when giving additional comments.

> *"Yeah, objectively secondary school Agricultural science education preparing a candidate for self employment in farming especially under the current employment crisis is a good intention though the real dilemma I can see here is that the subject is still taught and learnt in conditions which are extremely far from the ideal. Fundamental skills to enable this are still lacking to our candidates. On other hand, any good school widen students prospects beyond what can be obtained in the economy of one, two or three hectares by use of hand hoe. Therefore, to me I think that even if conditions are improved and schools taught correctly the knowledge and skills intended by the curriculum, yet, the problem of negative attitude towards self-employment in agriculture and farming will still exist among many candidates in our country. Currently farming in our country is very risky undertaking in terms of weather changes due to climatic changes as well as unforeseen price fluctuations for agricultural produce".*

(c) Agriculture as a dignified and paying occupation

Teacher respondents were asked to judge their students' attitudes regarding statements that agriculture is a dignified occupation as well as farming is a paying job as presented in Table 26. The results in Table 26 indicate that like student respondents in Table 23, almost all (90%) teacher respondents in both original and new schools disagreed, that is, agriculture is not a dignified and paying occupation on the face of their students. Of the major reasons given by teacher respondents for disagreement was that agriculture returns from farming are usually low in face of risks and uncertainties in agricultural sector of Tanzania. In addition, they were in opinion that farming environment in Tanzania is not attractive for most youths. This was revealed from one teacher respondent who said the following when giving additional comments on the statement.

> *"Sincerely speaking, this curriculum intention of building in students' mind that agriculture is a dignified and paying occupation is good, however, students of the current technological era are far different from us while we were at similar age, they are quite selective on jobs to pick regardless of the prevailing employment crisis. They usually prefer occupations which enable them within short period of time to secure good cars, good house, clean and safe water, easy access to social services like medical, electricity and other stuffs of the like, all these are not very possible for someone engaging solely in farming in Tanzanian conditions where farming is full of risks and uncertainties".*

When these results are compared with what is presented in Table 23 on students' responses, show that teacher and student respondents' judgement as far as the statement that "agriculture is dignified and paying occupation" is concerned were more or less similar. This implies that the subjects' intention was not achieved.

(d) Secondary school agricultural experiences as preparation for candidates' knowledge and skills for their family and society

Teacher respondents were asked as to whether the experiences their students were exposed in teaching and learning Agricultural science subject in secondary schools acquainted them with fundamental knowledge and skills for their families and societies as shown in Table 26. The results in Table 26 show that in majority (90% and 100%) of teacher respondents in original and new schools, respectively, were in opinion that their students didn't acquired the fundamental skills for their families and societies. For the case of knowledge, all (100%) of teacher respondents in original schools agreed that their students have acquired a considerable agricultural knowledge for their families and societies. On the side of new schools, majority (80%) agreed that their students have acquired a considerable agricultural knowledge for their families and societies although 20% disagreed. These results are more or less similar with those of students in Table 23. The results in both school categories confirm the fact that secondary school Agricultural science was able to prepare candidates for knowledge but not for skills to improve farming in their families and societies.

(e) Students' willingness to pursue further studies in agriculture

Teacher respondents were asked as to if their students were eager to go for further studies in agriculture if at all provided a chance to do so as presented in Table 26. Results in Table 26 were pretty good, indicating that all (100%) of the teacher respondents both in original and new schools were in opinion that their students were willing to pursue further education in agriculture if at all they got a chance. These results compared with those of student respondents in Table 23, they are more or less similar, hence justify what was observed in student respondents.

The study found from teacher respondents' point of view that to a great extent, the willingness observed was associated with students' efforts to secure employment in agriculture related careers so as to escape engaging in farming exclusively. However, in new schools, further studies in agriculture for Agricultural science candidates was also been taken as an honorific opportunity to both candidates and to their schools as it was among few science subjects of which students succeeded to take it for further studies.

An overall teacher respondents' opinions on their students' attitudes towards the subject itself as well as farming career was determined by using a 35-point Likert-type summated scale. The aim was to obtain information on teacher respondents' opinions upon their students' attitude towards the subject itself and investigate if students have favourable attitude towards the subject and farming as a career as it was intended in the Agricultural science subject syllabus/curriculum. Maximum and minimum points of the scale were computed where maximum points scored were 26 and 23 for original and new schools, respectively, and minimum points scored were 18 and 16 for original schools and new schools, respectively. The overall opinions of teacher respondents on their students'

attitude on agriculture as a subject as well as a career were computed on the basis of the point ranges on the index summated scale as shown in Table 27.

Table 27: Distribution of overall determination of teacher respondents opinions on their students' attitudes on Agricultural science subject and farming career (n=20)

Statistical value	Original schools (n=10) %	New schools (n=10) %
Positive	10	10
Neutral	0	0
Negative	90	90

Results in Table 27 indicate that only 10% of teacher respondents' in both original and new schools perceived that their students had favourable attitude towards Agricultural science subject as well as farming and farming related career. This is because the points for negative or unfavourable attitude were 7 to 20, the points for neutral attitude were 21, and points for positive or favourable attitude were 22 to 35. On the basis of the above point ranges, those who had unfavourable attitude were 90% for both original and new schools. These results when compared with those on students part on an overall determination of student respondents' attitude towards Agricultural science subject as well as farming career, they are more or less similar. However, not all of the teacher respondents judged their students to have negative attitude, though the majority judged them to have such attitude as opposed to the subject's aim. On the basis of the above point ranges, there was no difference in attitudes between students from original and new schools towards the subject and farming careers from teacher respondents' point of view.

It can generally be concluded from this section that Agricultural science teaching in secondary school education curriculum did little particularly in skills and attitude

modification on the candidates. Of the major objectives of Agricultural science subject only knowledge was achieved to a reasonable extent leaving far behind the skills and attitudes due to the fact that students were rather taught for knowledge than skills and attitudes. Lack of agricultural practical skills compounded with meagre rewards from farming in both students' families and communities impeded students acquiring the intended attitudes towards Agricultural science subject and farming as an occupation which essentially was the subject's core intention. Thus for the subject to achieve its intentions, conditions for practical teaching should be ensured in schools in terms of teaching and learning materials, facilities and good teacher preparation involving capacity building to make them up to date both pedagogically and knowledgeable in subject matters. Government's interventions in adding value attached to farming should also not be undermined if at all school candidates are to be helped to acquire favourable attitudes towards agriculture as an opportunity for self employment.

4.5 Potential for Improving Teaching and Learning of Agricultural Science Subject

Potential for improving teaching and learning of Agricultural science subject in the study schools were determined by use of open ended questions in terms of strengths, challenges and opportunities available for effective teaching and learning. It involved clustering information into sub-themes which were strengths, challenges and opportunities available in schools as far as teaching and learning Agricultural science subject is concerned. These were listed and grouped from all student and teacher respondents, thereafter all aspects were analysed to generate frequencies and percentages.

4.5.1 Student respondents' opinions on the strengths in teaching and learning Agricultural science subject

The study sought to search out the strengths in teaching and learning Agricultural science

subject from student respondents points of view. To allow a detailed determination of strengths from student respondents' point of view, they were studied in terms of the following four aspects, namely: (a) Valuable lessons learnt in Agricultural science subject, (b) Interesting aspects portrayed by teachers in teaching Agricultural science subject, (c) Valuable aspects regarding materials and facilities for teaching and learning Agricultural science, and (d) Things most helped students learn Agricultural science in their schools.

4.5.1.1 Valuable lessons learnt in Agricultural science subject

Valuable lessons student respondents acknowledged to learn in Agricultural science subject were presented in Table 28.

Table 28: Distribution of student respondents' opinions on valuable lessons learnt in Agricultural science subject (n=100)

No.	Lesson	Original schools (n=50)* %	New schools (n=50)* %
1	Studying Agricultural science subject can make student acquire significant knowledge in crop and livestock husbandry	65	41
2	Practical teaching is key to successful learning of crop and livestock husbandry	58	37
3	Processing of farm produce can add value hence increasing income and well being of producer/farmers	6	13
4	Mechanization can improve production and productivity of farms	20	8
5	Control of pests and diseases improve crops and livestock production and reduce crop loses	10	12
6	If agriculture is properly practised (modernised) creates employment opportunity	10	16
7	Livestock breeding by using AI/proven sire results in improving production and productivity of farm animals	6	0
8	Proper agronomic practices do enhance environmental and soil conservation	4	5
9	Diversification of farm activities can save small holder farmers economically by reducing farming risks	0	5
10	Nothing valuable learnt	0	22

*Multiple responses

Results in Table 28 show that most (65% and 41%) of student respondents in original and new schools, respectively, were interested to learn that studying Agricultural science subject can made them acquire significant knowledge in crop and livestock husbandry. It was followed by the lesson that practical teaching is a key to successful learning of crop and livestock husbandry which was learned by 58% and 37% of student respondents in original and new schools, respectively.

Other valuable lessons were also learnt though by small proportion of student respondents. These, with their respective percentages in parentheses as they were learned in original and new schools, respectively, included the following: processing of farm produce can add value hence increasing income and well being of producer/farmers (6% and 13%), mechanisation can improve production and productivity of farms (20% and 8%), control of pests and diseases improve crops and livestock production and reduce crop losses (10 % and 12 %), if agriculture is properly practised (modernised) creates an employment opportunity (10% and 16), proper agronomic practices do enhance environmental and soil conservation (6% and 5%), diversification of farm activities can save small holder farmers economically by reducing farming risks (0% and 5%) and livestock breeding by using artificial insemination or proven sire results in improving production and productivity of farm animals (6% and 0%). Despite the valuable lessons learned, yet, 22% of student respondents from new schools indicated to waste their time learning Agricultural science subject as they found nothing valuable to learn for the entire time of about four years they spent for their ordinary secondary school education.

Results in Table 28 show the two main pro and con lessons leant. The greatest pro lesson learned by student respondents in both school categories was crop and livestock husbandry knowledge whereas the second was con, inadequacy in teaching and learning Agricultural

science, that is, without practical teaching, crop and livestock husbandry is hardly learned. These results imply that even if Agricultural science syllabus/curriculum intends a student to learn knowledge and skills in several aspects as well as acquire favourable attitudes towards agriculture, yet, most (65% and 41%) of student respondents in original and new schools, respectively, benefited only to acquire crop and livestock husbandry knowledge. On the other hand, a considerable part (58% and 37%) of the respondents from original and new schools, respectively, had also experienced a painful lesson of missing practical teaching which hinders them learn what they expected.

4.5.1.2 Interesting aspects portrayed by teachers in teaching Agricultural science subject

Interesting aspects portrayed by teachers in teaching Agricultural subject were determined by exploring student respondents' opinions on the best things they liked from their Agricultural science teachers as shown in Table 29.

Table 29: Distribution of student respondents' opinions on valuable aspects portrayed by Agricultural science teachers (n=100)

No.	Aspect	Original schools (n=50)* %	New schools (n=50)* %
1	Possession of good agricultural knowledge	59.2	68.1
2	Simplicity and clarity in teaching	44.9	34.0
3	Humble and hard working	20.4	29.8
4	Good advice and encouragement	28.6	14.9
5	Good responses to students' questions	12.2	6.4
6	Eager to use the available teaching and learning materials	6.1	4.3
7	Nothing found interested	4.1	0

*****Multiple responses

Results in Table 29 indicate that most (59.2% and 68.1%) of student respondents in original and new schools, respectively, were interested with the extent their teachers

possessed knowledge in various subject matters. Simplicity and clarity in teaching was the second aspect found interesting to 44.9% and 34.0% of student respondents in original and new schools, respectively. Other interesting aspects were found though in a relatively small proportion compared to the former. These, with their respective percentages in parentheses as they were found in original and new schools, respectively, included the following: humble and hard working (20.4% and 29.8%), eager to use the available teaching and learning materials (28.6% and 14.9%), good responses to students' questions (12.2% and 6.4%), and good advice and encouragement (6.1% and 4.3%). In spite of the interesting aspects experienced from Agricultural science teachers teachings, albeit 4.1% of original schools' student respondents experienced nothing interesting from their teachers.

Observing these results, it is good that Agricultural science teachers look to be knowledgeable enough in front of their students, however, for learning strength purpose they might excite their students in portraying some other crucial pedagogical characteristics which would be more valuable for their students learning rather than just appreciating their knowledge ability.

4.5.1.3 Valuable aspects regarding materials and facilities for teaching and learning Agricultural science subject

Strengths in teaching and learning Agricultural science on teaching materials and facilities side was determined by investigating student respondents' views on the best things they liked in the aspect as presented in Table 30. Results in Table 30 show that majority (76% and 92%) of student respondents, in original and new schools, respectively, didn't found anything enjoyable as far as materials and facilities for teaching and learning Agricultural science subject were concerned. In spite of high degree of disappointment on materials and facilities for teaching and learning Agricultural science subject, on the other hand

there was small (12% and 8%) proportion of student respondents in original new schools, respectively, who enjoyed the use of locally available materials for teaching and learning Agricultural science in their schools.

Table 30: Distribution of student respondents' opinions on valuable aspects regarding materials and facilities for teaching and learning in Agricultural science subject (n=100)

No	Aspect	Original schools (n=50) %	New schools (n=50) %
1	Use of locally available materials	12	8
2	Presence of quality books	12	0
3	Nothing found interested	76	92

Additionally, regardless of severe shortage of books observed in resources section, yet, 12% of student respondents in original schools enjoyed best the presence of books with simple language and good illustrations whereas in new schools the case was not applicable. These results suggest that if deliberate efforts are put into providing schools with text books as well as use of vast array of locally available agricultural teaching and learning materials together with improvisation, students might be helped to find the subject more enjoyable than the former.

4.5.1.4 Things most helped students learn Agricultural science subject

The study sought to find out the important things which helped students to learn Agricultural science subject in their schools as it is shown in Table 31. Results in Table 31 indicate that majority (86% and 70%) of student respondents in original and new schools, respectively, were in opinion that Agricultural science teachers were mainly helped them learn the subject. However, small part (14% and 30%) of student respondents in original and new schools, respectively, were in opinion that notes from past students were the

important thing helped them to learn the subject in their schools. These results suggest that equipping schools with Agricultural science subject teachers should not be undermined if at all the subject has to be taught and learnt effectively in secondary schools.

Table 31: Distribution of student respondents' opinions on the things most helped them learn Agricultural science subject (n=100)

No	Statement	Original schools (n=50) %	New schools (n=50) %
1	Support from Agricultural science teachers	86	70
2	Notes from past students	14	30

4.5.2 Challenges in teaching and learning Agricultural science subject

The study wanted to seek out student and teacher respondents' opinions on challenges which encountered in teaching and learning Agricultural science subject in the study schools. The results for challenges are presented and discussed under two main parts, that is, students and teacher respondents' opinions on challenges facing teaching and learning Agricultural science.

4.5.2.1 Student respondents' opinions on challenges in learning Agricultural science subject

Student respondents' opinions on challenges facing them in learning Agricultural science subject were investigated and presented as multiple responses in Table 32. Results in Table 32 indicate that all (100%) student respondents in original and new schools pointed out that the greatest challenge faced them for their success in Agricultural science subject was inadequate materials and facilities for learning. Lack of practicals teaching and learning was the second great challenge pointed out by 74% and 94% of student respondents in original and new schools, respectively. Absence and inadequacy of

Agricultural science subject teachers was the third challenge pointed out by 66% and 94% of student respondents in original and new schools, respectively, however, for new schools this challenge was in the same position as lack of practical teaching. Other challenges were pointed out by the student respondents, however, in a small proportion as compared to the former. These, with their respective percentages in parentheses as they were found in original and new schools, respectively, included: too long syllabus which is not well known and unavailable to students (28% and 22%), discouragement from fellow students with negative attitude towards agriculture (8% and 12%), absence of land for farm/garden (8% and 0%), and managing some difficult topics (10% and none).

Table 32: Distribution of student respondents' opinions on the challenges in teaching and learning Agricultural science (n=100)

No	Statement	Original schools (n=50)* %	New schools (n=50)* %
1	Inadequate materials and facilities for teaching and learning	100	100
2	Lack of practicals	74	94
3	Absence and inadequacy of teachers	66	94
4	Too long syllabus	14	18
5	No well known and lack of syllabus booklet	14	4
6	Discouragement from fellow students with negative attitude towards the subject	8	12
7	Absence of land for farm and garden	8	0
8	Managing some difficult topics	10	0

* Multiple responses

These results indicate that of the challenges facing students to learn Agricultural science subject effectively, inadequate learning materials and facilities, lack of practical learning as well as absence or too few subject's teachers were the foremost. Too long and unknown syllabus to students, absence of land for farming as well as discouragement from students with negative attitudes though pointed out by few student respondents all together makes

the subject learning in face of students unpleasant. Looking across these challenges, deliberate and immediate attention by the government through their respective ministries, municipals and councils responsible for education in secondary school education curriculum are called for, so as to ensure the subject's learning effectiveness.

4.5.2.2 Teacher respondents' opinions on challenges in teaching Agricultural science subject

Teacher respondents' opinions on challenges facing them in learning Agricultural science subject were investigated and presented as multiple responses in Table 33.

Table 33: Distribution of teacher respondents' opinions on the challenges in teaching and learning Agricultural science subject (n=20)

No	Statement	Original schools (n=10)* %	New schools (n=10)* %
1	Inadequate materials and facilities for teaching and learning	100	100
2	Too long and old syllabus	100	100
3	Lack of conditions for practical teaching	100	100
4	Negative attitude for majority of students	100	20
5	Absence and/or few teachers	70	100
6	Shortage of land for farm and garden	60	0
7	Lack of capacity building for teachers	60	50
8	Weak implementation of ESR	50	70
9	Heavy teaching load	10	40

* Multiple responses

Results in Table 33 indicate that all (100%) teacher respondents in original and new schools pointed out that the greatest challenges faced them teaching Agricultural science subject were inadequate materials and facilities, lack of conditions for practicals teaching and learning as well as too long and old syllabus. While all (100%) of teacher respondents

in original schools pointed out negative attitudes towards the subject as a great challenge, only 20% in new schools perceived it as a challenge. Whereas all (100%) teacher respondents in new schools pointed out the absence and/or too few Agricultural science teachers as a great challenge for teaching the subject in their schools, 70% of their counterparts in original schools perceived it as a challenge. This was also well featured in resources section.

Lack of capacity building to Agricultural science teachers which pointed out by (60% and 50%) of teacher respondents in original and new schools, respectively, and weak implementation of Education for Self-Reliance (ESR) policy which highlighted by (50% and 70%) in original and new schools, respectively, were other important challenges facing Agricultural science subject teachers in teaching the subject. Heavy teaching load was pointed out as a challenge by (10% and 40%) of teacher respondents in original and new schools, respectively. While 60% of teacher respondents in original schools were challenged by absence of land for farming and horticulture, none in new schools experienced such challenge.

These challenges with exception of weak implementation of Education for Self-Reliance policy and too high teaching loads, when compared with those in Table 32 on students' responses show that they were not very different in terms of the list and proportionality of response majority. However, results in teachers' part showed higher accentuation of the challenges as compared to students' responses. One teacher respondent from original schools when explaining about challenges said that:

> *"Negative attitudes towards the subject and agriculture in general is really a big problem in our schools to the extent that students usually argue on the relevance of the subject in conjunction with the position of agriculture in our country by using an awkward slogan asking, if agriculture in this country is still a backbone or backache of economy! Indicating that agriculture is no longer a backbone rather a back pains.*

Therefore you can see that position of agriculture to our youths currently is really worrying, in turn it affects teaching and learning of the subject badly".

The above explanation suggests that improvement of teaching and learning conditions for Agricultural science subject in schools alone would not help greatly getting better students' attitudes towards the subject and agriculture at large. Improvement in schools' teaching and learning conditions rather needs to be coupled with interventions which will improve the status of average farmers in the country to be instituted by parties responsible for farmers' welfare.

4.5.3 Respondents' opinions on opportunities for teaching and learning Agricultural science subject in secondary schools

The study sought to find out student and teacher respondents' opinions on opportunities which were available for teaching and learning Agricultural science subject in the study schools. The results for opportunities were presented and discussed under two main parts, that is, students' and teachers' opinions on opportunities in teaching and learning Agricultural science.

4.5.3.1 Student respondents' opinions on opportunities for teaching and learning Agricultural science in secondary schools

The study sought to seek opinions of student respondents concerning available opportunities found in their schools to facilitate teaching and learning Agricultural science subject as shown in Table 34. Results in Table 34 indicate that most (42% and 38%) of student respondents in original and new schools, respectively, considered locally available resources at school, home and nearby school as an opportunity. Other opportunities were pointed out by student respondents, however, in a small proportion as compared to the former. These, with their respective percentages in parentheses as they were found in original and new schools, respectively, included: high demand of agricultural knowledge and skills in Tanzanian environment (12% and 30%), and good and enough Agricultural science teachers who are willing to teach (8% and 0%).

Table 34: Distribution of student respondents' opinions on the available opportunities for teaching and learning Agricultural science subject (n=100)

No	Statement	Original schools (n=50) %	New schools (n=50) %
1	Locally available resources at school, home and nearby school	42	38
2	High demand of agricultural knowledge and skills in Tanzanian environment	12	30
3	Good and enough teachers who are willing to teach	8	0
4	Nothing found as an opportunity in the school	38	32

These opinions on opportunities taken as a whole indicate that majority (62% and 68%) of student respondents in original and new schools, respectively, realised some opportunities for teaching and learning Agricultural science subject in their schools. In contrast, the rest (38% and 32%) of student respondents in original and new schools, respectively, were in opinion that their schools have no opportunities for teaching and learning Agricultural science subject. Possibly, they have been exhausted with the prevailing inadequate conditions for teaching and learning the subject in their schools. Most of key informants including head of schools and education officers were in opinion that the greatest opportunity of teaching and learning the subject in secondary schools is the prevailing demand of agricultural knowledge and skills for agricultural production in the current era of "Kilimo kwanza" programme in Tanzania.

4.5.3.2 Teacher respondents' opinions on opportunities for teaching and learning Agricultural science in secondary schools

The study wanted to seek opinions of teacher respondents with reference to available opportunities found in their schools to facilitate teaching and learning Agricultural science subject as shown in Table 35.

Table 35: Distribution of teacher respondents' opinions on the available opportunities for teaching and learning Agricultural science subject (n=20)

No	Statement	Original schools (n=10) %	New schools (n=10) %
1	Locally available resources at school, home and nearby school	50	0
2	High demand of agricultural knowledge and skills in Tanzanian environment	20	10
3	Positive attitude for some students	30	20
4	Students practising school experiences in their rural homes	0	70

Results in Table 35 indicate that while most (50%) of teacher respondents in original schools considered locally available resources at school, home and nearby school as a great opportunity, it was not the case in new schools. Conversely, while 70% of teacher respondents in new schools considered possibility of students practising school experiences in their rural homes as a great opportunity, it doesn't hold water in original schools. A relatively small part (30% and 20%) of teacher respondents in original and new schools in original and new schools, respectively, pointed out positive attitudes of some students as next opportunity. High demand of agricultural knowledge and skills in Tanzanian environment was the last opportunity highlighted by 20% and 10% of teacher respondents in original and new schools in original and new schools, respectively.

The results in Table 35 on teacher's part compared with Table 34 on students responses show that their opinions are alike whereby use of locally available resources at school, home and nearby school as well as possibility of students practising school experiences in their rural homes considered as the great opportunity for both student and teacher respondents. These two opportunities are more or less similar, except that they were viewed especially by teacher respondents of the two school categories from different perspective. This suggests that if these perspectives are harmonised and tried out then followed by capacity building to Agricultural science subject teachers on suitable means to

employ this opportunity, effectiveness of teaching and learning of the subject would have been considerably improved.

4.5.4 Suggestions on ways to improve Agricultural science subject teaching and learning

The study sought to search out student and teacher respondents' opinions on ways to improve teaching and learning Agricultural science subject in the study schools so as to make it more interesting, enjoyable and beneficial for the future of students and the country/nation. The results for suggestions were presented and discussed under two main parts, that is, students' and teachers' suggestions to improve teaching and learning in Agricultural science subject.

4.5.4.1 Student respondents' suggestions on ways to improve Agricultural science subject teaching and learning

The study investigated student respondents' opinions on what should be done to make Agricultural science subject more interesting, enjoyable and beneficial for the future of both students and their families/societies particularly in resources and processes for teaching and learning as shown in Table 36. Results in Table 36 indicate that for improvement of teaching and learning resources, all (100%) of student respondents from both original and new schools were in opinion that to make Agricultural science more enjoyable, interesting and beneficial to them and their societies, the government should have to provide schools with enough materials and facilities for teaching and learning.

Other suggestions which were pointed out by majority of student respondents with their respective percentages in parentheses as they were found in original and new schools, respectively, included the following: schools to be provided with enough and qualified Agricultural science teachers (80% and 100%), the syllabus to involve entrepreneurial

Table 36: Distribution of student respondents' opinions on the ways to improve teaching and learning Agricultural science subject in selected secondary schools (n=100)

No	Statement	Original schools (n=50)* %	New schools (n=50)* %
	Teaching and learning resources		
1	The government to provide schools with enough teaching and learning materials and facilities	100	100
2	The government to provide schools with enough and qualified Agricultural science teachers	80	100
3	The government to provide schools with single textbook	40	10
4	The syllabus should made available to students and public	70	58
5	The syllabus should be updated to remove outdated matters and to comply with current science and technology	84	14
6	The syllabus should involve entrepreneurial skills	74	68
	Teaching and learning processes		
1	Equal emphasis on both, practicals and theory	90	74
2	Use of active teaching and learning strategies	40	32
3	Students to be allowed to reflect the learnt lessons in classes	14	0
4	Guidance and counselling on importance of Agricultural science subject over other subjects	30	14
5	More frequent tests, examinations, exercises and assignments	84	94
6	Assessment should base on mastery and application of skills learnt rather than knowledge only	64	52
7	Timely feedback	34	28

*****Multiple responses

skills (74% and 68%), the syllabus to be made available to students and public (70% and 58%), the syllabus to be updated to remove outdated subject matters and to comply with current science and technology (84% and 14%). A relatively small (40% and 10%) of students suggested the government to provide schools with single textbook, that is, a book

that contain all the subject matters to be learned in a particular class as they are in the syllabus.

On the side of improvement of teaching and learning processes so as to make the subject more studied by students, enjoyable, interesting and beneficial to them and their societies, student respondents gave seven suggestions. These, with their respective percentages in parentheses as they were found in original and new schools, respectively, were: equal emphasis on practicals and theory (90% and 74%), use of active teaching and learning strategies (40% and 32%), students to be allowed to reflect the learnt lessons in classes (14% and 0%), guidance and counselling on importance of Agricultural science subject over other subjects (30% and 14%), more frequent tests, examinations, exercises and assignments (84% and 94%), assessment should base on mastery and application of skills learnt rather than knowledge only (64% and 52%), and timely feedback (34% and 28%). These results imply that if Agricultural science subject has to be made more enjoyable, interesting and beneficial to students and their families/societies, these suggestions have to be worked upon by the parties responsible for each suggestion(s).

4.5.4.2 Teacher respondents' suggestions on ways to improve Agricultural science subject teaching and learning

The study explored teacher respondents' opinions on what should be done to make Agricultural science subject more interesting, enjoyable and beneficial for the future of both students and their families/societies particularly in resources and processes for teaching and learning as shown in Table 37. Results in Table 37 show that in terms of materials and facilities for teaching and learning, teacher respondents proposed seven ideas to make Agricultural science more enjoyable, interesting and beneficial to students and their families/societies. These, with their respective percentages in parentheses as they were found from teacher respondents in original and new schools, respectively, were: (a)

Table 37: Distribution of teacher respondents' opinions on the ways to improve teaching and learning Agricultural science subject in secondary schools (n=20)

No	Opinion	Original schools (n=10)* %	New schools (n=10)* %
	Teaching and learning resources		
1	The government to provide schools with enough teaching and learning materials and facilities	100	100
2	The governments to provide schools with enough and qualified Agricultural science teachers	50	100
3	Parents to procure books	50	10
4	The government to provide schools with land for farming	50	0
5	The government to provide schools with water for horticultural practicals	30	100
6	The syllabus should be reviewed	100	100
7	Curriculum developers and teachers to effectively relate what is learnt in school with skills needed in real life settings	70	50
	Teaching and learning processes		
1	The MoEST, PO-RALG, Municipals, Councils to provide capacity building for Agricultural science teachers	70	50
2	Motivating students through practical teaching and prize giving for excellent performers	60	30
3	Improving students' attitudes through provision of career guidance and counselling	70	30
4	Widening range of ex-agricultural science students to join A-Level, Colleges and Universities	70	70
5	Parents to finance study trips for their children	50	20
6	More practical assessment for skills mastery	100	100
	Others		
	The government to strengthen implementation of ESR policy at levels of MoEST, PO-RALG, Municipals, Councils and Schools	90	50

***Multiple responses

The government to provide schools with enough teaching and learning materials and facilities (100% and 100%), (b) The governments to provide schools with enough and qualified Agricultural science teachers (50% and 100%), (c) Parents to procure books (50% and 10), (d) The government to provide schools with land for farming (50% and 0%), (e) The government to provide schools with water for horticultural practicals (30% and 100%), (f) The syllabus should be reviewed (100% and 100%), and (g) Curriculum developers and teachers to effectively relate what is learnt in school with skills needed in real life settings (70% and 50%).

Teacher respondents had six major suggestions for improvement of teaching and learning processes so as to make the subject more enjoyable, interesting and beneficial to them and their societies. These, with their respective percentages in parentheses as they were found in original and new schools, respectively, were: (a) The MoEST, PO-RALG, Municipals and Councils to provide capacity building for Agricultural science teachers (70% and 50%), (b) Motivating students through practical teaching and prize giving for excellent performers (60% and 30%), (c) Improving students' attitudes through provision of career guidance and counselling (70% and 30%), (d) Widening range of ex-agricultural science students to join A-Level, Colleges and Universities (70% and 70%), (e) Parents to finance study trips for their children (50% and 20%), and (f) Provision of more practical assessment for skills mastery (100% and 100%).

Other suggestion which essentially teacher respondents thought that if tacked would have been dealt all the other suggestions on both resources and processes was the government to strengthen implementation of ESR policy at levels of MoEST, PO-RALG, Municipals, Councils and Schools which was pointed out by 90% and 50% of the respondents in original and new schools, respectively. Comparing these results with those in students'

part they are not very different, however, due to variation of experience between teachers and students, teacher respondents appear to provide a relatively more accentuation on issues and facts.

It can generally be concluded from this section that locally available resources at schools, students' homes and nearby schools as well as chance of day scholars to practise in their homes what is learnt in schools is a great opportunity available in continuing teaching Agricultural science subject in Tanzanian secondary schools. Weak implementation of vocationalisation policy that guides teaching and learning Agricultural science in secondary schools found to challenge effectiveness of teaching and learning of the subject adversely. As the policy of Education for Self-Reliance which initiated teaching and learning of Agricultural science subject as its implementation is still governing education in the country, it is now a high time for Tanzania government to strengthen the policy implementation at all levels and parties responsible with education.

4.6 Summary of the Discussion

The overall objective of this study was to investigate effectiveness of the teaching and learning Agricultural science subject in selected agricultural secondary schools in Tanzania. The study found that resources for teaching and learning Agricultural science were either inadequate or missing in the study schools. Processes used in teaching and learning Agricultural science subject were far different from what was intended by the curriculum. The study further revealed that students acquired more knowledge compared to skills and change of attitudes. Finally, the potential for improvement of teaching and learning Agricultural science subject was found to be based on use of locally available resources in schools and opportunity for students' involvement in agricultural activities at home. The following chapter gives conclusions and recommendations based on major results of the study.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the study findings, a number of lessons regarding effectiveness of teaching and learning Agricultural science subject in selected secondary schools in Tanzania were drawn. These lessons are important because of their policy implications on improvement of conditions of teaching and learning of Agricultural science subject in the study schools and beyond. The conclusions and recommendations from this study are now presented.

5.1 Conclusions

(a) Shortage of essential human and non-human resources with respect to physical facilities, implements and machinery resources, textbooks and reference books, teachers and timetable for teaching and learning lowers Agricultural science teachers' productivity and students' achievement.

(b) Teaching and learning processes lack clarity in students' learning goals, variety of teaching and learning strategies, interaction in teaching and learning, engagement in teaching and learning, effective assessment for teaching and learning as well as guidance and counselling which results into poor students' academic achievement.

(c) Teaching and learning of Agricultural science subject in ordinary level secondary schools did little particularly in skills achievement and attitude modification on the candidates. Both school and non-school factors are equally responsible for acquisition of favourable attitudes towards school programmes.

(d) Potential for improving teaching and learning of Agricultural science subject in the study schools were based on use of locally available resources in schools and opportunity for students' involvement in agricultural activities at home.

5.2 Recommendations

(a) To alleviate inadequacy of teaching and learning resources, the Ministries, Municipals and Councils responsible for education in ordinary level secondary schools should adequately equip schools with all human and non-human resources as it is predetermined by the syllabus/curriculum.

(b) To improve teaching and learning processes, interactive teaching and learning should be strengthened in schools by the Ministries, Municipals and Councils responsible for managing education in ordinary level secondary schools through ensuring conditions for practical teaching and assessment as well as guidance and counselling so as to facilitate meaningful or fruitful learning in Agricultural science subject. Schools should be encouraged and enabled to start and maintain demonstration plots, botanical gardens and some few livestock species as well as capacity building in Agricultural science teachers for practical and more interactive teaching of the subject.

(c) For the subject to achieve its intentions more effectively, on top of ensuring conditions for practical teaching and learning in schools, governments' interventions in improving value attached to farming should also be initiated and stabilised so as to enable school candidates acquire favourable attitudes towards agriculture as an opportunity for self employment.

(d) To foster the potential for continuing teaching and learning Agricultural science more effectively, the ESR Policy which initiated Agricultural science subject in secondary schools as the main policy which is still governing education in the country should be revitalised.

(e) Suggestions for further studies

  (i) To undertake a case study on interaction between teachers and students in the study schools. The major purpose of this study would be to elicit more reliable

clues about communication behaviours of teachers and students during the teaching-learning process.

(ii) To undertake case studies on effectiveness of teaching and learning Agricultural science subject in secondary schools in other regions in the county in order to enable generalisation of observations. The major purpose of the case studies would be to develop and enhance understanding of effectiveness of teaching and learning Agricultural science subject in secondary schools.

(f) Major contributions of the study

This study revealed the extent to which conditions for teaching and learning Agricultural science subject using existing curriculum are being met and students' achievements of the intended objectives. This information could help the government to review and evaluate related policies to taking Agricultural science as an optional subject in order to ensure they are still relevant. The review process may highlight the need for amendment even significant re-writing of the policies which would lead to making Agricultural science a core subject in secondary schools in the country.

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APPENDICES

Appendix 1: Checklist for Agricultural science subject teaching and learning resources

- Observation schedule
- Topic: Effectiveness of teaching and learning Agricultural science subject in selected secondary schools in Tanzania
- Region ……. District …… Division…….. Ward……School ….....
- Date…….

Teaching and learning resource	Required	Available	Status condition
Physical facilities			(Good/Poor)
1) Agricultural science laboratory			
2) Agricultural science workshop			
3) School farm			
4) Library			
Implements and machines			(Working/Not working)
5) Tractor			
6) Ploughs			
7) Harrows			

Textbooks

Title	Year of publication	Author	Place	Publisher

Reference books

Title	Year of publication	Author	Place	Publisher

Agricultural science subject teachers

Required	Number of teachers available			
	Permanently employed		Temporarily employed	
	Males	Females	Males	Females

Agricultural science syllabus booklet

Quantity required	Quantity available

Timetable

Number of Agricultural science per week	

Appendix 2: Agricultural Science Student's questionnaire

- ***Confidential***
- Questionnaire: Personal interviews
- Topic: Effectiveness of teaching and learning Agricultural science subject in selected secondary schools in Tanzania
- Region …… District …… School ……
- Respondent's No…… Date…….

1.0: **Students' Characteristics**

1.1 **Personal characteristics**

a) Sex……..... (1) Male [ ] (2) Female [ ]

b) Age..... (years)

1.2 **Situational characteristics of students (Student's home background)**

a) Parent's/guardian's occupation

Farmer	Formally employed	Informally employed	Does business	Other (Specify)

b) If parents/guardians are farmers what agricultural activities are they involved in?

Cultivating crops	Keeping livestock	Both crops & livestock production	Other (Specify)

c) Student's family support in learning Agricultural science subject
- Support for learning materials
- Moral encouragement to study the study the subject
- Other support (specify).....
- Not supported

2.0 **Resources used in teaching and learning Agricultural science subject curriculum in secondary schools**

2.1 **Agricultural science subject syllabus**

1. Show your opinion on the relevance, organisation and coverage of the Agricultural science subject curriculum/syllabus
2. Do you have any additional comment on the syllabus?

3.0 **Processes used in teaching and learning Agricultural science subject in secondary schools**

3.1 **Teaching and learning processes**

Show your opinion on the teaching and learning processes used in Agricultural science subject

(Tick [√] whichever is appropriate or applicable)

Statement	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
Clarity in teaching and learning					
1) Students are led to know the goals required in Agricultural science lessons					
2) Students are encouraged to reflect the extent to which they achieve the teaching and learning goals					

Statement	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
Additional comments?					
Use of variety of teaching and learning strategies					
3) Teaching and learning Agricultural science lessons takes on in various styles					
Additional comments?					
Interactions in teaching and learning					
4) Students work in and out classroom environment where they feel safe to discuss with and question teachers					
5) Students work collaboratively with each other in Agricultural science lessons					
Additional comments?					
Engagement in teaching and learning					
6) Students are involved in active learning activities throughout Agricultural science lessons					
7) Students are encouraged to make use of the school out-classroom environment as a source of agricultural knowledge and skills					
Additional comments?					
Purpose/focus of assessment					
8) Teachers explains what learning objectives will be gained from home-works					
9) Assessment focus upon skills mastery and applications in real-life settings					
Additional comments?					
Frequency of assessment					
10) Sufficient exercises are done in each new topic					
11) The number of formative tests done during the term is enough					
Additional comments?					
Feedback					
12) Individual feedback and corrective instructions are always provided by teachers					
13) Teachers always make follow-up to ensure that students understand what they are teaching and make necessary adjustments					
Additional comments?					
Guidance and counselling					
14) Teachers usually advise students on opting the subjects and career opportunities					
Additional comments?					

3.2 Use of variety of teaching/learning and assessment methods/strategies

Show your opinion on the use of variety of teaching and learning methods/strategies by teachers in teaching different agricultural skills and knowledge

(Tick [√] whichever is appropriate or applicable to you)

Methods/strategies	ALWAYS	SOMETIMES	NEVER
Teaching and learning methods/strategies			
1) Group work to co-produce reports and presentations			

Methods/strategies	ALWAYS	SOMETIMES	NEVER
2) Classroom based problem-solving and enquiries			
3) Posing problems as well as solving those set by the teacher			
4) Library search			
5) Practice of technical or laboratory skills			
6) Debates			
7) Demonstrations			
8) Supervised practicals at School Farm/garden			
9) Supervised practicals at School workshop/tool shed			
10) Lecture			
11) Field trips			
12) Question and Answer			
13) Brainstorming			
14) Role playing of issues			
15) Guest speaker			
16) Projects			
17) Peer teaching (one students teaching others)			
18) Exhibitions (agricultural shows and exhibitions)			
19) Experiential learning (Using life experiences as examples)			
20) Case studies			
Additional comments?			
Assessment methods/strategies			
1) Practical tasks to demonstrate performance			
2) Portfolios (record of work & progress and assessing it over period of time)			
3) Checklists, Rating scales and Rubrics			
4) Oral presentations			
5) Project work			
6) Written essays or reports			
7) Analysis of texts			
8) Locally/school developed tests/examinations			
9) Externally developed tests/examinations			
10) Quizzes			
11) Class exercises/assignments			
12) Take-home assignments			
Additional comments?			

3.3 **Engagement in out of classroom activities**

Show out of classroom activities that applies to you

Tick (√) any activity applicable to you

a) In addition to agriculture classes (both theory and practicals) which of the following activities did students participate in while attending their secondary education in this school? (multiple answers are accepted)

[ ] Crop production
[ ] Livestock production
[ ] Gardening
[ ] Agricultural science subject club
[ ] Others (please specify).....

b) Did the experience obtained in (a) above enrich students' school experience and interest in agriculture today? Yes [ ] No [ ]

Please give reasons for your answer.....
.....

4.0 **Knowledge, skills and attitudes achieved by students in the implemented Agricultural science subject curriculum in secondary schools**

4.1 **Students' Agricultural science knowledge**

As a result of learning Agricultural science subject in secondary school, how would you rate yourself in the following?

(Tick [√] whichever is appropriate or applicable to you)

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
Knowledge in Fundamentals of Agriculture					
1) Agriculture as a science					
2) Scientific procedures in Agricultural science					
3) The Agricultural science laboratory					
4) Contribution and role of agriculture to the economy of Tanzania					
5) Agricultural development in Tanzania					
Additional comments?					
Knowledge in Crop Production					
6) Introduction to crop science and production					
7) Classification of crop plants grown in Tanzania					
8) Distribution of major crop plants of economic importance in Tanzania					
9) Factors affecting crop production in Tanzania					
10) Farming systems					
11) Cropping systems and planting patterns					
12) Principles of crop production					
13) Crop protection					
14) Horticultural production					
15) Handling and processing of crop products					
16) Crop storage structures					
17) Annual field crops' production					
18) Forest crops' production					
19) Perennial field crops' production					
Additional comments?					
Knowledge in Livestock Production					
20) Introduction to livestock science and production					
21) Factors affecting livestock production in Tanzania					
22) Livestock farming systems in Tanzania					
23) Principles of livestock production					
24) Poultry farming					
25) Livestock feeds and feeding					
26) Pig farming					
27) Goat farming					
28) Sheep farming					
29) Dairy cattle farming					
30) Improvement of livestock breeds					
31) Fisheries and fish production					
Additional comments?					
Knowledge in Soil and its agricultural utilisation					

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
32) The concept of soil					
33) Soil constituents					
34) Weathering					
35) Soil formation					
36) Physical properties of soil					
37) Types of soils found in Tanzania					
38) Soil plant nutrients					
39) Soil fertility and productivity					
40) Soil reaction					
Additional comments?					
Knowledge in Agro-mechanics					
41) The concept of agro-mechanics					
42) The farm workshop					
43) Farm power and machinery					
44) Agricultural mechanisation					
45) Farm surveying and mapping					
46) Soil and water conservation					
Additional comments?					
Knowledge in Farming business economics and agricultural extension					
47) The concept of farming business economics					
48) Agricultural economics					
49) Price and its determinants					
50) Factors of production					
51) Farm records and accounts					
52) Risks and uncertainty in farming business					
53) Specialisation and diversification in production					
54) Agricultural marketing					
55) Agricultural extension					
Additional comments?					
Knowledge in Agriculture and environmental management					
56) Environmental degradation					
57) Environmental pollution					
Additional comments?					

4.2 **Students' Agricultural science skills**

As a result of learning Agricultural science subject in secondary school, how would you rate yourself in the following?

(Tick [√] whichever is appropriate or applicable to you)

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
Skills in Fundamentals of Agriculture					
1) Demonstrating safety precautions in using Agricultural science laboratory					
2) Identifying apparatus and equipment used in Agricultural science laboratory					
3) Using Agricultural science laboratory apparatus and equipment					
4) Conducting simple Agricultural science laboratory experiments					

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
Additional comments?					
Skills in Crop Production					
5) Demonstrating the general principles of horticultural crop production					
6) Demonstrating the general principles of annual crop production					
7) Demonstrating the general principles of perennial crop production					
8) Performing agro-forestry cultural practices					
9) Demonstrating principles of pasture production including hay and silage making					
Additional comments?					
Skills in Livestock Production					
10) Demonstrating principles of dairy cattle production					
11) Demonstrating principles of goat production					
12) Demonstrating principles of sheep production					
13) Demonstrating principles of swine production					
14) Demonstrating principles of poultry production					
15) Demonstrating principles of fish pond production					
Additional comments?					
Skills in Soil and its agricultural utilisation					
16) Carrying out experiments to demonstrate that soil contain mineral matter, organic matter, water, air and living organisms					
17) Improving soil structure					
18) Identifying deficiency symptoms caused by lack of soil nutrients					
19) Preparing compost					
20) Storing manure and fertilizers					
21) Reclaiming acid, alkaline and saline soils					
Additional comments?					
Skills in Agro-mechanics					
22) Identifying field hand tools					
23) Using field hand tools					
24) Caring for field hand tools					
25) Identifying farm workshop tools					
26) Using farm workshop tools					
27) Caring for farm workshop tools					
28) Demonstrating simple plumbing work					
29) Demonstrating simple carpentry and joinery work					
30) Demonstrating simple sheet metal work					
31) Operating two-wheeled tractor					
32) Applying various survey methods in school farm					
33) Controlling various forms of erosion					
Additional comments?					
Skills in Farming business economics and agricultural extension					
34) Keeping various school farm records					

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
35) Keeping various school farm accounts					
Additional comments?					
Skills in Agriculture and environmental management					
36) Practising measures which prevent occurrence of degradation on land at school or nearby community village(s)					
37) Practising measures which prevent occurrence of degradation on water bodies					
38) Practising measures which prevent occurrence of pollution on land and water bodies					
39) Practising measures which prevent pollution of the atmosphere					
Additional comments?					

4.3 **Students' attitudes**

Show students attitudes towards studying Agricultural subject in secondary school by using tick [√] or fill in the blanks to indicate what is appropriate to you.

1) Students are willingly opt for Agricultural science in secondary school

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

2) Secondary school Agricultural science prepare candidates for self-employment in agricultural sector

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

3) Farming is a paying job

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

4) Agriculture is a dignified occupation

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

5) School agricultural science experiences prepares candidates for skills to their family/society

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....

6) Agricultural science prepares candidates for knowledge to their family/society

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....

7) Agricultural science students are eager to go for further studies in agriculture

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

5.0 **Potential for improving teaching and learning of Agricultural science subject**

1. Show your opinion on the strengths of Agricultural science subject curriculum by filling in the blanks

a) What are the most valuable lessons (i.e. most important and interesting things) you have learnt in Agricultural science subject?
.....

b) What did you like the best about the Agricultural science subject teachers? .....
.....

c) What did you like the best about the Agricultural science subject teaching and learning materials and facilities? .....
.....

d) What most helped you to study Agricultural science subject at this secondary school?
.....

2. Which are the greatest challenges face you for the success in Agricultural science subject? .....
.....

3. What are the available opportunities for a teacher teaching and a student learning Agricultural science subject in this secondary school?.....
.....

4. What do you think should be done to make Agricultural science subject in secondary school more interesting, enjoyable and beneficial for the future of students and the country/nation particularly in:

a) Teaching and learning resources .....
.....

b) Curriculum/syllabus?.....
.....

c) Teaching and learning methods/strategies/techniques .....
.....

d) Assessment.....
.....

5. Do you have anything else that you think is important about Agricultural science teaching and learning in secondary school? .....
.....

Thank you for your cooperation

Appendix 3: Agricultural science subject teacher's questionnaire

- ***Confidential***
- Questionnaire: Personal interviews
- Topic: Effectiveness of teaching and learning Agricultural science subject in selected secondary schools in Tanzania
- Region …… District …… School ……....
- Respondent's No…… Date…….

1.0 **Agricultural Science Teacher's Characteristics**

1.1 Teacher's personal characteristics

a) Sex .....(1) Female [ ] (2) Male [ ]
b) Age..... (years)
c) Professional qualification..... (1) PhD in Education; (2) MSc Ed; (3) BSc Ed; (4) Post-graduate Diploma in Ed; (5)Diploma in Ed; (6) Other (specify).....
d) Teaching experience .....(years)

1.2 **Teacher's situational characteristics**

a) Teaching load .....(number of periods per week)
b) An average class size.....(an average number of students in a classroom)

2.0 **Resources used in teaching and learning Agricultural science subject curriculum in secondary schools**

2.1 **Teaching and learning materials and resources**

Teacher's opinion on the availability and adequacy of Agricultural science teaching and learning resources in his/her school

a) Physical facilities (laboratory, workshop, school farm, library)
b) Implements and machinery resources (tractor, ploughs, harrows)
c) Books (textbooks and reference books)
d) Teachers
e) Timetable
f) Syllabus

2.2 **Agricultural science subject syllabus**

3. Show your opinion on the relevance, organisation and coverage of the Agricultural science subject curriculum/syllabus

4. Do you have any additional comment on the syllabus?

3.0 Processes used in teaching and learning Agricultural science subject in secondary schools

3.1 **Teaching and learning processes**

Show your opinion on the teaching and learning processes used in Agricultural science subject

(Tick [√] whichever is appropriate or applicable)

Statement	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
Clarity in teaching and learning					
1) Students are led to know the goals required in Agricultural science lessons					

Statement	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
2) Students are encouraged to reflect the extent to which they achieve the teaching and learning goals					
Additional comments?					
Use of variety of teaching and learning strategies					
3) Teaching and learning Agricultural science lessons takes on in various styles					
Additional comments?					
Interactions in teaching and learning					
4) Students work in and out classroom environment where they feel safe to discuss with and question teachers					
5) Students work collaboratively with each other in Agricultural science lessons					
Additional comments?					
Engagement in teaching and learning					
6) Students are involved in active learning activities throughout Agricultural science lessons					
7) Students are encouraged to make use of the school out-classroom environment as a source of agricultural knowledge and skills					
Additional comments?					
Purpose/focus of assessment					
8) Teachers explains what learning objectives will be gained from home-works					
9) Assessment focus upon skills mastery and applications in real-life settings					
Additional comments?					
Frequency of assessment					
10) Sufficient exercises are done in each new topic					
11) The number of formative tests done during the term is enough					
Additional comments?					
Feedback					
12) Individual feedback and corrective instructions are always provided by teachers					
13) Teachers always make follow-up to ensure that students understand what they are teaching and make necessary adjustments					
Additional comments?					
Guidance and counselling					
14) Teachers usually advise students on opting the subjects and career opportunities					
Additional comments?					

3.2 **Use of variety of teaching/learning and assessment methods/strategies**

Show your opinion on the use of variety of teaching and learning methods/strategies by teachers in teaching different agricultural skills and knowledge

(Tick [√] whichever is appropriate or applicable to you)

Methods/strategies	ALWAYS	SOMETIMES	NEVER
Teaching and learning methods/strategies/techniques			
1) Group work to co-produce reports and presentations			
2) Classroom based problem-solving and enquiries			

Methods/strategies	ALWAYS	SOMETIMES	NEVER
3) Posing problems as well as solving those set by the teacher			
4) Library search			
5) Practice of technical or laboratory skills			
6) Debates			
7) Demonstrations			
8) Supervised practicals at School Farm/garden			
9) Supervised practicals at School workshop/tool shed			
10) Lecture			
11) Field trips			
12) Question and Answer			
13) Brainstorming			
14) Role playing of issues			
15) Guest speaker			
16) Projects			
17) Peer teaching (one students teaching others)			
18) Exhibitions (agricultural shows and exhibitions)			
19) Experiential learning (Using life experiences as examples)			
20) Case studies			
Additional comments?			
Assessment methods/strategies/techniques			
1) Practical tasks to demonstrate performance			
2) Portfolios (record of work and progress and assessing it over period of time)			
3) Checklists, Rating scales and Rubrics			
4) Oral presentations			
5) Project work			
6) Written essays or reports			
7) Analysis of texts			
8) Locally/school developed tests/examinations			
9) Externally developed tests/examinations			
10) Quizzes			
11) Class exercises/assignments			
12) Take-home assignments			
Additional comments?			

3.3 **Engagement in out of classroom activities**

Show out of classroom activities that applies to your school

Tick (√) any activity applicable to you

a) In addition to agriculture classes (both theory and practicals) which of the following activities did students participate in while attending their secondary education in this school? (multiple answers are accepted)

[ ] Crop production
[ ] Livestock production
[ ] Gardening
[ ] Agricultural science subject club
[ ] Others (please specify).....

b) Did the experience obtained in (a) above enrich students' school experience and interest in agriculture today? Yes [ ] No [ ]

Please give reasons for your answer.....
.....

4.0 **Knowledge, skills and attitudes acquired by students in the implemented Agricultural science subject curriculum in secondary schools**

4.1 **Students' Agricultural science knowledge**

As a result of learning Agricultural science subject in secondary school, how would you rate your students in the following?

(Tick [√] whichever is appropriate or applicable to you)

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
Knowledge in Fundamentals of Agriculture					
1) Agriculture as a science					
2) Scientific procedures in Agricultural science					
3) The Agricultural science laboratory					
4) Contribution and role of agriculture to the economy of Tanzania					
5) Agricultural development in Tanzania					
Additional comments?					
Knowledge in Crop Production					
6) Introduction to crop science and production					
7) Classification of crop plants grown in Tanzania					
8) Distribution of major crop plants of economic importance in Tanzania					
9) Factors affecting crop production in Tanzania					
10) Farming systems					
11) Cropping systems and planting patterns					
12) Principles of crop production					
13) Crop protection					
14) Horticultural production					
15) Handling and processing of crop products					
16) Crop storage structures					
17) Annual field crops' production					
18) Forest crops' production					
19) Perennial field crops' production					
Additional comments?					
Knowledge in Livestock Production					
20) Introduction to livestock science and production					
21) Factors affecting livestock production in Tanzania					
22) Livestock farming systems in Tanzania					
23) Principles of livestock production					
24) Poultry farming					
25) Livestock feeds and feeding					
26) Pig farming					
27) Goat farming					
28) Sheep farming					

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
29) Dairy cattle farming					
30) Improvement of livestock breeds					
31) Fisheries and fish production					
Additional comments?					
Knowledge in Soil and its agricultural utilisation					
32) The concept of soil					
33) Soil constituents					
34) Weathering					
35) Soil formation					
36) Physical properties of soil					
37) Types of soils found in Tanzania					
38) Soil plant nutrients					
39) Soil fertility and productivity					
40) Soil reaction					
Additional comment?					
Knowledge in Agro-mechanics					
41) The concept of agro-mechanics					
42) The farm workshop					
43) Farm power and machinery					
44) Agricultural mechanisation					
45) Farm surveying and mapping					
46) Soil and water conservation					
Additional comments?					
Knowledge in Farming business economics and agricultural extension					
47) The concept of farming business economics					
48) Agricultural economics					
49) Price and its determinants					
50) Factors of production					
51) Farm records and accounts					
52) Risks and uncertainty in farming business					
53) Specialisation and diversification in production					
54) Agricultural marketing					
55) Agricultural extension					
Additional comments?					
Knowledge in Agriculture and environmental management					
56) Environmental degradation					
57) Environmental pollution					
Additional comments?					

4.2 **Students' Agricultural science skills**

As a result of learning Agricultural science subject in secondary school, how would you rate your students in the following?

(Tick [√] whichever is appropriate or applicable to you)

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
Skills in Fundamentals of Agriculture					
1) Demonstrating safety precautions in using Agric. science laboratory					
2) Identifying apparatus and equipment used in Agric science laboratory					
3) Using Agricultural science laboratory apparatus and equipment					
4) Conducting simple Agricultural science laboratory experiments					
Additional comments?					
Skills in Crop Production					
5) Demonstrating the general principles of horticultural crop production					
6) Demonstrating the general principles of annual crop production					
7) Demonstrating the general principles of perennial crop production					
8) Performing agro-forestry cultural practices					
9) Demonstrating principles of pasture production including hay and silage making					
Additional comments?					
Skills in Livestock Production					
10) Demonstrating principles of dairy cattle production					
11) Demonstrating principles of goat production					
12) Demonstrating principles of sheep production					
13) Demonstrating principles of swine production					
14) Demonstrating principles of poultry production					
15) Demonstrating principles of fish pond production					
Additional comments?					
Skills in Soil and its agricultural utilisation					
16) Carrying out experiments to demonstrate that soil contain mineral matter, organic matter, water, air and living organisms					
17) Improving soil structure					
18) Identifying deficiency symptoms caused by lack of soil nutrients					
19) Preparing compost					
20) Storing manure and fertilizers					
21) Reclaiming acid, alkaline and saline soils					
Additional comments?					
Skills in Agro-mechanics					
22) Identifying field hand tools					
23) Using field hand tools					
24) Caring for field hand tools					
25) Identifying farm workshop tools					
26) Using farm workshop tools					
27) Caring for farm workshop tools					
28) Demonstrating simple plumbing work					
29) Demonstrating simple carpentry and joinery work					
30) Demonstrating simple sheet metal work					
31) Operating two-wheeled tractor					

Statement	VERY POOR	POOR	MODERATE	GOOD	VERY GOOD
32) Applying various survey methods in school farm					
33) Controlling various forms of erosion					
Additional comments?					
Skills in Farming business economics and agricultural extension					
34) Keeping various school farm records					
35) Keeping various school farm accounts					
Additional comments?					
Skills in Agriculture and environmental management					
36) Practising measures which prevent occurrence of degradation on land at school or nearby community village(s)					
37) Practising measures which prevent occurrence of degradation on water bodies					
38) Practising measures which prevent occurrence of pollution on land and water bodies					
39) Practising measures which prevent pollution of the atmosphere					
Additional comments?					

4.3 **Students' attitudes**

Show students' attitudes towards studying Agricultural science subject in secondary school by using tick [√] or fill in the blanks to indicate what is appropriate to you.

1) Students are willingly opt for Agricultural science in secondary school

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

2) Secondary school Agricultural science prepare candidates for self-employment in agricultural sector

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

3) Farming is a paying job

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

4) Agriculture is a dignified occupation

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

5) School agricultural science experiences prepares candidates for skills to their family/society

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

6) Agricultural science prepares candidates for knowledge to their family/society

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

7) Agricultural science students are eager to go for further studies in agriculture

Strongly Disagree	Disagree	No opinion	Agree	Strongly Agree

Please give reasons for your answer.....
.....

5.0 **Potential for improving teaching and learning of Agricultural science subject**

1. Which are the greatest challenges face you for the success in teaching Agricultural science subject?.....
.....

2. What are the available opportunities for a teacher teaching and a student learning Agricultural science subject in this secondary school?.....
.....

3. What do you think should be done to make Agricultural science subject in secondary school more interesting, enjoyable and beneficial for the future of students and the country/nation? .....
.....

4. Do you think there is anything missing that can be of relevance as regarding this study?
.....
.....

Thank you for your cooperation.

Appendix 4: Key informants checklist

- ***Confidential***
- Questionnaire: Personal interviews
- Topic: Effectiveness of teaching and learning Agricultural science subject in selected secondary schools in Tanzania
- Region/Ministry …… District …… Division…….. Ward……School ….....
- Respondent's No…… Date…….

Key Informant's characteristics
Sex .....(1) Female [ ] (2) Male [ ]
Age..... (years)
Professional qualification..... (1) PhD; (2) MSc; (3) BSc; (4) Advanced Diploma; (5) Ordinary Diploma; (6) Certificate; (7) Other (specify).....
Position.....
Years in the position .....(years)

1. What is your opinion on availability and adequacy of teaching and learning resources of Agricultural science subject curriculum in secondary school with reference to:
   (a) Teaching and learning physical facilities?
   (b) Implements and machinery resources?
   (c) Books (Textbooks and reference books)?
   (d) Agricultural science subject teachers
   (e) Timetable?
   (f) Agricultural science subject syllabus?

2. What is your opinion on the syllabus used to teach/learn Agricultural science subject in secondary school with reference to:
   (a) Relevance?
   (b) Organisation?
   (c) Coverage?
   (d) Other(s)?

3. What is your opinion on teaching and learning processes in Agricultural science subject curriculum in secondary school with reference to:
   (a) Clarity in learning goals to students
   (b) Methods/strategies used in teaching and learning?
   (c) Interactions in teaching and learning (both teacher-student and student-student)?
   (d) Engagement in teaching/learning (both inside and outside classrooms)
   (e) Assessment for teaching & learning (focus/purpose, frequency, methods/strategies used, feedback communication)?
   (f) Guidance and counselling?

4. What are your opinions on the knowledge, skills and attitudes, acquired by students from the implemented Agricultural science subject curriculum in ordinary level secondary schools?

5. What do you think are the strengths, challenges and opportunities as regarding to teaching and learning of the Agricultural science subject curriculum in ordinary level secondary education?

Strengths	Challenges	Opportunities

6. What do you think could be done to make Agricultural science subject in secondary school more interesting, enjoyable and beneficial for the future of students and the country/nation particularly.....
   .....
   .....
   .....

7. Do you think there is anything missing that can be of relevance as regarding this study?
   .....
   .....
   .....

Thank you for your cooperation