

THE IMPACT OF PROJECT-BASED LEARNING ON ACQUISITION OF
AGRICULTURAL KNOWLEDGE AND SKILLS IN SENIOR
HIGH SCHOOLS IN THE VOLTA REGION

BY

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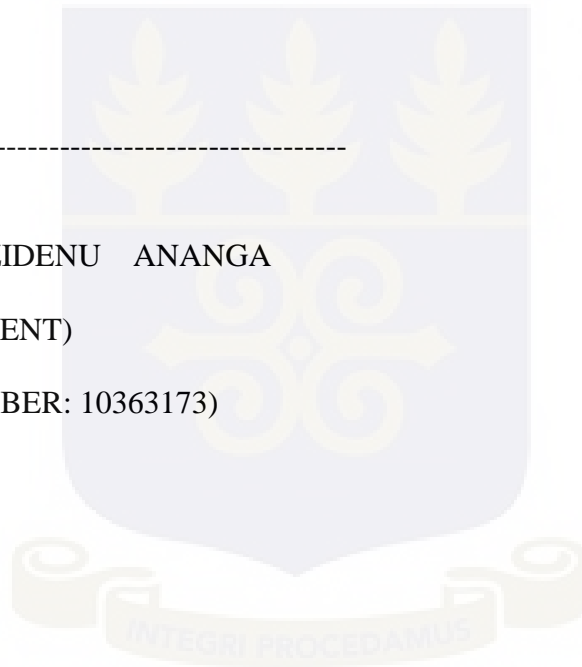
DECLARATION

I, Foster Dodzidenu Ananga hereby declare that this thesis “The impact of project-based learning on acquisition of agricultural knowledge and skills in senior high schools in the Volta region”, is my own work and that it has not previously been submitted for assessment to another University or for another qualification, and that all the sources I have quoted have been duly indicated and acknowledged as complete references.

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DEDICATION

This thesis is dedicated to my wife, Pearl and my three lovely sons, Dennis, Oswin and Edmund for their significant sacrifices that enabled me to pursue Master of Philosophy Degree.



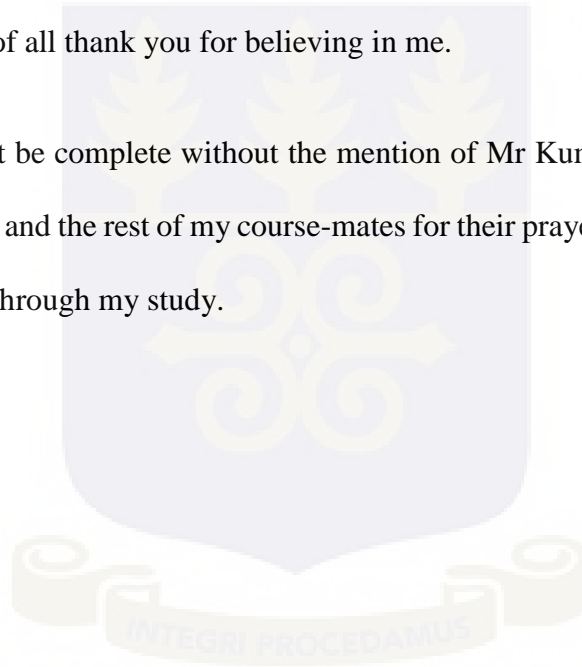
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ABSTRACT

Agricultural knowledge and skills acquired by Agricultural science students in Senior High Schools in Ghana is very crucial in developing the career pathways of students after successful completion of their course of study. The purpose of the study was to investigate the impact of Project-Based learning on acquisition of Agricultural knowledge and skills in Senior High Schools in the Volta Region. Using multi-stage sampling techniques such as purposive and stratified random sampling techniques, 150 final year students offering Agriculture courses and 12 of their teachers were selected from three Public schools in the Volta Region. Non-experimental descriptive survey design was used and the data collected were analysed using Statistical package for social sciences version 18. Two separate sets of questionnaires were constructed for students and teachers respectively to complete them from which data were collected. The study revealed that both Traditional teaching methods and Project-based learning methods indicated positive correlation and significant relationships with crop production related knowledge ($r=0.284$ · $p<0.01$) and ($r=0.334$ · $p<0.01$) respectively at the 0.01 levels perceived to be acquired by students during instructions. Again, both Traditional teaching methods and Project-based learning methods had positive correlation and significant relationship with knowledge in livestock production($r=0.219$ · $p<0.05$) and ($r=0.245$ · $p<0.05$) respectively and again, both had positive correlation and significant relationship with knowledge in farm management ($r=0.163$ · $p<0.05$) and ($r=0.215$ · $p<0.05$) respectively and all the 0.05 significant levels. But in all the cases, Project-based learning methods had stronger relationships with knowledge in livestock production and knowledge in farm management than Traditional teaching methods respectively. Therefore, Project-based learning methods is highly recommended to be used to teach Agricultural science subjects that would result in acquisition of more Agricultural knowledge. The study also revealed that Project-Based learning methods in Agriculture in Senior High Schools had more positive impact on student's Agricultural skills

than Traditional teaching methods. Project-Based learning methods had higher positive and significant relationship with crop production skills ($r=0.322$, $p<0.01$), farm management skills ($r=0.204$, $p<0.05$) at 0.01 and 0.05 alpha levels respectively than Traditional teaching methods with crop production skills ($r=0.286$, $p<0.01$), Farm management skills ($r=0.174$, $p<0.05$). Again the Project-Based learning methods had positive relationship with animal production skills ($r=0.015$) while Traditional teaching methods had negative relationship with animal production skills ($r=-0.011$). It is concluded that Project-Based learning methods had more positive impact on acquisition of Agricultural knowledge and skills than Traditional teaching methods including the lecture method. If Project-Based learning is to make more meaningful impact in society in job creation, then the Government, Parents, Community organizations and Development agencies should play their respective roles in promoting Agricultural Education in Ghana.

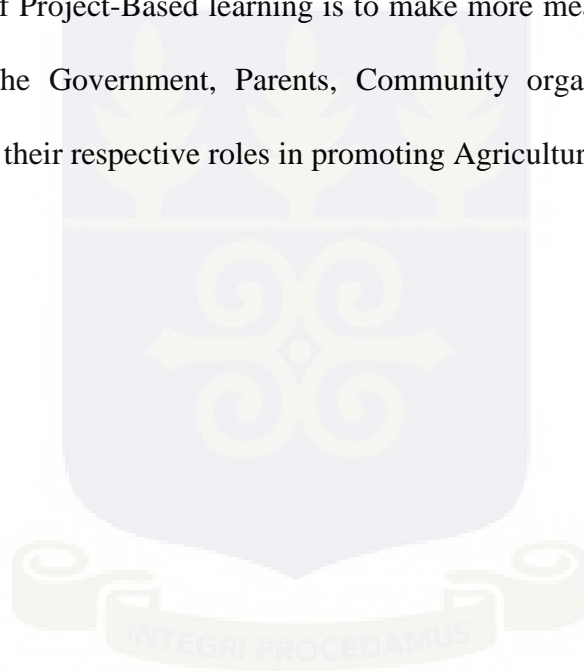


TABLE OF CONTENTS

DECLARATION	-----	i
DEDICATION	-----	ii
ACKNOWLEDGEMENT	-----	iii
ABSTRACT	-----	iv
TABLE OF CONTENTS	-----	vi
LIST OF TABLES	-----	xii
LIST OF FIGURES	-----	xiv
LIST OF ABBREVIATIONS	-----	xv
CHAPTER ONE: INTRODUCTION	-----	1
1.0 An Overview of Education in Ghana	-----	1
1.1 The Research Problem	-----	8
1.2 The Research Questions	-----	9
1.3 The Research Objectives	-----	10
1.4 The Research Hypotheses	-----	11
1.5 Significance of the Study	-----	11
1.6 Scope of the Study	-----	12
1.7 Limitations of the Research	-----	12
1.8 Summary	-----	12

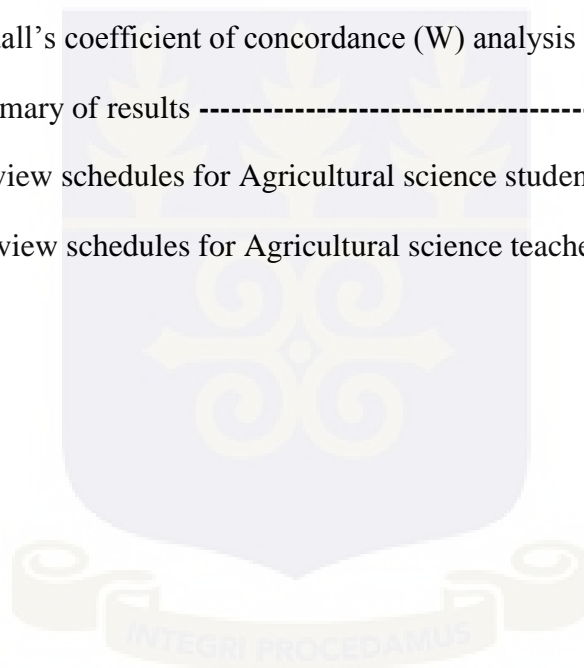
CHAPTER TWO: RELATED LITERATURE REVIEW	13
2.0 Introduction	13
2.1 Presage Variables	14
2.1.1 <i>Teacher formative experience in Agricultural science</i>	14
2.1.2 <i>Teacher training experience in Agricultural science</i>	12
2.1.3 <i>Properties of teachers</i>	16
2.1.4 <i>Teaching style</i>	19
2.1.5 <i>Human Capital Theory</i>	20
2.2 Motivation of the Teacher	21
2.3 Context Variables	23
2.3.1 <i>Students formative experience and its relevance in learning</i>	23
2.3.2 <i>Self-efficacy and its impact on academic achievement</i>	24
2.3.3 <i>Learning style and its impact on learning</i>	25
2.3.4 <i>Learning modes and its uniqueness in Agricultural Education</i>	27
2.4 Theories of Learning	28
2.4.1 <i>Experiential learning theory</i>	29
2.4.2 <i>Discovery learning theory</i>	35
2.4.3 <i>Social learning theory</i>	36
2.4.4 <i>Cognitive theory of learning</i>	37
2.5 Family Background of Students	39
2.6 School Facilities for Learning Purposes	40
2.7 School and Community Relationship in Teaching and Learning Process	41
2.8 Process Variables	42
2.9 Teaching Methodology	44

2.9.1	<i>Definition of Project-Based Learning (PBL)</i> -----	44
2.9.2	<i>Historical overview of Project-Based Learning (PBL)</i> -----	45
2.9.3	<i>Theoretical foundation of Project-Based Learning</i> -----	46
2.9.4	<i>Importance of Project-Based Learning (PBL)</i> -----	46
2.9.5	<i>Project-Based Learning implementation challenges</i> -----	48
2.9.6	<i>Project-Based Learning versus Traditional learning methods</i> -----	49
2.10	Teaching Process -----	50
2.11	Teacher-Student Interaction and Relationship -----	50
2.12	Evaluation of Learning Effectiveness -----	51
2.13	Product Variables -----	51
2.13.1	<i>Students' immediate knowledge and skills gained in Agriculture</i> -----	52
2.13.2	<i>Students' long-term effects on Agricultural knowledge and skills</i> -----	52
2.13.3	<i>Application of Agricultural knowledge and skills by students after completion of school</i> -----	52
2.14	Summary -----	53
CHAPTER THREE: RESEARCH METHODOLOGY -----		54
3.0	Introduction -----	54
3.1	The Research Design -----	54
3.2	Study Population -----	55
3.3	Sample Size -----	56
3.4	Sampling Method -----	57
3.4.1	<i>Purposive sampling</i> -----	57
3.4.2	<i>Stratified random Sampling</i> -----	57

3.5	Instruments used in Data collection -----	59
3.5.1	<i>Interview sessions</i> -----	59
3.5.2	<i>Questionnaire administration</i> -----	60
3.6	Data Collection Techniques -----	61
3.7	Data Sources -----	61
3.8	Method of Data Analysis -----	62
3.9	Validity and Reliability of Instruction -----	63
3.10	Research Constraints -----	63
3.11	Summary -----	64
 CHAPTER FOUR: RESULTS AND DISCUSSIONS -----		65
4.0	Introduction -----	65
4.1	Agricultural Science Students’ Demographic Characteristics -----	65
4.1.1	<i>Age distribution versus type of schools attended</i> -----	65
4.1.2	<i>Time spent in learning by Agricultural science students</i> -----	66
4.2	Agricultural Science Teachers’ Demographic Characteristics -----	68
4.2.1	<i>Distribution of teachers by sex</i> -----	68
4.2.2	<i>Ages of teachers</i> -----	69
4.2.3	<i>Academic qualification of Agricultural science teachers</i> -----	70
4.2.4	<i>Teaching experience of Agricultural science teachers</i> -----	72
4.3	The impact of Agricultural Science Teachers’ Teaching values on Acquisition of Agricultural Knowledge and Skills -----	74
4.4	Motivation of the Teacher -----	74
4.5	Students’ Perception of the Impact of Teaching Methodologies on Acquisition of Agricultural knowledge and skills -----	77
4.6	The impact of Teacher-Student Interaction and Behaviour Settings	

	in Teaching and Learning Process -----	85
4.7	The Modes of Assessment of Project works given to Agricultural Science Students by their Teachers -----	88
4.8	The Perceived Benefits Agricultural Science Students derive from Project-Based Learning -----	90
4.9	Factors that Constraint the Use of Project-Based Learning Technique by Agricultural Science Teachers -----	91
4.10	Projects Executed by Agricultural Science Students under the Project-Based Learning and the Agricultural Science Knowledge and Skills Perceived to be Acquired by Students -----	92
4.11	Effects of Project-Based Learning on Students Ability to Establish Personal Garden and Rearing of Small Ruminants -----	94
4.12	Ambition of Agricultural Science Students after Completion of Course of Study with the Agricultural Knowledge and Skills gained under Project-Based Learning -----	96
4.13	Summary -----	99
 CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS -----		
	RECOMMENDATIONS -----	101
5.0	Introduction -----	101
5.1	Summary and Conclusions -----	101
5.2	Recommendations -----	105
5.2.1	<i>Recommendations for government</i> -----	105
5.2.2	<i>Recommendations for school authorities and teachers</i> -----	106
5.2.3	<i>Recommendations for parents and developmental agencies</i> -----	107
5.3	Recommendations for further Research -----	107

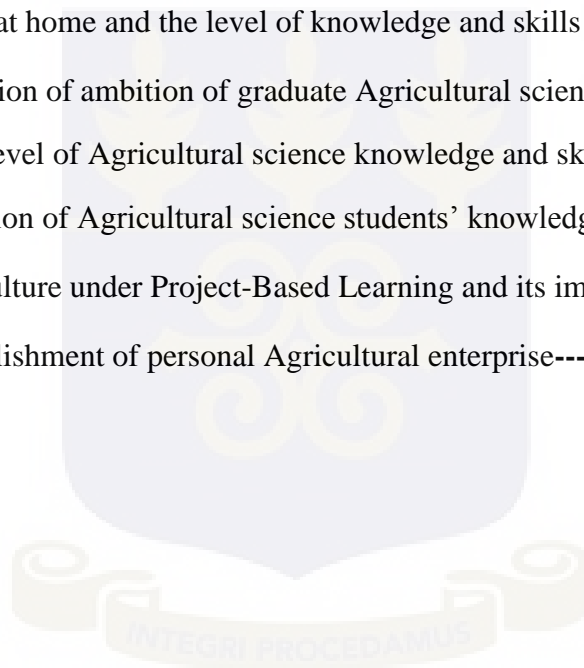
LIST OF REFERENCES -----	108
LIST OF APPENDICES -----	124
APPENDIX A: Questionnaire for Senior High Agricultural science students-----	124
APPENDIX B: Questionnaire for Agricultural science teachers-----	130
APPENDIX C: Pearson rank order Correlation of teaching methods and Agricultural knowledge acquisition-----	136
APPENDIX D: Pearson rank order Correlation of teaching methods and Agricultural skills acquisition-----	137
APPENDIX E: Kendall's coefficient of concordance (W) analysis and summary of results -----	138
APPENDIX F: Interview schedules for Agricultural science students-----	139
APPENDIX G: Interview schedules for Agricultural science teachers-----	140



LIST OF TABLES

Table 3.1: Name of School, number of Agricultural science students selected in the final year and number of Agricultural science teachers in the various Schools selected-----	56
Table 4.1: Cross tabulation between age category of student and school attended-----	65
Table 4.2: Cross tabulation between time spent on learning Agricultural Science note by Students and school attended-----	67
Table 4.3: Agricultural science teachers' academic qualification and its impact on the level of knowledge and skills gained by student-----	71
Table 4.4: Agricultural science teachers teaching experience (years) and its impact on the level of knowledge and skills gained by students.-----	73
Table 4.5: Motivational packages for effective and efficient teaching of Agricultural science subjects-----	75
Table 4.6: Correlation between frequency use of teaching methodologies and perceived Agricultural knowledge gained by students in Senior High school-----	79
Table 4.7: Correlation between frequency use of teaching methodologies and perceived Agricultural skills gained by students in Senior High school-----	82
Table 4.8: The perception students hold about Student-Teacher interaction and Behaviour setting in teaching and learning process-----	86
Table 4.9: Distribution of mode of assessment of Agricultural science students' project works by their teachers and its impact on the level of knowledge and skills gained by students.-----	89

Table 4.10: Ranking of factors that constrain the use of Project-Based Learning by Agricultural science teachers and its effect on teaching and learning of Agricultural science. -----	91
Table 4.11: Multiple responses of Projects executed by Agricultural science students under Project-Based Learning strategy and the level of knowledge and skills gained.-----	93
Table 4.12: Distribution of personal garden established by Agricultural science students at home and the level of knowledge and skills gained -----	95
Table 4.13: Distribution of personal garden established by Agricultural science students at home and the level of knowledge and skills gained.-----	95
Table 4.14: Distribution of ambition of graduate Agricultural science students and the level of Agricultural science knowledge and skills gained.-----	96
Table 4.15: Application of Agricultural science students' knowledge and skills in Agriculture under Project-Based Learning and its impact on the establishment of personal Agricultural enterprise-----	98



LIST OF FIGURES

Figure 2.1: Conceptual framework of the study-----13
Figure 4.1: Distribution of Agricultural science teachers by sex-----68
Figure 4.2: Distribution of Agricultural science teachers by age category-----70



LIST OF ABBREVIATIONS

GES	Ghana Education Service
HND	Higher National Diploma
MOE	Ministry of Education
PESTECH	Peki Senior High/Technical
PBL	Project-Based Learning
SPSS	Statistical Package for the Social Science



CHAPTER ONE: INTRODUCTION

1.0 An Overview of Education in Ghana

From the perspective of the role of education in the development of human resources for national development, the United Nations (UN) defines education as a force that develops well-rounded and engaged citizens and builds more cohesive and participatory societies (Cohen & Bloom, 2005). Therefore, the aim of an educational system should be to develop well-rounded and engaged citizens who will build more cohesive and participatory societies.

A well- rounded education covers comprehensive knowledge, skills, attitudes and values which are balanced across a wide range of subjects with the purpose of providing opportunities for students to expand their future options, professionally, socially and personally in order to become competent and contributing citizens (Weitz, 2008). For Aina (2009), it is an education for skill building and skill identity, which ultimately becomes a means of livelihood.

Successive governments in Ghana on account of the belief in the benefits of good education have sought to use education as the vehicle for accelerating the implementation of their development policies and programmes. It was however, realized that, even before the attainment of political independence in Ghana, the type and quality of education system inherited from the colonial era usually did not address the country needs and critical problems of development and equity.

Various education review committees emphasized this fact and proposed remedies which led to the formulation of various educational reforms such as the Ghana Education Act 1961, The New Structure and Content of Education 1974, The Education Trust Fund, The University Renationalization Committee Report of 1988 and The Free Compulsory Universal and Basic Education Programme (MOE, 1997).

The report of the Dzobo Committee educational reform which started in 1972 was finally implemented in 1987 nationwide to promote efficiency in education and the structure of this education system was 6-3-3 years which represented 6 years of Primary school education, three 3 years of Junior high school education and 3 years of Senior high school education. For example, there had been discontentment with the rather long duration of 17 years of pre-university education and that necessitated the Committee to propose a significant reduction in the duration of pre-university education from 17 to 12 years. This major reform also shifted emphasis from academic to practical orientation and this brought to the fore the introduction of Technical and Vocational programmes into the curricula of both Junior and Senior High schools in Ghana as its major content. Some of these Technical and Vocational programmes introduced into the curriculum of Senior High school education included Home Economics, Visual Arts, Technical skills, and Agricultural education (Manko & Mensah, 2003).

In line with government policy to deepen the study of vocational and technical subjects in the country, Agriculture education also has received a major boost of reviewing Agriculture education to ensure the development of well-trained Agricultural workforce including managers and specialists of various kinds. The central aim of the Agricultural education at the Senior High level is to train students in the basic principles of Agriculture, provide avenues for the development of their skills and change the attitudes of youth towards Agriculture (GES, 2010).

The general Agriculture syllabus is designed to help students to:

- Appreciate the importance of Agriculture in the socio-economic development of Ghana.
- Acquire, decision-making skills through the scientific principles of observation, data collection, analysis and interpretation.
- Develop positive attitude, interests, habits and good practices in Agriculture.
- Be aware of the roles of extension services in the Agricultural value chain.

- Recognise job opportunities in Agriculture.
- Acquire techniques for efficient management of agribusiness.
- Acquire requisite knowledge and skills needed for further training in agriculture.

All of these objectives need not be achieved at all stages of Agricultural Education. The achievement of some or a combination of some of these objectives will lead to Agricultural knowledge and skills acquisition. According to Ministry of Education teaching syllabus for teaching General Agriculture for Senior High school (2010), defined knowledge as the ability to remember or recall material already learned which constitutes the lowest level of learning.

Practical skills on the other hand are the competencies or ability required for performing satisfactorily in a job. Performance is a reflection of skills. The skills acquired by students in Agriculture at the Senior High school in job performance are intellectual skills, psychomotor skills, social skills and attitude (Bergmann, 2003).

In this regard, Production Agriculture refers to the act of producing agricultural produce. It is therefore concerned with the quality and quantity of product. Procedure utilized is similar to those operative in factories. The particular method for a particular quality or quantity of produce would have been predetermined and all participants would be expected to follow it. Learning is only achieved through a process of repetitive doing and it may not be necessary to have acquired academic knowledge of scientific Agriculture. In effect, the school would have determined for instance, how many tubers of yam or number of eggs it wishes to produce. It would therefore make available so many hectares of land for yams and so many birds for egg production. (Bergmann, 2003).

The teacher would be aware of what type of fertilizer to use, what time to plant the yam and will only give relevant instructions to students. The teacher himself does not used to have had formal

school instructions on the production of the farm produce. He might follow that already outlined by an Agricultural expert or he himself might have even learnt through an apprenticeship system (Ikeoji, 1998).

The learner does not need to be exposed to learning experiences in all the various components of Agricultural science. It might be possible for him to apply skills acquired in one aspect to another. Evaluation of educational achievement in this instance will mainly take into consideration the quantity and quality of produce. It is obvious from the foregoing that the amount of hectares of land and quantity of animal required would be determined by the level of production required in each school and definitely be more than would be required for Productive Agriculture.

Education in Productive Agriculture in this context refers to acquisition of skills, attitudes and values that will make the students capable of production of Agricultural produce. It should therefore provide knowledge and skills that may be directly or indirectly useful for Agricultural activities.

Like in any other science, the basic scientific skills of careful and thorough observation, complete and accurate reporting of what is observed, organization of information acquired, generalization on the basis of the information and prediction as a result of generalization, should be learnt. In addition to these practical skills, specific to scientific Agricultural activities such as those required in the agronomy of crops and production of animals would also be required. These later group of skills will mainly include manual work such as clearing and tilling of land, planting, weeding, protection and harvesting of crops, rearing of animals etc.

The type of learning experiences required to achieve these skills could be obtained both in the laboratory and on the field. While the practice of these skills are important, it is the nature of science to enable students understand the 'hows' of practice, the knowledge of the 'whys' that

enables the student who eventually becomes a farmer improve on the practice such that the quality and quantity of production is improved.

The curriculum therefore, would include academic knowledge or cognition required for adequate conceptualization of skills being taught for example History of agriculture, Physiology of plants and animals, distribution of crops and animals, principles of breeding, soil science etc. These may be taught in class using charts, maps, diagrams, by performing relevant laboratory experiments and relating all these to practice on the field. In this context therefore, it is sufficient to have a school garden and keep any type of livestock in order to illustrate and learn the processes and conditions required for production. The school garden does not have to be big enough to give a substantial harvest or allow for individual plot holdings. Appropriate skills may be learnt in groups. Productive agriculture therefore should not concern itself strictly with the quality or quantity of produce beyond the level of illustration in the field (Shannon, 2006).

Observation has shown that as laudable as the objectives of Agricultural education in Ghana are, it would be impossible to achieve them due to poor delivery process of the programme and inappropriate methods of teaching and evaluating of students performance in Agriculture at the Senior High level (Ikeoji, 1998).

It is evident therefore that since the goal has now changed from that of passing an examination to that stated by GES, the teaching method, and learning experiences may need modification even if the content remains the same. The content too may need re-organisation as shown in the GES syllabus (2010). The various methods that could be utilized by the teacher to impact knowledge and skills in Agriculture according to Shannon (2006) include:

- (1) Lecture or 'talk-chalk' method
- (2) Demonstration

(3) Practical Class work (i.e., Laboratory investigative method)

(4) Routine Practical Work (i.e. working routinely on the different sections of the school farm)

(5) Projects

(6) Homework

It may however, also include Discussions, trips and Guided Discovery method as suggested by (GES, 2010). Unfortunately the Lecture method with only a little bit of laboratory investigative and routine practical work are being utilized in most Ghanaian schools. It is evident from the earlier description of Productive agriculture that all these methods, although to different degrees, would be required to achieve the goal of making students “capable of producing” Agricultural produce. The Lecture method is the least useful. The Guided Discovery method is very useful in teaching the relevant scientific attitude, while Demonstration and Field trips are also crucial.

Projects however 'mini' are the most important to effective evaluation and Routine work may be integrated into it. Routine Practical work method is definitely important to Production Agriculture. Problems also arise when these various methods are not adequately integrated and learning experiences are not carefully selected and arranged. For instance, some teachers do not bother to investigate what crops grow best in the school locality before directing pupils to grow crops. The result is that the crops may not grow well enough for the teacher to utilize it in demonstration. Also, the scheduling of cropping session may not fall within school term and harvesting may be required during the holiday. Students who would have gone on holidays would thus miss the relevant learning opportunity. Class work or lectures are also not related to field trips, and practical work (in the laboratory and on the farm) sometimes. The essence is therefore lost. (Abaloo, 2010).

During the last half century, educators have struggled to find the most effective teaching, learning and assessment strategies for students. Since the process of effective teaching is sensitive to the educational context, the process and the product, these factors must be carefully designed and assessed (Gulbahar & Tinmaz, 2006). Project-Based Learning (PBL) has emerged to become an instructional approach that is gaining growing interest within the engineering education community (Hadim & Esche, 2002).

However, all projects require teamwork and collaboration among students and are designed to culminate in a substantive final product (Thomas, 2000). Project-based learning offers a wide range of benefits to both students and teachers. A growing body of academic research supports the use of Project-Based Learning in school to engage students, cut absenteeism, boost cooperative learning skills, and improve academic performance (George Lucas Educational Foundation, 2001).

For students, benefits of project-based learning include:

- Increased attendance, growth in self-reliance, and improved attitudes toward learning (Thomas, 2000)
- Academic gains equal to or better than those generated by other models, with students involved in projects taking greater responsibility for their own learning than during more traditional classroom activities (Boaler, 1999; SRI, 2000)
- Opportunities to develop complex skills, such as higher-order thinking, problem solving, collaborating, and communicating (SRI, 2000)
- Access to a broader range of learning opportunities in the classroom, providing a strategy for engaging culturally diverse learners (Railsback, 2002).

1.1 The Research Problem

Over the years, the world has changed and, in many of the developing countries, Agricultural education and training have failed to adapt and respond to the realities of rural societies. Curricula and teaching methods and tools often have been developed that are not relevant to the development objectives of individual countries, to the needs of farmers and to the labour market in general (World Bank, 2002).

Lindley (1999), notes that the mission of Agricultural education in Africa in the 21st century is to work toward improved, relevant and effective teaching, research and extension. The teacher's teaching methods has a lot to do with the amount of knowledge, skills and attitudes imparted to learners. The current situation of teaching and learning of Agriculture in schools in Ghana is a concern to all including government and society at large.

Agriculture is being taught as one of the art subjects and given orientation as education for citizenship. Agricultural Education should be utilitarian and stimulating, bringing theoretical ideals to practical reality. This is the position of the Project-Based Learning concept but some Agricultural science teachers in Senior High schools in the country barely use this method of teaching despite the enormous benefits derived from Project-Based Learning such as access to a broader range of learning opportunities in the classroom, growth in self-reliance, opportunities to develop complex skills, such as higher-order thinking, problem-solving, collaborating, communication skills and creation of self-employment. The observed challenges facing Agricultural science teachers in the use of Project-Based Learning strategy in teaching Agricultural science subjects have been poor funding, recognizing situations that make for good projects, structuring problems as learning opportunities, collaborating with colleagues to develop interdisciplinary project, managing the learning process and integrating technologies where appropriate (Intel, 2003). This means that most topics in Agriculture in schools are taught as biology without practical aspects of production due to these difficulties. Methods of instruction

are lecture based and most of the time devoid of demonstration. This removes first-hand experience with reality and eliminates the effective development of competence. Research indicates that many students find Agricultural science difficult, boring and not interesting (Bergmann, 2002).

Agricultural Education Institutions in Ghana are not adequately equipping their graduates with the knowledge and practical skills needed by employers or by the graduates themselves to go into self-employment in Agriculture or Agribusiness (Okorley, 2001). This has led to joblessness among the graduates today which stems from their inadequate acquisition of entrepreneurial, technical, managerial and vocational skills and other vocational courses.

This has further aggravated the youth negative behaviour in the society as most antisocial acts including armed robbery, militancy, restiveness and other social vices could be traced to the high rate of unemployment (Okafor, 2011). Unfortunately, most research studies on youth unemployment have not been able to trace the root cause. This study is designed to fill that gap by assessing the impact of Project-Based Learning on acquisition of Agricultural knowledge and skills in Senior High Schools and other traditional teaching methods so as to equip youth with employable skills to mitigate youth unemployment in Ghana.

1.2 The Research Question

The general question the study seeks to address is:

How does Project-Based Learning used by teachers in teaching processes influence acquisition of Agricultural knowledge and skills of students in Senior High Schools?

The study seeks to answer the following specific research questions.

1. To what extent do the demographic characteristics of Agricultural Science teachers and students influence teaching and learning of Agriculture in Senior High schools?

2. To what extent have traditional teaching methods and Project-Based learning methods adopted by Agricultural Science teachers impacted on acquisition of Agricultural knowledge and skills of students in the Senior High schools?
3. What are the factors that constrain the use of Project –Based Learning strategies by Agricultural Science teachers and learning outcomes in the Senior High schools?

1.3 The Research Objectives

The broad objective of the study is to examine what influence Project-Based Learning has on acquisition of Agricultural knowledge and skills in Senior High Schools.

The specific objectives of the study are to:

1. Determine personal characteristics of the respondents that influence teaching and learning of Agriculture in Senior High schools.
2. Determine the impact of Project-Based learning methods on students' acquisition of Agricultural knowledge and skills in Senior High schools.
3. Determine the impact of traditional teaching techniques on Agricultural knowledge and skills acquisition in Senior High schools.
4. Investigate the factors that constrain the use of Project-Based learning methods in acquisition of Agricultural knowledge and skills in Senior High schools.

1.4 The Research Hypotheses

The following Hypotheses were generated for the study.

Ho₁: The demographic characteristics of Agricultural Science teachers and students have no influence on teaching and learning of Agriculture.

Ho₂: There will be no significant difference in the acquisition of Agricultural knowledge and skills by students using Project-Based learning methods and traditional teaching methods of teaching.

Ho₃: There is no agreement among Agricultural Science teachers in the rankings of the factors that constrain the use of Project-Based Learning and learning outcomes.

1.5 Significance of the Study

It is a fact that Agriculture is capable of increasing the manpower needs, provide employment opportunities, sustain and stabilize the economy, thereby building a dynamic strong and self-reliant nation (Iwena, 2000). The realization of the above may be hampered by the ineffective traditional chalk and talk methods of teaching Agricultural Science in the classroom. The old traditional classroom environment is too dull and teacher-centred.

The research seeks to find new ways to improve instruction, so as to facilitate learning and to hold the attention of students by assessing the impact of Project-Based Learning on acquisition of Agricultural knowledge and skills.

Findings from the study would help to generate new information and verify existing knowledge about the most suitable teaching methods that enable students studying Agricultural Science in Senior High Schools to acquire requisite knowledge and skills. It would also inform educational authorities and other stakeholders in Agricultural policy formulation, curriculum designing and

organization of in-service training for Agricultural Science teachers so as to improve teaching and learning of Agricultural Science for the right results.

1.6 Scope of the Study

The scope of this study was limited to the impact of Project-Based Learning and other traditional methods on acquisition of Agricultural knowledge and skills in Public Senior High Schools in the Volta Region. The sample of this study included Agricultural Science teachers and students in some selected Public Senior High schools in the Volta Region.

1.7 Limitations of the Research

Mounton (2001) notes that the lack of generalization is a limitation to using research survey for research. Research survey has been criticised for producing soft data because they lack the rigours that is required by social scientific research. They have been accused of being more descriptive than analytical and deep than broad.

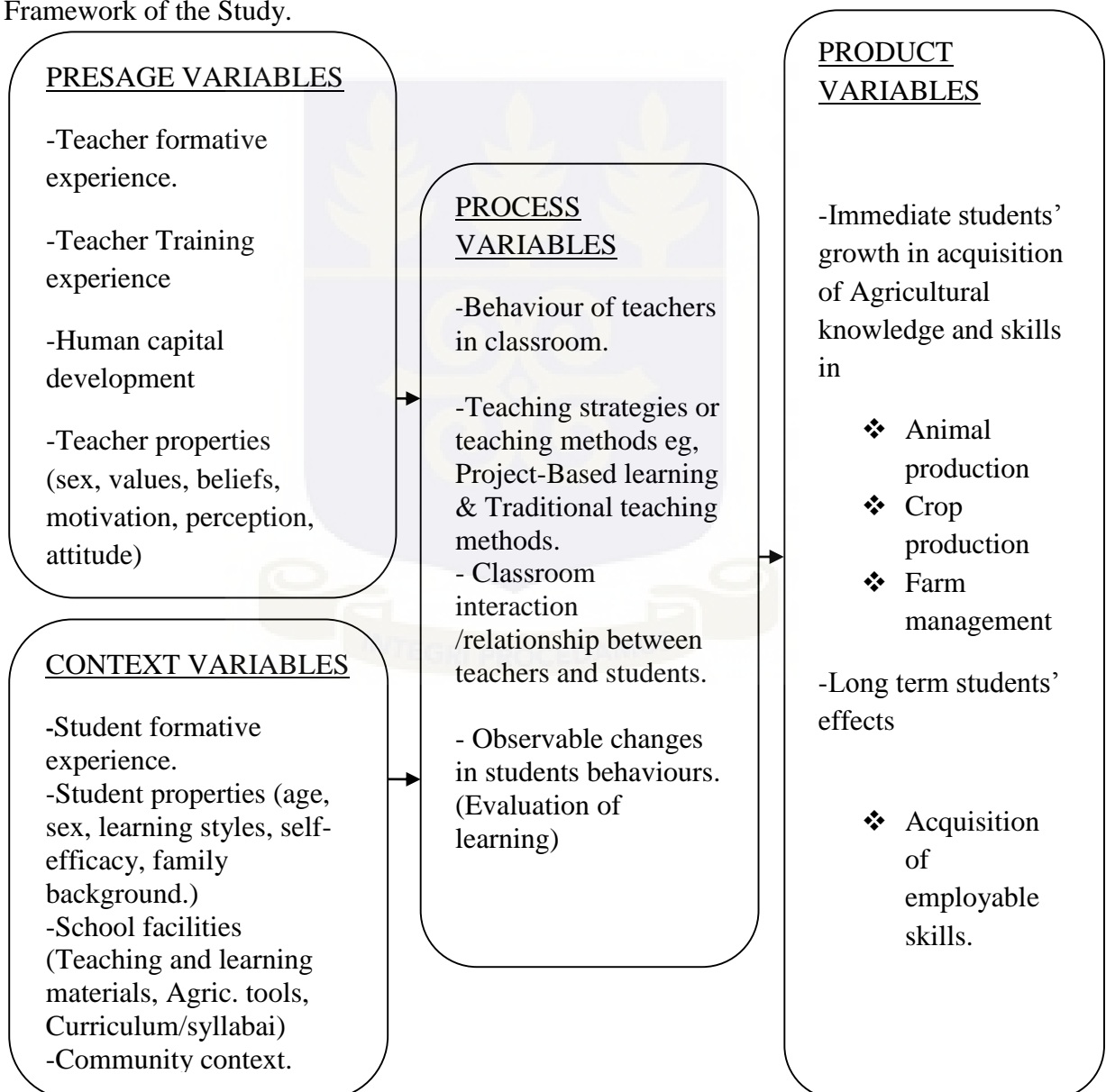
1.8 Summary

Many educational review committees have been making frantic efforts to provide the type of education that could empower the individual to make a meaningful contribution to improve living standard and also to put to use the Agricultural knowledge and skills acquired through Project-Based Learning in the production of quality Agricultural produce. The observed phenomenon was that some of the teaching methodologies used by Agricultural science teachers were not effective and efficient enough to produce the much needed results, hence the need to find more innovative instructional methods to fill gap. The study was guided by four (4) objectives, three (3) research questions and three (3) hypotheses. The study therefore seeks to find new ways to improve instructions.

CHAPTER TWO: CONCEPTUAL FRAMEWORK AND RELATED LITERATURE

2.0 Introduction

This chapter reviews relevant literature on the topic “the impact of Project-Based Learning on acquisition of Agricultural knowledge and skills in Senior High Schools in the Volta Region” based on the conceptual framework of the study in figure 2.1 consisting Presage variables, Context variables, Process variables and Product variables. Figure 2.1: The Conceptual Framework of the Study.



Dunkin and Biddle’s (1974) adaptation of Mitzel’s learning process (Mitzel, 1960)

According to Miles and Huberman (1994), a conceptual framework is a written or visual presentation that explains either graphically or in narrative form, the main things to be studied, the key factors, concepts or variables and the presumed relationship among them. The conceptual framework for this study lies in Dunkin and Biddle's (1974) adaptation of Mitzel's learning process (Mitzel, 1960). In this model, four variables are presented in teaching and learning process such as presage, context, process and product variables. The authors posit that presage variables and context variables influence process variables, which in turn yield product variables.

Presage variables are variables that deal with teacher characteristics. Context variables include student characteristics, school and community contexts and classroom contexts. Process variables embrace the actual activities that take place in the classroom. Process variables affect product variables, which are the outcomes of teaching.

2.1 Presage Variables

Presage variables concern traits that teachers have that affect the teaching process (Dunkin and Biddle, 1974; Clark and Peterson, 1986). These include teacher formative experiences, teacher training experiences, human capital development and teacher properties.

2.1.1 Teacher formative experience in Agricultural science

Teacher formative experiences are inclusive of all the incidences and situations that teachers go through that can mould and shape their behaviour and mental reactions. For instance, teacher's race, religion, culture and family background that has led their classification into ascribed positions in society. Teachers' Agricultural knowledge and skills, like students', must build on previous the Agricultural knowledge and skills they have. There is a close parallel between how

change occurs in conception of Agricultural Science and how it occurs in conceptions of teaching (Lillian, 2005). Jonassen & Gabrowski, (1993), defines prior knowledge as knowledge, skills in Agriculture or ability that a teacher brings to the learning process quite apart from the formal education received on the subject matter such as domestic knowledge, world knowledge, expert knowledge and pre-knowledge. They stated also that prior knowledge is a key principle of constructivist philosophy that is founded on the premise that by reflecting on our experiences, we construct our own understanding of the world we live and our mental models' adjust to accommodate new experiences.

2.1.2 Teacher training experience in Agricultural science Education

Their training experiences include the events that they went through while attending college or university. These events include the undergraduate courses taken, post-graduate education, teaching practice experience, in-service and all evidence that have the possibilities of shaping their beliefs in the teaching profession. “What teachers know, do, expect and value has a significant influence on the nature, extent and rate of student learning in Agricultural science.

The powerful (phrase) “*teachers make the difference*” captures the key role that professional educators play in shaping the lives and futures of their Agricultural science students (National Statement from the Teaching Profession on Teacher Standards, Quality and Professionalism, 2003). Teacher experience and teacher education level have been viewed as two characteristics that are related to teacher quality. They may also be viewed as important criteria in selecting teachers, serving as proxy variables for skills level or expertise in Agriculture. Teacher education level refers to the highest educational degree obtained by a teacher (Greenberg et al., 2004).

Teacher experience is the number of years a teacher has taught. The education of a teacher is based firmly on a foundation of general education including mastery of subject and insight in the interrelation and professional preparation. General education contributes to growth as a person, specialization provides scholarly knowledge of the subject Agriculture to be taught and integrated with professional Education leading to new understandings and skills for professional performance (Nayak & Rao, 2002).

Competent teachers apply broad, deep and integrated sets of Agricultural knowledge and skills as they plan for, implement, and revise instruction. Technology proficiency is but one dimension of teachers' competence (Siddiqui, 2004). Thorough understanding of the Agricultural science requires a depth study of all aspects of the subject from a variety of perspectives, to think of ideas and information, to enrich classroom situation, of various ways of presenting and explaining material to students and show students how various concepts and facts throughout the course in Agricultural science relate to each other.

Hattie, (2003) states that a major attribute of experts (teachers) is their deep representations about teaching and learning of Agricultural science. Experts and experienced teachers do not necessarily differ in the amount of Agricultural knowledge and skills they have about curriculum matters or knowledge about teaching strategies. But experts do not differ in how they organise and use this content knowledge in Agriculture.

2.1.3 *Properties of teachers*

Teacher attributes include their beliefs, attitude, perception and background knowledge toward the whole teaching and learning process. These properties are presumed to characterize the individual teachers because they carry these traits within themselves (Dunkin and Biddle, 1974). They are embedded deep within themselves that they serve to explain the teachers' behaviour in

response to a variety of situations. An attitude is a state of readiness, a tendency to act or react in a certain manner when confronted with a certain stimuli (Oppenheim, 1973). Attitude is reinforced by beliefs (the cognitive component) and often attracts strong feelings (the emotional component) that will lead to particular forms of behaviour (the action tendency component).

According to Parilah (1999), attitude is referred to as a person's inclinations, prejudices, ideas, fears and convictions about any specific topic. It is further described by their context (what the attitude is about), their direction (positive, neutral or negative feelings about the object or issue in question) and their intensity (an attitude may be held with greater and lesser vehemence).

Borg (2001) generally defines belief as a proposition, which is consciously or unconsciously held and accepted true by the individual holding it and which serves as a guide to thought and behaviour. It also helps to frame our understanding of events. However, in reference to teachers' beliefs, Borg specifically defines it as teachers' pedagogic beliefs that are relevant to their teaching. Richardson (1996) believes that teachers' beliefs come from three different stages of their educational career: personal experience, experience with schooling and instruction (pedagogical knowledge) and experience with formal knowledge in Agriculture. The beliefs of teachers about school subjects and how they are best taught, and how they themselves are trained are very crucial in teaching and learning of Agricultural Science and other subjects.

As all these characteristics influence the delivery of curriculum, they allow insight into the types of alignment that exist between teacher training, practice and national curriculum objectives. Coupled with achievement data, they will help identify the best towards the delivery of challenging curricula to students throughout the system (Rao, 2001). Teacher's beliefs about subject matter of Agricultural science can affect instructional practices and students' achievement. Teacher's pedagogical beliefs on the other hand refer to their notions about the

best way to teach a particular topic or subject within a discipline. The engagement of teachers with the ideas and activities promote the teachers' development.

Teachers' own beliefs and convictions about their own performance have much influence on the actual performance (Magno, 2006). It is explained that teachers who believe student learning can be influenced by effective teaching (outcomes expectancy beliefs) and who have confidence in their teaching activities (self-efficiency beliefs) would persist longer, provide a greater academic focus in the classroom and exhibit different types of feedback than teachers who have lower expectations concerning their ability to influence student learning.

Enochs, Smith & Huinker (2000), are among those who contextualised self-efficiency for teaching. They explained that self-efficacy is a belief in one's ability to teach effectively and teaching will have a positive effect on students learning.

According to Bell and John (1996), Teacher's background variables include age, gender, education, subject taught and teaching experience.

Woolfolk (1999), defined perception as the processes of determining the meaning of what are sensed. Perception occurs when teachers interpret a given meaning to stimuli in their classroom environment or in the students' classroom behaviour. Perception is important in a teaching and learning situation as it reinforces teachers' decision-making on how to handle classroom situations. Past research has shown that thinking (perception) plays an important part in teaching.

Background knowledge in this research refers to the Agricultural knowledge and skills that teachers have that they bring to class and relate them to students. It comprises the related curriculum and literature components as prescribed by the Ministry of Education. It also describes the teachers' familiarity with and awareness of 'what' to teach. Shulman (1986) defines

pedagogical content knowledge as subject matter knowledge in Agriculture for teaching. He sees it as an important way to understand the knowledge based on teaching. He further adds that teachers' pedagogical content knowledge in Agriculture influences teachers' classroom practices, which in turn influences students' learning and achievement.

2.1.4 Teaching Style

According to Orlich (1985), describes teaching as an activity of imparting knowledge, skills attitudes and values to learner. It involves creating situations to facilitate learning and motivating learners to have interest in what is being transmitted to them.

Mosston's spectrum of teaching styles (Mosston & Ashworth, 2002), established a framework of possible options in the relationship between teacher and learner and is based on the central importance of decision-making. The spectrum teaching styles is a continuum of teaching styles categorised according to the decisions made by teacher and or learner in the planning (pre-impact), teaching (impact) and evaluation (post-impact) phases of lesson. The pre-impact set is concerned with decisions made at the preparation stage before teaching, and involves subject matter, learning objectives, organization and presentation. The impact set includes decisions relating to performance and execution while the post-impact set includes evaluation of performance and feedback from learner to teacher. The spectrum can further be categorised in two distinct clusters namely reproduction and production. In reproduction cluster the central learning outcomes is for students to reproduce or recall Agricultural knowledge and skills known, whereas in production cluster, the central learning is for students to discover new Agricultural information or unique solutions to problems.

All teaching styles when used appropriately, contribute to human development in different ways (Chatoupis & Vagenas, 2011). Chatoupis (2009), high-lighted the need to investigate the

outcomes and contributions of different teaching styles, for a given period of time, to teach content rather than to compare one style with another.

2.1.5 Human capital theory

To sustain competitiveness in the school organization, human capital becomes an instrument used to increase productivity. Human capital refers to processes that relate to training, education and other professional initiatives in order to increase the level of Agricultural knowledge, skills, abilities, values and social assets of an employee which will lead to the employee's satisfaction and performance, and eventually on an organization performance (Shultz, 1993). Rastogi (2002), stated that human capital is an important input for organizations especially for employees' continuous improvement mainly on Agricultural knowledge, skills and abilities embodied in individuals that facilitate the creation of personal, social and economic wellbeing. A preponderance of research in recent years has given strong evidence that the best way to improve achievement is having an effective Agriculture teacher in every classroom and an effective Agriculture Administrator in every school (Leithwood et al, 2004). Therefore, the development of human capital, the talents, competencies and knowledge of Agriculture teacher and Agriculture Administrators has drawn increasing attention in the education community. As researchers and policymakers strive to better understand and how to attract and retain highly skilled Agriculture teachers and Administrators and bridge the gap between the under-performing Ghanaian school system and the more effective systems of global competitors, investing in a thoughtful human capital strategy is crucial. The three dimensions of the human capital pipeline are preparation, recruitment and retention of highly talented and effective Agriculture teacher and Administrators.

Below are the definitions of human capital development.

- Preparation refers to how Agriculture teachers are prepared through training, certification and licensure. This includes oversight of traditional programmes in schools of education and alternative certification.
- Recruitment addresses how Agriculture teachers are recruited into the profession, including mentoring and induction programmes for novice educators and mobility policies for all educators.
- Retention focuses on what is done to support Agriculture teachers once they are in the workforce, including professional development, compensation and incentives and working conditions as well as mechanisms for existing ineffective Agriculture teachers.

Knowledge in general is recognised as a fourth economic pillar alongside those of land, labour and capital. In knowledge economy, resources such as skills, expertise and intellectual acumen are often more critical than other economic resources such as land and labour and even capital, because it is difficult to measure its level.

The training and retraining approach is seen as a method or approach that could be used for the achievement of manipulative skills and knowledge in Agriculture. Training function, therefore, proceeds from the assumption that the gap between required and actual performance, which calls for a bridge through training, is the result of inadequacy of Agricultural knowledge, skills and attitudes (Okorie, 2000).

2.2 Motivation of the Teacher

Motivating students begins with a motivated teacher. With the increasing amount of shortages of teachers across the educational field, there has been a renewed focus in understanding what motivates Agriculture teachers to remain active in the teaching profession. However, for the last

decades, much of what is known about teacher motivation has been scarce. Retelsdorf & Gunther, (2011) attribute this lack of knowledge to the paucity of compelling conceptual frameworks.

According to Kreitner & Kinick (2001), define motivation as those psychological processes that cause the arousal, direction and persistence of voluntary actions that are directed. On their part, Mathis & Jackson (2002), also define motivation as the desire with a person causing that person to act. They contend that people act for a reason, to reach a goal. Motivation, therefore, is a goal directed, drives and seldom occurs in a void. According to Bennell (2004), work motivation refers to the psychological processes that influence individual behaviour with respect to the attainment of workplace goals and task.

Agriculture is the backbone of Ghana's economy (ISSER, 2005). Agricultural science teachers among other major stakeholders in Agriculture need to be motivated to train the future agriculturalist and agricultural policymakers of the nation. Osei (2005), stated that over the years, teachers in Ghana including Agricultural teachers and their unions have complain and embark on various strike actions to demand improvement in salary and other work conditions. These strike actions normally affect the students and consequently the future leaders and frontiers of Agriculture and national development.

To understand and explain human behaviour, a number of motivational theories have been developed by scholars. These have generally been grouped into two: Content and process approaches to the study of motivation. Proponents of the content approach are interested in "what is" within people that motivate them. It is based on the assumption that people have a set of needs or desires outcomes which they embark upon actions to achieve them. On the other hand, proponents of the process approach are concern on "how and why" people are motivated to achieve organizational goals (Lucey, 2005).

2.3 Context Variables

Context variables consist of student factor, availability of school facilities and community assistance. The student factor, availability of school facilities and community assistance concern conditions to which Agricultural science teachers have to make personal adjustments. Student factor comprises the nature of the social background of the students thus their attitudes, motivation, interest, goals, beliefs, formative experience or prior knowledge, age, sex, learning style, home activities and disposition they bring into class with them have a great impact on their learning. The school facilities include syllabi, Agricultural tools, Library, classrooms, land for farming and curriculum. Community assistance is the help the community offers the schools in diverse ways.

2.3.1 Students formative experience and its relevance in learning

Background knowledge is the raw material that conditions learning. It acts as mental hooks for the lodging of new information and is the building block of content and skills in Agriculture education. Marzano (2004) simply defines prior knowledge as “what a student or person already knows about the content of a subject.”

Background knowledge comes into play when learners connect what they already know to new learning, use their personal knowledge and experiences to access new ideas and situations, and bring past learning experiences to mind to help guide them with new challenges. Activating prior knowledge helps students make stronger connections and find deeper relevance in learning, and this boosts student engagement (Jensen & Nickelsen, 2008). "If we have some prior knowledge, a point of connection or even a positive feeling about the new material, our potential to learn is enhanced" (Ontario Ministry of Education, 2010).

As students build background knowledge, they increase their sources of reliable information. This is critical at a time when there is so much access to information, but not all of it is credible

and valid. One way to show students that they build on background knowledge is through interactive mind mapping which initially captures their prior knowledge and then the revisions to their thinking over time as they acquire new knowledge and information (Goudvis & Buhrow, 2011).

2.3.2 Self-efficacy and its impact on academic achievement

The foundation for self-efficacy theory is found in social cognitive theory, particularly the work of Albert Bandura (Pajares, 2002). Bandura (1986), asserted that a reciprocal relationship exists between personal factors, environmental factors, and behaviour.

Of particular importance to social cognitive theory is the concept that personal factors, which include cognitive, biological, and affective events, are related to behaviour and environmental factors. One such personal factor is self-efficacy. Pajares (2002), asserted that, “of all the thoughts that affect human functioning and standing at the very core of social cognitive theory, are self-efficacy beliefs.” Regarding self-efficacy, Bandura (1995), explains that it "refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations". Self-efficacy has been thought to be a task-specific version of self-esteem (Lunenburg, 2011). The basic principle behind Self-Efficacy Theory is that individuals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those they do not (Van der Bijl & Shortridge-Baggett, 2002). Therefore, in an educational setting, self-efficacy can influence achievement and attitudes of students' Agricultural science in acquiring knowledge and skills with confidence (Pajares, 2002).

Self-efficacy is influenced by mastery experiences, vicarious experiences, social influences, and physiological or emotional states. Thus, previous personal successes, watching others succeed, being told that he and she can succeed, and positive biological feedback can all increase a student's self-efficacy in Agricultural Education. It is important to note that influencing self-

efficacy vicarious experiences can occur by observing models, particularly peer models (Schunk, 2000). Therefore, a student's self-efficacy can be increased by observing another student, viewed as a peer, succeed at a similar task or in a similar situation in Agricultural science.

2.3.3 Learning style and its impact on learning

Individual learning styles differ, and these individual differences become even more important in the area of education. Therefore, the real challenge in Agriculture Education is keeping the students it is designed for in mind (Canavan, 2004).

Kolb, Rubin & McLntyre (1974) defined learning style as an individual's inherited foundation, particular past life experience and the demands of the present environment that emphasise some learning abilities over others.

Hiltz (1993), indicates that a primary goal in studying a new medium of communication foreducational delivery must be the identification of its impact on learning. Students may benefit from understanding their own learning style by taking measures to adjust the way they acquire Agricultural knowledge and skills (Cowley *et al.*, 2002).

While instructors cannot always accommodate each student's need, it is important that several learning opportunities are provided (Tu and McIsaac, 2002). It is expected that when the learning experience is more effective for the student, an increased level of user acceptance of information systems will result.

Lindsay (1999) found that a match between learning style and teaching style reveals increases in student achievement and satisfaction in Agricultural science.

Kolb & Fry (1975) has described four basic learning styles: accommodative, assimilative, divergent, and convergent.

- *Assimilative Style.* The assimilative learning style is characterized by the ability to reason inductively. Kolb (1984) has suggested that one of the assimilator's greatest abilities is to "create theoretical models in assimilating disparate observations into an integrated explanation". Assimilators concern themselves with ideas and abstract concepts rather than with people and social interactions and are concerned with abstract, logical rather than practical aspects of theories. Individuals who use the assimilative style incorporate the learning modes of reflective observation and abstract conceptualization.
- *Accommodative Style.* As opposed to the assimilative style, accommodative learners excel at accomplishing Agricultural tasks by following directions, meticulously planning, and ultimately seeking new experiences (Kolb, 1984). They are characterized as being opportunistic, action driven, and risk takers. The accommodative label comes from their ability to adapt themselves to changing circumstances. Unlike assimilative learners, those who are accommodative solve problems in an intuitive trial-and-error manner rather than through careful examination of facts, and they rely heavily on other people for information rather than on their own analytic ability.
- *Convergent Style.* Kolb suggests that the convergent learner's greatest strength is the ability to efficiently solve Agricultural problems, make decisions and apply practical ideas to solve Agricultural problems. Generally, these people do well on standard conventional intelligence tests because they can organize knowledge by hypothetical deductive reasoning and thus are able to converge to one given answer (Kolb, 1976).

- *Divergent Style.* The divergent learner is best at tasks that require “imaginative ability and awareness of meaning and value” (Kolb, 1984). Individuals with this learning style have the ability to identify concrete examples of a concept and to generate numerous qualities about this concept from many perspectives. They are then able to organize these qualities by how each quality interrelates to one another, which then provides a meaningful “gestalt” whole of the concept. Divergent learners prefer the learning modes of concrete experiences and reflective observation.

2.3.4 Learning modes and its uniqueness in Agricultural Education

Learning mode is concerned with the uniqueness and complexity of present reality as opposed to theories and generalizations (Kolb, 1984). Kolb identifies four learning modes such as Concrete experience, Reflective observation, Abstract conceptualization and Active experimentation.

- *Concrete Experiences.* The concrete experiences mode is the characteristics of learners who desire plenty of opportunities for direct human interpersonal interactions. These individuals also prefer to feel and experience rather than think. Kolb (1984) describes them as intuitive decision makers, who value circumstances involving people in real world situations. More often than not, people who prefer the concrete experience learning mode take an artistic intuitive approach to problem solving rather than a scientific approach.
- *Reflective Observation.* This mode focuses on the ability to understand the meaning of ideas. Individuals who are characterized by this mode value objective judgment, impartiality, and patience. They prefer abstract understanding over practical applications, and they prefer to reflect and observe rather than act on a situation.

- *Abstract Conceptualization.* Individuals oriented toward abstract conceptualization typically attend to tasks that involve logical investigation of ideas and concepts in Agriculture. Unlike concrete experiences, this learning mode is characterized by a preference to depend on cognitive rather than emotional skills in Agriculture. Commonly, individuals who prefer this mode involve themselves with and tackle academic problems that require the ability to build general theories in order to come up with a solution.
- *Active Experimentation.* “The active experimentation learning mode focuses on actively influencing people and changing situations” (Kolb, 1984). In other words, individuals in this learning mode prefer to be involved in peer interactions that allow them to play an integral role in the decisions made in these interactions. This mode emphasizes practical applications or solutions rather than reflective understanding of a problem.

2.4 Theories of Learning

Learning theories explain how learning occurs. Sarfo (2002), defines learning theory as a set of statements that explain, describe, predict and control behaviour change (learning). Burns (1995) conceives of learning as relatively permanent change in behaviour with behaviour including both observable activity and internal processes such as thinking, attitudes and emotions. According to Leacock (1998), learning occurs in four ways. These are transmission, acquisition, accretion and emergence.

- Transmission is the process by which knowledge, ideas and skills are taught to others through conscious telling, demonstration and guidance.
- Acquisition is the conscious choice to learn. Material in this category is relevant to the learner. This method includes exploring, experimenting, self-instruction, inquiry and general curiosity.

- Accretion is the gradual, often subconscious or subliminal, process by which students learn things like language, culture, habits, prejudices and social rules and behaviours. The students are usually unaware that the processes involved in accretion are taking place.
- Emergence is the result of patterning, structuring, and construction of new ideas and meanings that did not exist before, but which emerges from the brain through thoughtful reflection, insight and creative expression or group interactions.

In this section, the following theories of learning and their educational implications relevant to this study would be discussed.

- Experiential theory
- Discovery learning theory
- Social learning theory
- Cognitive theory of learning

2.4.1 Experimental learning theory

Experience learning is knowledge, skills or abilities attained through observation, simulation or participation which provides depth and meaning to learning and engages the mind and body through activity of reflection and application.

The first context of experiential learning as Smith (2001) described it is the sort of learning undertaken by Agricultural science students who are given a chance to acquire and apply knowledge, skills and feelings in an immediate and relevant setting. The type of learning could naturally align with a contemporary career and technical education or Agricultural education programme.

Knowledge results from the combination of grasping and transforming experience (Kolb, 1984). Grasping experience refers to the process of taking in information, and transforming experience is how individuals interpret and act on that information. The Experiential learning theory model portrays two dialectically related modes of grasping experience the Concrete Experience (CE) and Abstract Conceptualization (AC) and two dialectically related modes of transforming experience are Reflective Observation (RO) and Active Experimentation (AE).

Learning arises from the resolution of creative tension among these four learning modes. This process is portrayed as an idealized learning cycle or spiral where the learner “touches all the bases” thus experiencing (CE), reflecting (RO), thinking (AC), and acting (AE) in a recursive process that is sensitive to the learning situation and what is being learned. Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guides in creating new experiences. Evidence from experiential learning research in international contexts supports the cross-cultural applicability of the model (Kolb & Kolb, 2011).

Kolb (1984) proposed six characteristics of experiential learning:

- Learning is best conceived as a process, not in terms of outcomes. Although punctuated by knowledge milestones, learning does not end at an outcome, nor is it always evidenced in performance. Rather, learning occurs through the course of connected experiences in which knowledge is modified and re-formed. As Dewey suggests, education must be conceived as a continuing reconstruction of experience, the process and goal of education are one and the same thing.

- All learning is re-learning. Learning is best facilitated by a process that draws out the learners' beliefs and ideas about a topic so that they can be examined, tested and integrated with new, more refined ideas. Piaget called this proposition constructivism—individuals construct their knowledge of the world based on their experience.
- Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world. Conflict, differences, and disagreement are what drive the learning process. These tensions are resolved in interactions of movement back and forth between opposing modes of reflection and action and feeling and thinking.
- Learning is a holistic process of adaptation. Learning is not just the result of cognition but involves the integrated functioning of the total person thinking, feeling, perceiving and behaving. It encompasses other specialized models of adaptation from the scientific method to problems solving, decision making and creativity.
- Learning results from synergetic transactions between the person and the environment. In Piaget's terms, learning occurs through equilibration of the dialectic processes of assimilating new experiences into existing concepts and accommodating existing concepts to new experience. Following Lewin's famous formula the behaviour is a function of the person and the environment, the Experiential learning theory holds that learning is influenced by characteristics of the learner and the learning space.
- Learning is the process of creating. In, Experiential learning theory, knowledge is viewed as the transaction between two forms of knowledge:

social knowledge, which is co-constructed in a socio-historical context, and personal knowledge, the subjective experience of the learner. This conceptualization of knowledge stands in contrast to that of the “transmission” model of education in which pre-existing, fixed ideas are transmitted to the learner.

“The focus of experiential learning is placed on the process of learning and not the product of learning” (University of California Davis [UCD], 2011). Proponents of experiential learning assert that students will be more motivated to learn when they have a personal stake in the subject rather than being assigned to review a topic or read a textbook chapter. What is essential in experiential learning, however, is “that the phases of experiencing (doing), reflection and applying are present. In addition, “the stages of reflection and application are what make experiential learning different and more powerful than the models commonly referred to as learn-by-doing or hands-on-learning (UCD, 2011).

The following is a list of experiential learning principles as noted from the (Association for Experiential Education, 2011):

- Experiential learning occurs when carefully chosen experiences are supported by reflection, critical analysis and synthesis.
- Experiences are structured to require the student to take initiative, make decisions and be accountable for results.
- Throughout the experiential learning process, the student is actively engaged in posing questions, investigating, experimenting, being curious, solving problems, assuming responsibility, being creative and constructing meaning.

- Students are engaged intellectually, emotionally, socially, soulfully and or physically. This involvement produces a perception that the learning task is authentic.
- The results of the learning are personal and form the basis for future experience and learning.
- Relationships are developed and nurtured: student to self, student to others and student to the world at large.
- The instructor and student may experience success, failure, adventure, risk-taking and uncertainty, because the outcomes of the experience cannot totally be predicted.
- Opportunities are nurtured for students and instructors to explore and examine their own values.
- The instructor's primary roles include setting suitable experiences, posing problems, setting boundaries, supporting students, insuring physical and emotional safety, and facilitating the learning process.
- The instructor recognizes and encourages spontaneous opportunities for learning.
- Instructors strive to be aware of their biases, judgments and pre-conceptions, and how these influence the student.
- The design of the learning experience includes the possibility to learn from natural consequences, mistakes and successes.

Instructor-Teacher Roles in Experiential Learning

In experiential learning, the instructor or teacher guides rather than directs the learning process where students are naturally interested in learning. The instructor or the teacher assumes the role of facilitator and is guided by a number of steps crucial to experiential learning as noted by (Wurdinger & Carlson, 2010).

- Be willing to accept a less teacher-centric role in the classroom.
- Approach the learning experience in a positive, non-dominating way.
- Identify an experience in which students will find interest and be personally committed.
- Explain the purpose of the experiential learning situation to the students.
- Share your feelings and thoughts with your students and let them know that you are learning from the experience too.
- Tie the course learning objectives to course activities and direct experiences so students know what they are supposed to do.
- Provide relevant and meaningful resources to help students succeed.
- Allow students to experiment and discover solutions on their own.
- Find a sense of balance between the academic and nurturing aspects of teaching.
- Clarify students' and instructor roles.

Student Roles in Experiential Learning

Qualities of experiential learning are those in which students decide in themselves to be personally involved in the learning experience (students are actively participating in their own learning and have a personal role in the direction of learning). Students are not completely left to teach themselves; however, the instructor assumes the role of a guide and facilitates the learning process. The following list of student roles has been adapted from (UC-Davis, 2011 and Wurdinger & Carlson, 2010).

- Students will be involved in Agricultural science problems which are practical, social and personal.

- Students will be allowed freedom in the classroom as long as they make headway in the learning process in acquisition of Agricultural knowledge and skills.
- Students often will need to be involved in difficult and challenging situations in Agriculture while discovering.
- Students will self-evaluate their own progression or success in the learning process in Agriculture which becomes the primary means of assessment.
- Students will learn from the learning process in Agriculture and become open to change. This change includes less reliance on the instructor and more on fellow peers, the development of skills to investigate (research) and learn from an authentic experience, and the ability to objectively self-evaluate one's performance.

2.4.2 Discovery learning theory

Discovery learning, according to Bruner (1996), is an “inquiry-based, constructivist learning philosophy that takes place in problem-solving situations where the learner draws on his or her own past experience and existing knowledge to discover facts and relationships and new truths to be learned;” in essence, “obtaining knowledge for oneself” (Clabaugh, 2009; as cited, in Schunk, 2008). When students interact with their environment through exploration of objects and then work together to form hypotheses, they are actively engaged in the process of developing problem-based learning skills in Agriculture (Schunk, 2008).

Bruner believed that as a result of this learning process, students are “more likely to remember concepts and knowledge discovered in Agriculture on their own” (Clabaugh, 2009). Further, Schunk emphasizes that the discovery model “is a type of inductive reasoning” that allows Agricultural science students to move from “studying specific examples to formulating general rules, concepts, and principle through a minimally guided instructional approach that involves

direction; teachers arrange activities in which students search, manipulate, explore, and investigate issues in Agricultural science” (Schunk, 2008).

2.4.3 Social learning theory

The notion of social learning has been used in quite different meanings to refer to processes of learning and change of individuals and social systems. In the influential work of Bandura (1977) social learning refers to individual learning based on observation of others and their social interactions within a group through imitation of role models. It assumes an interactive feedback between the learner and their environment, the learner changing the environment, and these changes affecting the learner.

Social learning theory talks about how both environmental and cognitive factors interact to influence human learning and behaviour. It focuses on the learning that occurs within a social context. It considers what Agricultural science students learn from one another during acquisition of Agricultural knowledge and skills in the classroom and in the school gardens and farms, including such concepts as observational learning, imitation, and modelling. It is believed that Agricultural science students learn more Agricultural knowledge and skills from their peers than even their teachers.

(Cunia, 2007) indicated that social learning has the following implications.

- Learning by observation (models) students learn simply by observing other students.
- Modelling provides an alternative to shaping for teaching new behaviours. Instead of using shaping, which is operant conditioning, modelling can provide a faster, more efficient means for teaching new behaviour. To promote effective modelling a

teacher must make sure that the four essential conditions exist; attention, retention, motor reproduction, and motivation.

- Cognition plays a role in learning.
- Learning can occur without change in behaviour.
- Teachers and parents must model appropriate behaviours and take care that they do not model inappropriate ones.
- Teachers should expose students to a variety of other models.
- Students must believe that they are capable of accomplishing school tasks.
- Teachers should help students set realistic expectations for their academic accomplishments.
- Self-regulation techniques provide effective methods for improving behaviour.
- Describing the consequences of behaviour increases appropriate behaviour and decreases inappropriate ones.

2.4.4 Cognitive theory of learning

The cognitive theory of learning lays emphasis on the human conscious mind being the major element in the learning process. It explains the careful structuring of the mind that enables it collect, organize and relate new experiences and knowledge to the already existing ones in the brain.

Various aspects of cognitive theories of learning exist. They have proved to be of uttermost help to educators who want learning to be from rote to meaningful learning so as to have new knowledge coming up (Benskim, 2012). Benskim identifies five types of cognitive theory of learning as:

Mnemonics

This cognitive theory of learning that emphasizes on acronyms as a quick storage and retrieval of Agricultural knowledge and skill information.

Dual Coding

Cognitive learning theory is enhanced when verbal presentation of Agricultural science lessons is complemented by visual images.

Schema Theory

This cognitive theory of learning states that information learnt is grouped into patterns of likeness in the brain's long term memory. This is very useful in learning as it helps Agricultural science educators try to link the just to be acquired Agricultural knowledge with the already existing Agricultural knowledge for harmonization.

Meaningful Learning

It is a cognitive learning theory that further enhances learning as it enables the Agricultural students to link the new Agricultural knowledge with familiar information.

Law of Continuity

A cognitive learning theory that helps in making learning a continuous process on which new Agricultural knowledge and skills is built on previously gained knowledge and skills.

Cognitive learning theorists argue that past Agricultural experiences, techniques and skills enhance transfer of Agricultural knowledge and decision making. This is in line with the schema theory whereby, information is grouped in patterns of similarity when it is being stored in the long term memory.

According to cognitive theory of learning, past Agricultural experiences and knowledge provides the learner or the decision maker with basic information on the new topic. This gives them an upper edge while dealing with the new topic. Therefore, past Agricultural experience and previously acquired Agricultural knowledge is important when acquiring new truths.

Using past Agricultural experiences gives more ability and information to the brain hence, refining it and placing it in a better state to solve problems. After all, learning is a continuous step by step process: what is learnt today forms a foundation for tomorrow's Agricultural knowledge and skills (Benskim, 2012).

2.5 Family Background of Students

Parents are the major role players in academic achievement of students. In the teaching and learning process, family factors influence students' success and school achievement. Parental expectation and aspiration, home environment and parental involvement in their children's education, such as creating conducive home environment and the consistent provision of assistance in their studies, are the main factors that could affect the student's academic achievement (Christenson et al., 1992). Kloosterman (1999), studied the effects of home environment on learners' socio-emotional and cognitive development.

The author clearly showed that the family and school environments play important roles in learners socio-emotional and cognitive development. Emotional support, family values such as respect, strong maternal role, legacy and maintenance of the home language were identified as the most essential family factors (Kloosterman, 1999).

Marks (2006) reported that both family size and family type have effect on students' academic achievement. Students from large, single-parent and re-constituted families are found to be grouped in the academically weaker categories in the school. The study also clearly showed that family types such as single-parent and reconstituted family had negative effects on student Agricultural performance. These empirical studies showed that family factors can and do affect students achievement.

2.6 School Facilities for Learning Purposes

School facilities can be defined as those things that enable the teacher to do his or her work very well and helping the learners to learn effectively. The chalkboard for example, facilitates the imparting of information on the learner. School facilities also include school buildings such as classrooms, assembly halls, laboratories, workshops, libraries. They also include teaching aids, chairs, tables, devices such as modern educational hardware and software in the form of magnetic tapes, films, transparent stripes and Agricultural tools. The school farm or garden is another important ground of the school; it is an integral part of the school facilities. It is a part of the school compound that enables Agricultural science students to do practicals that may result in acquisition of Agricultural knowledge and skills by students. School facilities are all the things that are needed for effective teaching–learning process to take place. They are designed to enhance the process of teaching. The absence of school facilities implies the non-existence of any set up that may be referred to as school.

Peretemode (2001) concludes that “educational facilities are those things of education which enables a skilful teacher to achieve a level of instructional effectiveness that far exceeds what is possible when they are not provided”. The successful implementation of any educational programme depends mostly on the quality of available school facilities that are to be provided for such programme. This is supported by the view of Abraham (2003), who posits that “the type of atmosphere required for effective learning is that consisting of better school buildings, more and better teaching facilities”.

Again, Abraham (2003), posits that “the quality of education that our children get bears direct relevance to the availability or the lack of physical facilities and overall atmosphere where the learning takes place. The desire for education attainment is on the high side, the consumers of

education therefore expect the attainment of standard and quality education that will give them a sense of belonging, fulfilment and satisfaction.

2.7 School and Community Relationship in Teaching and Learning Process

School-community partnership is a driving force behind quality assurance practice, aimed at improving the quality of school management, learning environment, curriculum delivery and students' learning outcomes through the involvement of meaningful, close, strong and goal oriented partnership between the school authority and other relevant stakeholders (Parent-Teachers Association (PTA), Old Students Association, Non-government agencies, Communities, Ministries, School Board, Individuals and other social institutions). This synergy is necessary because a virile and responsive school-community relationship is a building block for the attainment of specified standards and set goals and production of quality outputs that will satisfy the expectations of the institution's customers and society (Ayeni, 2010).

The Physical resources the community can provide for the school include:

- Land for Agricultural use on the school premises, with fertile soil.
- Water supply sufficient (through run-off collection or groundwater) for maintaining Agricultural activities.
- Accommodation for responsible teachers on or near the school.
- Classroom and practical facilities which are safe and healthy for everyone using the school.

Community members involved in schooling and school members involved in the community:

- farmers and local experts help teachers and students learn about Agriculture and land use systems

- parents and community members learn new ideas, methods and techniques from their children and teachers and from school demonstration plots
- As a result, this will:
 - maximize limited resources
 - develop relevant curriculum and learning materials
 - identify and address problems of promoting girls' education
 - create and nourish community-school partnerships
 - realize democracy
 - increase accountability
 - ensure sustainability
 - improve the home environment

2.8 Process Variables

Process variables examine the actual activities that take place in classrooms. They comprise the observable behaviours of both students and teachers. As often assumed, the success of teaching is in the teachers' hands. Therefore, how and why the teachers behave in class matters. Process and product variables concern the actual activities of classroom teaching-what teachers and students do in class.

The methods employed are either teacher-centered or student-centered learning. This refers to all the observable activities that take place between teachers and students in class; how teachers teach, how students respond and so forth.

Fung and Chow's (2002) review on pedagogy and classroom practices revealed that the teacher-centered and student-centered teaching methods are basic to most theoretical and teaching propositions. It is believed that much of the success in teaching in classrooms lies in the teachers'

hands because they are responsible in stimulating students' interest and in gearing the mood and flow of the class.

Behaviour is a response, which an individual shows to his environment at different times. UNESCO (1986), documented that “anything that an organism does that involves action and response to stimulation” is termed as behaviour.

Good classroom management and organization, and a good lesson plan also minimises the likelihood of misbehaviour. Craig and Dickenson (2003), stated that almost all classroom behaviour is learned and that students must clearly understand what is expected of them. The responsibility lies with the teachers to explain how and why they want them to work in that way, and to give positive feedback when students respond positively. In the McBer Report (DFES, 2000), it is stated that students themselves want a teacher to keep discipline in the classroom.

According to Kyriacou (1998), maintaining discipline is necessary for learning to be effective. He also suggested that students' misbehaviour can be minimised by generally skilful teaching. Wong and Wong (2005), differentiate between management and discipline in the classroom. They stated that “effective teachers manage their classrooms with procedures and routines. Ineffective teachers discipline their classrooms with threats and punishments”. They also underlined that discipline has to do with how students behave, and management has to do with procedures on how students have to work in the classroom. Many ineffective teachers use reward stickers, incentive gifts, infractions cards to discipline their classroom with punishments. They only waste time, and do not solve the problem, effective teachers manage the classroom with procedures and routines to maximise and engage learning time.

Misbehaviour such as lack of silence can occur. Some seem to obtain virtual silence all the time. Others obtain almost perfect silence, but students need regular reminders, while others, seldom achieve any silence and students behaviour need regularly keeping in check.

Craig and Dickenson (2003) pointed out that it is unreasonable to expect total silence for extended periods. On the other hand, an effective teacher is aware that some students might prefer to sit quietly and have low active participation in the classroom activities, although they know how to make the students participate.

2.9 Teaching Methodology

Teaching Methodology is the process of teaching and the resultant learning by developing a link between the students and the Agricultural knowledge and skill contents embodied in the school curriculum through effective teaching methods, provide the required environment to the students in learning a particular Agricultural skill or an area of knowledge. Methodology as defined by many Authors is a way of doing something in a systematic, orderly and regular manner.

2.9.1 Definition of Project-Based Learning (PBL)

During the last half century, educators have struggled to find the most effective teaching, learning and assessment strategies for students. Since the process of effective teaching is sensitive to the educational context, the process and the product, these factors must be carefully designed and assessed (Gulbahar & Tinmaz, 2006). Project-Based Learning (PBL) has emerged to become an instructional approach that is gaining a growing interest within the engineering education community (Hadim , & Esche, 2002).

The Buck Institute for Education (2005), therefore defines Project-Based Learning as a systematic teaching methods that engages students in learning essential Agricultural knowledge

and life-enhancing skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and tasks.

Other researchers have defined Project-Based Learning as learning by doing (Thomspson, & Beack, 2007), and as student-driven investigations of complex, real-life questions or problems. Some projects are long-term, investigation spanning the entire school term, others are shorter units. However, all projects require teamwork and collaboration among students and are designed to culminate in a substantive final product (Thomas, 2000).

2.9.2 Historical overview of Project-Based Learning (PBL)

First reference to Project-Based Learning was mentioned in the work of Kilpatrick 1918 who believed that using literacy in meaningful contexts provided a means for building background knowledge and for achieving personal growth. He suggested that projects be interdisciplinary maths, science, social studies to provide learners with a rich array of concepts and ideas. He intended that topics come from students' interests maintaining that group projects, proposed, planned, executed and evaluated by students would help learners to develop an understanding of their lives while preparing to work within a democracy.

Project-Based Learning also reflects a Vygotskian perspective. Vygotsky theorizes that learning occurs through social interaction that encourages individuals to deal with the kind of cognitive challenges that are just slightly above their current levels of ability (Wertsch, 1985). He posits that concepts develop and understanding happens when individuals enter into discussion with more capable peers and teachers. These individuals can model problem-solving, assist in finding solutions, monitor progress and evaluate success (Tharpe, 1988).

2.9.3 Theoretical foundations of Project-Based Learning

Project-Based Learning has a long history. As far back as the early 1900s, John Dewey supported "learning by doing." This sentiment is also reflected in constructivism and constructionism. Constructivism (Perkins, 1991; Piaget, 1969; Vygotsky, 1978) explains that individuals construct Agricultural knowledge through interactions with their environment, and each individual's Agricultural knowledge construction is different. So, through conducting investigations, conversations or activities, an individual is learning by constructing new Agricultural knowledge by building on their current knowledge. Constructionism takes the notion of individuals constructing knowledge one step further.

Constructionism (Harel & Papert, 1996) posits that individuals learn best when they are constructing an artefact that can be shared with others and reflected upon, such as hencoop, flower beds, vegetables in the school garden and other Agricultural products. Another important element to constructionism is that the artefacts must be personally meaningful, where individuals are most likely to become engaged in learning. By focusing on the individual learner, project based learning strives for "considerable individualization of curriculum, instruction and assessment, in other words, the project is "learner centered" (Moursund, 1998).

2.9.4 Importance of Project-Based Learning

Project-Based Learning offers a wide range of benefits to both students and teachers. A growing body of academic research supports the use of Project-Based Learning in school to engage students, cut absenteeism, boost cooperative learning skills, and improve academic performance of students in Agricultural Education (George Lucas Educational Foundation, 2001).

For students, benefits of Project-Based Learning include:

- Increased attendance, growth in self-reliance, and improved attitudes toward learning of Agriculture science (Thomas, 2000)
- Academic gains equal to or better than those generated by other models, with students involved in projects taking greater responsibility for their own learning than during more traditional classroom activities (Boaler, 1997; SRI, 2000)
- Opportunities to develop complex skills, such as higher-order thinking, problem-solving, collaborating, and communicating Agriculture (SRI, 2000)
- Access to a broader range of learning opportunities in the classroom, providing strategy for engaging culturally diverse learners in Agricultural science lessons (Railsback, 2002)

For teachers, additional benefits include enhanced professionalism and collaboration among colleagues, and opportunities to build relationships with students (Thomas, 2000). Additionally, many teachers are pleased to find a model that accommodates diverse learners by introducing a wider range of learning opportunities into the classroom. Teachers find that students who benefit the most from Project-Based Learning tend to be those for whom traditional instructional methods and approaches are not effective for them (SRI, 2000).

Teachers who have used Project-Based instruction in Agricultural science classes report that many students who often struggle in most academic settings find meaning and justification for learning by working on projects (Nadelson, 2000). The teacher also notes that by facilitating learning of content knowledge as well as reasoning and problem-solving abilities, Project-Based instruction can help students prepare for state assessments and meet state standards.

2.9.5 Project-Based Learning implementation challenges

Teachers who bring Project-Based Learning into the classroom may have to adopt new instructional strategies to achieve success. Having the teacher to take the role of a guide or a facilitator is not the way that most educators were taught, nor even the way they were taught to teach. Direct-instruction methods that rely on textbooks, lectures, and traditional assessments do not work well in the more open-ended, interdisciplinary world of Project-Based Learning. Rather, teachers do more coaching and modelling and less "telling." They need to be comfortable with "wrong turns" that students may make en route to completing a project (Intel, 2003). Teachers may find themselves learning alongside with their students as projects unfold.

Specific challenges facing teachers include:

- Recognizing situations that make for good projects
- Structuring problems as learning opportunities
- Collaborating with colleagues to develop interdisciplinary projects
- Managing the learning process
- Integrating technologies where appropriate
- Developing authentic assessments

Indeed, teachers may have to be willing to take risks to overcome initial challenges. A supportive administration can help by implementing more flexible schedules, such as block schedules or team planning time, and providing teachers with professional development opportunities.

2.9.6 Project-Based Learning methods versus Traditional teaching methods

There are distinct differences between Project-Based Learning methods and traditional teaching methods. "Project-Based Learning is a model which is distinguished from traditional teaching since the focus is put on the learner and his project. Learners have the opportunity to work more

autonomously and build their Agricultural knowledge and skills” (Schneider, 2005). A traditional classroom setting is teacher-centered, with lecture and note taking as key components. A Project-Based setting is student-centered with student inquiry and exploration as key elements. In PBL, student’s complete contextualized tasks as opposed to isolated lessons. In this manner, students can see the relevance of the Agricultural task to their everyday lives. “Learning from projects rather than from isolated problems is, in part, so that students can face the task of formulating their own problems, guided on the one hand by the general goals they set, and on the other hand by the ‘interesting’ phenomena and difficulties in Agriculture they discover through their interaction with the environment” (Collins, Brown & Newman, 1989). Unlike traditional teaching methods, projects are designed to “reflect the learning and work people do outside the classroom.” For that reason, students are “assessed in a manner that reflects how quality is judged in the real world” (Evertson 2006).

Project-Based instruction is an engaging way to teach state required standards. The state’s Agricultural content standards are indeed taught, but they are joined with other Agricultural content and skills to make a meaningful, rigorous and interesting learning experience. With traditional teaching methods, it is very difficult to keep students engaged in the learning process. In Project-Based Learning, students can become self-motivated learners through creating products “valuable in their own right” and collaborating with other students (Evertson, 2006). The main difference between Traditional and Project-Based methods is the student’s acquisition of procedural versus conceptual knowledge. Through projects, students can not only learn Agricultural knowledge, skills and concepts, they are also provoked and encouraged to investigate, ask questions and develop new knowledge. It is not that the previous could not happen in a Traditional lecture and note-taking classroom setting, but PBL is designed around

student-centeredness to allow each individual student to draw on previous knowledge, from any level, and develop new knowledge and skills in Agriculture.

2.10 Teaching process

Cameron (2001), has already given the general description about teaching. She emphasizes that teaching is a process to construct opportunities for learning and to help learners take advantages of them. “Teaching can never guarantee learning; all it can do is to construct opportunities for learning and to help learners take the advantages” (Cameron2001). According to that quotation, it can be drawn that in a teaching learning process, the teachers should be able to help the students in constructing understanding towards the lesson to acquire new knowledge and skills in Agriculture education.

2.11 Teacher-Student Interaction and Relationship

Pianta’s (1995) teacher-student relationship theory posits that teachers shape student experiences in school. Beyond the traditional role of teaching academic skills, teachers regulate student activity level, teach communication skills, provide opportunities for students to form peer relations, provide behavioural support, and teach coping skills. Teachers have multiple roles and spend a large amount of time with students. Pianta’s (1995) theory proposes that when teachers have close and positive relationships with students, they are more motivated to spend extra time and energy promoting student success.

But when teachers have conflictual and negative relationships with students, they more frequently attempt to control student behaviour and thus hinder efforts to promote a positive school environment for them (Hamre & Pianta, 2001). Furthermore, Hamre and Pianta (2001), speculated that students react to their relationships with their teachers.

When students perceive that they have close and positive relations with teachers, they are more inclined to trust and like those teachers and thus are more motivated to succeed. In contrast, when students perceive that they have conflictual and negative relationships with teachers, they do not like or trust the teachers, are not motivated to succeed and may be defiant towards the teachers (Hamre & Pianta, 2001).

2.12 Evaluation of Learning Effectiveness

Goal-directed, intentional learning has a component in which students and teachers evaluate achievement of corresponding learning goals. The evaluation of learning is manifold and implies self-evaluation and different kinds of formative and summative assessment (American Association for the Advancement of Science, 2000).

2.13 Product Variables

Product variables focus on the outcomes of teaching, specifically the changes that result in the students. They simply describe the desired outcomes of education. Product variables refer to the educational outcomes identified and desired by teachers, which form the basis of teacher lesson planning. They also refer to the criteria teachers use to assess the effectiveness of a lesson (Kyriacou, 1996). The most important educational outcomes for students as identified by teachers are:

- Increased knowledge and skills in Agriculture
- Increased interest in the subject or topic in Agriculture
- Increased intellectual motivation
- Increased academic self-confidence and self-esteem
- Increased autonomy
- Increased social development.

Many of these outcomes can be measured by tests, but others are often based on subjective forms of assessment, such as the teacher's opinion. Unfortunately such methods can often be problematic and must be treated with caution (Thaine, 2010).

2.13.1 Students' immediate knowledge and skills gained in Agriculture

Certainly the teacher should be concerned with immediate students' growth with respect to learning the Agricultural science subject matter taught and developing positive attitudes toward the subject. Other Agricultural knowledge and skills acquire during the teaching process such budding, grafting, application of fertilizers, rearing of domestic animals and appropriate use of concepts in Agriculture help students to pass their examination in practical and theoretical papers (Cocking, 2000). Especially social skills in working as a team and getting along with other students should be a desired immediate outcome, as well.

2.13.2 Students' long-term effects on Agricultural knowledge and skills gained

However, teachers must also be concerned with long-term effects of education and the development of a person's adult personality, the development of professional competence of Agricultural students, and the attitude that learning continues throughout the lifetime of the person. The long-term outcomes are the ultimate measure of the effectiveness of an educational experience (Dyer & Osborne, 2006).

2.13.3 Application of Agricultural knowledge and skills by student after completion of school

According to Oluwole (2008), education in Productive Agriculture refers to acquisition of skills, attitudes and values that will make the students capable of production of Agricultural produce after school. It should therefore provide Agricultural knowledge and skills that may

be directly or indirectly useful for Agricultural activities while Production Agriculture refers to the act of producing Agricultural produce. It is therefore concerned with the quality and quantity of product.

Procedure utilized is similar to those operative in factories. The particular method for a particular quality or quantity of produce would have been predetermined and all participants would be expected to follow it. In the light of this, the need for students' participation in Agriculture cannot be overemphasized.

Onuekwusi and Okorie (2008) asserted that students with higher levels in Agricultural knowledge and skills can bring the entrepreneurial spirit into Agriculture after school. Entrepreneurship implies risk bearing and a desire, willingness and ability to take necessary measures to improve output and productivity.

The Senior High school Agriculture however, is vocational and is supposed to make school leavers immediately employable, if they are unwilling to go on to the tertiary level. Oluwole (2008) while exploring the dimensions of this policy suggested the integration of “practical” and “production” Agriculture as a sure way to ensure sustainable Agricultural production and national food security.

2.14 Summary

The conceptual framework for this study lies in Dunkin and Biddle's (1974) adaptation of Mitzel's learning process (Mitzel, 1960) consisting of four variables in teaching and learning process such as Presage variables, Context variables, Process variables and Product variables. The concepts and the Educational theories related to the dependent and independent variables were reviewed with their relevance to the study. The theoretical foundations of the study is on constructivism and constructionism theories of John Dewey.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This chapter elaborates on the description and appropriateness of the methodology used in the conduct of this research. According to Polit and Hungler (2004), methodology refers to ways of obtaining, organising and analysing data. Methodology decisions depend on the nature of the research question.

Methodology can be described as the framework associated with a particular set of paradigmatic assumptions that can be used to conduct research (O’Leary, 2004). The methodology employed in this research is social research involving research design, study population, sample size, sampling technique, data collection instruments and procedure, data source and analysis.

3.1 Research Design

In a research, once the objectives of the project have been established, the issue of how these objectives can be met leads to a consideration of which research design will be appropriate. A research design according to Walliman (2006) ‘provides a framework for the collection and analysis of data and subsequently indicates which research methods are appropriate’.

It is the model used by the researcher to discharge the burden of proof to the logical organisation that allows him or her to feel that whatever they have done in their research allows them to reach valid conclusions’ (Miller & Brewer, 2003).

For the purpose of this study, non-experimental descriptive survey was used because non-experimental research involves variables that are not manipulated by the researcher and are studied as they exist.

Also, a descriptive survey was used because it provides an accurate portrayal or account of the characteristics for example behaviour, opinions, abilities, beliefs, and knowledge and skills of both Agricultural students and teachers (Burns & Grove, 2003).

Descriptive research provides information about the population being studied and also attempt to find answers to the questions, “who, when, how, what and where” (McNabb, 2002).

A combination of qualitative and quantitative research methods were also used because they complement each other (Burns & Grove, 2000). The qualitative approach provided detailed descriptions of particular social settings under investigation and also recognised that people construct meaning within a socio-cultural environment in which they live. Therefore, the descriptive survey was used to quantify data.

3.2 Study Population

The population includes all elements that meet certain criteria for inclusion in a study (Burn & Grove, 2003). The population for the study included two sub-populations:

- Agricultural science students in the final year of Agricultural programme in three randomly selected Public Senior High Schools in the Volta Region namely: Ho Mawuli, Ho Mawuko and Peki Senior High/Technical.
- All the Agricultural Science teachers who teach in Ho Mawuli, Ho Mawuko and Peki Senior High/Technical. The final year students of Agricultural programme were used because they had considerable amount of Agricultural knowledge and skills during the period this study was carried out compared with Agricultural science students from the lower forms who had not covered much of the syllabuses in Agricultural science subjects.

Ghana Education Service (2013) Register of Programmes and Courses for Public and Private Senior High Schools, Technical and Vocational Institutes revealed that there are a total of 79 Public Senior High and Technical Schools in the Volta Region out of which 52 offer Agricultural Science Programme.

3.3 Sample Size

The number or the size of the targeted population that is used for a study and analysis is termed as the sample size. According to Fraenkel & Wallen (2006), a sample with the minimum of 100 is essential for descriptive studies.

Borg & Gall, (1989) also suggests that for a survey research there may be at least 100 subjects in each major subgroup whose responses are to be analyzed.

In accordance with this premise, 150 Agricultural science students in the randomly selected Public Senior High Schools in the study area together with their respective Agricultural Science teachers of 12 were selected to constitute the sample size for the study (Refer to Table 3.1).

Table 3.1: Name of School, number of Agricultural Science Students selected in the final year and the number of Agricultural Science Teachers in the various Schools selected.

Name of School	No. of Agricultural Science Students	No. of Agricultural Science Teachers
Ho Mawuko School	70	6
Ho Mawuli School	50	3
Peki Senior High/Tech.	30	3
Total	150	12

Source: Survey Data, 2013

3.4 Sampling Method

According to O'Leary (2004), sampling is a process that is always strategic and sometimes mathematical, which will involve using the most practical procedures possible for gathering a sample that best 'represents' a larger population. A sample represents the population and is more manageable to work with than the whole population or pool of cases (Neuman, 2006).

The study used multi-stage sampling technique to select the appropriate respondents for data collection. The purposive sampling and stratified random sampling were employed in the study.

3.4.1 Purposive sampling

When purposive sampling is used, the researcher has a specific purpose and often a specific predefined group in mind (Trochim, 2006). The researcher also often uses his or her knowledge or expertise about the group to select subjects to represent the population (Berg, 1998).

Kumar (2005), states that purposive sampling is extremely useful when constructing a historical reality, describing a phenomenon or developing something about which only a little is known.

Purposive sampling was the obvious choice for this study, as the aim of the Thesis was to identify a particular pre-determined type of Agricultural science students only who were in their final year of study and their Agricultural science teacher for in-depth investigation but not all Agricultural science students in the study area.

3.4.2 Stratified random sampling

Stratified random sampling is the one in which the population is divided into subgroups or strata and a random sample is then selected from each subgroup (Fink, 1995). When a few

characteristics are known about a population, stratified random sampling is preferable because the population may be arranged in subgroups (Fowler & Floyd, 1993).

The 52 Public Senior High schools offering Agricultural Science Programme were purposively sampled from 79 Public Senior High Schools in the Volta Region for the study (GES, 2013). One Public Senior High School was randomly selected from each category (stratum) thus Grades A, B and C making a total of three Public Senior High Schools selected for the study. The selected schools were:

- Ho Mawuli ----- Grade A
- Ho Mawuko ----- Grade B
- Pestech ----- Grade C

The random selection was done to give equal representation to all the categories (strata) of the Schools in order to make the findings to have scientific outlook. Proportionate stratification was used again to select the required sample from each stratum. 70% from each stratum or category of the schools selected were sampled. For example, out of one hundred students (100) in Ho Mawuli School offering Agriculture in the final year, seventy students(70) were sampled, out of seventy-two students(72) in Ho Mawuko offering Agriculture in the final year, fifty(50) students were sampled and out of forty-three students(43) in Pestech offering Agriculture in the final year, thirty (30) students were sampled making a grand total sample for the study as one hundred and fifty(150) students.

All the final year Agricultural Science Students were purposively selected leaving SHS1 and SHS2 Students offering Agricultural Science programme. The final years Students who were purposively selected from the Schools were taken as the target population because it was

expected that these Students covered sufficient amount of the syllabus as well as wide range of practical lessons.

All the Agricultural Science teachers in the selected schools were included in the study since the number of Agricultural Science teachers was small to select from them for the study.

3.5 Instruments Used in Data Collection

The instruments that are employed to collect new facts or to explore new fields are called tools. It is of vital importance to select suitable instruments and tools. Different tools are used to collect different types of data.

The use of a particular research tool depends upon the type of research being conducted. The researcher may use one or more of the tools in combination for the purpose for which the study is conducted. Such tools or methods of data collection include tests, interviews, questionnaire, observation (Amin Marwat, 2010).

Both interview (qualitative data) (refer to Appendices F&G) and structured questionnaire (quantitative data) (refer to Appendices A&B) were used to collect both qualitative and quantitative data from respondents respectively.

3.5.1 Interview sessions

Qualitative interviewing is one of the most common and powerful ways in which the “hows” and “whats” of people and their lives can be studied (Fontana & Frey, 2005). It also manifests specific characteristics that make it an extremely versatile approach for doing research (Berg, 1998).

Based on the reasons given for using interview, the researcher acquired a small-size four-battery tape recorder. Recording was used because the researcher wanted to listen and at the same time

follow the flow of the discussion session with very little note-taking. Also the researcher could play back the recorded tape several times to familiarize with the content of the conversation before transcribing for data analysis. Some portion of the recorded tape was played back for listening of the interviewees to assure them that the real recording was done. Interviewees were however, made to understand that their identities would be confidential as much as possible. In all, both Agricultural science teachers and students were interviewed on two different set of interview questions for each category of respondents from the selected schools (refer to Appendices F&G).

3.5.2 Questionnaire administration

A questionnaire can be defined as a list of carefully structured questions, chosen after testing, with the view of eliciting reliable responses from a chosen sample. The aim of a questionnaire is to find out what a selected group of participants do, think or feel (Meyer *et al.*, 2004).

The entire questionnaires were personally administered by the researcher. For the teachers, the researcher explained the purpose of the study to them and then, the respondent-self completion method was adopted.

In the case of the students, the researcher explained the purpose of the study after which students were taken through the questionnaire by reading the questions one by one and allowing them to ask questions for clarification on any questions which was not clear to them. At the same time, allowing them to answer the questions. It took one hour thirty minutes to administer the two set of the questionnaires.

3.6 Data Collection Techniques

Data collection techniques describe how data is collected, methods used to get to the sample of respondents to be used for research and the way information is obtained from chosen respondents, analyzed and interpreted to arrive at conclusions that may be the foundation or backbone of the research (Gillham, 2000).

The data were collected personally from the respondents, one hour-thirty minutes after administration of questionnaire (refer to Appendices A&B) to qualified respondents. Two sets of questionnaires were designed, one for Agricultural science students (refer to Appendix A) and another one for their teachers (refer to Appendix B) because the nature of the objectives of the study demanded both the Agricultural science students and Agricultural science teachers to answer separate questionnaires for effective data collection to be achieved.

Also, two set of interview questions were used to collect qualitative data on Agricultural science teachers and students (refer to Appendices F&G).

3.7 Data Sources

All researchers require both secondary and primary data. Primary data 'entails going out and collecting information by observing, recording and measuring the activities and ideas of real people, or perhaps watching animals, or inspecting objects and experiencing events. This process of collecting primary data is often called survey research' (Walliman, 2006).

The primary data is made of both quantitative and qualitative data in every research work. For this study, the primary data was gathered from both Agricultural science teachers and their students in the form of two sets of questionnaires (refer to Appendices A&B). One set for Agricultural science teachers (refer to Appendix B) and another set for Agricultural science students (refer to Appendix A) in the final year in Senior High Schools in the Volta Region to

address the objectives set for the study. Open ended and closed ended questions were framed for the respondents to respond to them.

Secondary data were also gathered from research findings from journals, magazines, relevant textbooks and internet which helped intensively in the development of the literature review of this study.

3.8 Method of Data Analysis

Data analysis is a mechanism for reducing and organising data to produce findings that require interpretation by the researcher (Burns & Grove, 2003). According to De Vos (2002), data analysis is challenging and creative process characterised by an intimate relationship of the researcher with the participants and data generated.

Before starting data analysis, data needs to be organized which involves coding, editing and scrutiny. After the return of all administered questionnaires, each questionnaire was given code numbers. Data collected through research instruments, was analysed by using the analytical procedures which included descriptive statistics such as frequencies, percentage, cross tabulation and the use of SPSS (Statistical Package for Social Sciences, version 18). Also, Pearson's correlation coefficient was used to test for relationship between independent variables (teaching methodologies) and dependent variables (Agricultural knowledge and skills). Pearson's correlation coefficient (non-parametric) assesses the linear association between two variables.

Again, Kendall's coefficient of concordance (W) was used to measure the agreement among teachers who assessed a given set of constraints in the teaching using Project-Based Learning in Senior High Schools. Kendall's (W) ranges from 0(no agreement) to 1(complement agreement).

3.9 Validity and Reliability of Instruments

For the purpose of making questionnaires valid and reliable, the questionnaires were pilot tested. The pilot study was conducted in two schools in the Eastern Region that are not included in the sample study area. Ten Agricultural science teachers and thirty Agricultural science students participated in this pilot study. Some items regarding the factual information were excluded. Similarly, a few items were found irrelevant hence deleted.

3.10 Research Constraints

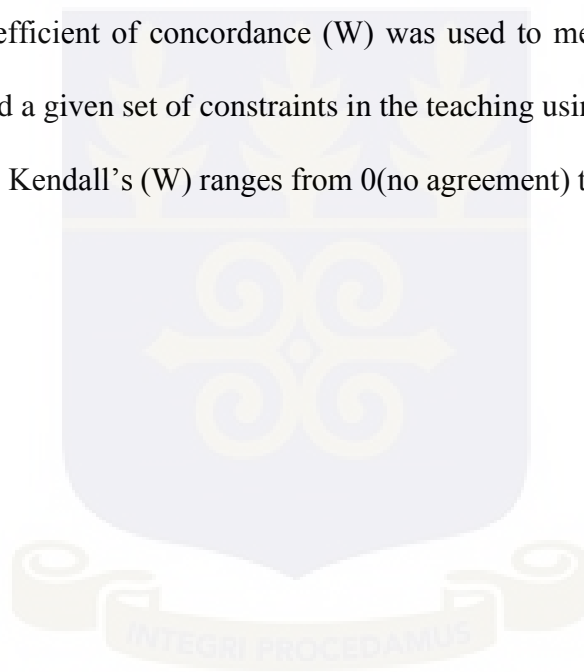
The constraints of time and financial resources and data collection problems such as visiting the selected schools, internet café for browsing, typing and printing, making telephone calls and administering of questionnaires reduced the scope of the study to only Agricultural science teachers and students in the selected Public Senior High Schools namely Ho Mawuli, Ho Mawuko Girls and Peki Senior High/Technical all of the Volta Region of Ghana.

In this research, some respondents collected the questionnaires but explained that they might not have time to answer it immediately. This delayed the process of meeting the time set for this aspect of the study work. Some Agricultural science teachers also collected the questionnaire and refused to answer with a simple reason that there was no attachment of financial reward. This condition was later satisfied before the job was done.

Since the study was confined to only Agricultural science teachers and their students in some selected Senior High Schools in the Volta Region, the findings and conclusions may not be applicable to the other Agricultural science teachers and students from other regions.

3.11 Summary

Non-experimental descriptive survey was used with a combination of qualitative and quantitative research methods. Data were collected from three randomly selected schools in the Volta Region. In all, 150 Agricultural science students and 12 Agricultural Science teachers were selected for the study. The instruments for data collection were interview and structured questionnaire. Data were analysed by using descriptive statistics, the statistical Package for Social Sciences, version 18) and Pearson's correlation coefficient was used to test for relationship between independent variables (teaching methodologies) and dependent variables (Agricultural knowledge and skills). Again, Kendall's coefficient of concordance (W) was used to measure the agreement among teachers who assessed a given set of constraints in the teaching using Project-Based Learning in Senior High Schools. Kendall's (W) ranges from 0(no agreement) to 1(complement agreement).



CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.0 Introduction

This chapter discusses the findings from 150 questionnaires completed by Agricultural science students from three selected Public Senior High Schools in the Volta Region. In addition, 12 set of questionnaires were distributed among the Agricultural science teachers in these selected schools to complete them.

4.1 Agricultural Science Students' Demographic Characteristics

The demographic characteristics of respondents on which data were collected included age, school attended and time spent on studying Agricultural science subjects.

4.1.1 Age distribution versus type of schools attended

The study obtained responses from respondents in the three selected Public schools on the grade of school attended and their age categories. Table 4.1 represents statistics on the findings of the respondents.

Table 4.1: Cross tabulation between age category of student and school attended

		School attended			Total
		Ho Mawuli Grade A	Ho Mawuko Grade B	Pestech Grade C	
Age Category of Student	16-18	25	17	4	46
	19-21	43	33	25	101
	22-24	2	0	1	3
Total		70	50	30	150

Source: Survey Data, 2013

According to Table 4.1, majority of the respondents 101 out of 150 across the three schools were between the ages of 19-21 years indicating a middle age group, and again 46 of the respondents

were between the ages of 16-18 years considered as young age group while 3 of the respondents were between the ages 22-24 years across the schools were found to be old. This finding revealed that most schools had mixed-age students and students in each of the classes were not necessarily operating at the same academic levels due to differences in ages. Meanwhile, young respondents of 25 were found in Ho Mawuli, 17 of them were also found in Ho Mawuko while Pestech recorded 4 respondents as being young. In another instance, 70 of the respondents attended Ho Mawuli which is a Grade A school, 50 of the respondents also attended Ho Mawuko which is a Grade B school and finally, 30 of the respondents attended Pestech which is Grade C school respectively. Looking at the enrolment figures from the three schools, it could be deduced that students get attracted to Grade A schools than Grade B and C schools because of availability of adequate school facilities, teaching and learning materials and highly motivated teachers. This supports Abraham (2003), assertion that quality of education that our children get bears direct relevance to the availability or the lack of physical facilities and overall atmosphere where the learning takes place. Abraham (2003), again said that “the type of atmosphere required for effective learning is that consisting of better school buildings, more and better teaching facilities”.

4.1.2 Time spent in learning by Agricultural science students

To ascertain the number of hours respondents spend on learning Agricultural science notes in a day, the following responses were obtained from respondents in relation to school attended as represented in Table 4.2

Table 4.2: Cross tabulation between time spent on learning Agricultural science note

by students and school attended

		Time spent on learning Agric. note in a day				Total
		1hour	2hours	3hours	4hours	
School attended	Ho Mawuli Grade A	30	25	10	5	70
	Ho Mawuko Grade B	20	23	7	0	50
	Pestech Grade C	9	15	5	1	30
Total		59	63	22	6	150

Source: Survey Data, 2013

According to Table 4.2, 122 respondents out of 150 use 1-2 hours to study Agricultural science notes while 28 of them use 3-4 hours to study the same notes. The implication is that the longer a particular subject is studied the higher the rate of learning outcomes leading to relatively permanent change in behaviour in learners. Higher-achievers are likely to be found in Grade “A” schools as in the case of Ho Mawuli with 15 respondents studying between 3-4 hours but only 7 respondents were located in Ho Mawuko whereas 6 of them were identified in Pestech. This supports the argument made by Cowley et al., (2002) that students may benefit from understanding their own learning style by taking measures to adjust the way they acquire knowledge and skills in Agriculture education. Low-achiever Agricultural science students often have difficulties in focussing attention on learning and easily lose their interest but High-achiever students get motivated to learn for several hours because they have self-efficacy for learning. Pajares (2002) was in support of the statement that self-efficacy can influence achievement and attitudes of students in an educational setting.

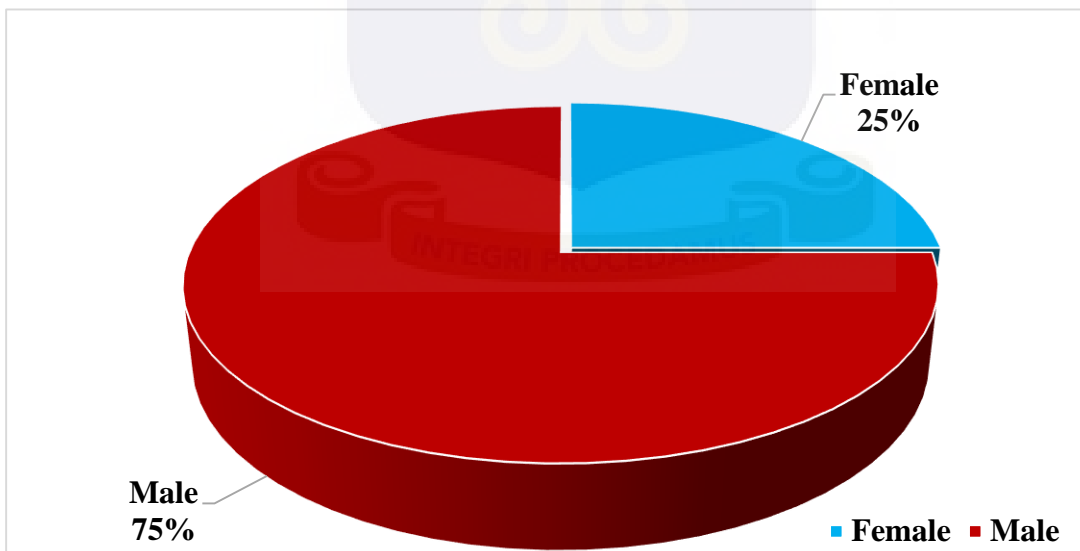
4.2 Agricultural Science Teachers' Demographic Characteristics

The teacher is the pivot of classroom instructional activity. As Windham (1988) succinctly put it, the characteristics of teachers are an indicator of teaching quality and educational effectiveness. This section, therefore, seeks to describe the characteristics of teachers that affect classroom teaching. The figures 4.1, 4.2, Tables 4.3 and 4.4 give statistical data about the respondents who are Agricultural science teachers in the three selected Senior High School in the Volta Region in the study area. Total of 12 teachers were administered with a set of questionnaires for appropriate responses to be solicited.

4.2.1 Distribution of teachers by sex

The sex of Agricultural science teachers were solicited to find the sex ratio. Figure 4.1 displays the visual picture of sex of respondents.

Figure 4.1: Distribution of Agricultural science teachers by Sex



Source: Survey Data, 2013

Figure 4.1 depicts a visual picture of sex of respondents. Data collected established that majority of the respondents 75% were male Agricultural science teachers while 25% of the respondents

were female Agricultural science teachers. This shows that teachers in the selected schools who teach Agricultural science subjects are male dominated.

4.2.2 Age of teachers

The ages of the respondents were determined by finding out whether the respondents were young or old since age has direct link with Agricultural science teacher output level. Figure 4.2 provides the summary of the ages of the Agricultural science teachers in the selected Public Senior High Schools.

On age distribution of respondents, it was found out from Figure 4.2 that majority of respondents were between 30-39 years representing 66.7% out of 12 respondents. Also, those in this age bracket were less experienced and more expectant with more needs such as family, marriage and other social responsibilities to satisfy but with their youthful exuberance, they are likely to carry out a lot of project works with students and also motivate them to learn harder considering the narrow gap nature of the ages of this category of teachers and students alike to enable them acquire more Agricultural knowledge and skills.

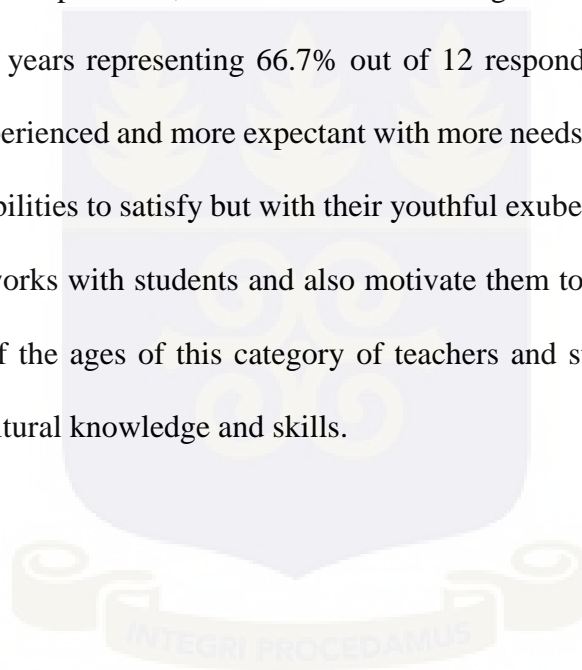
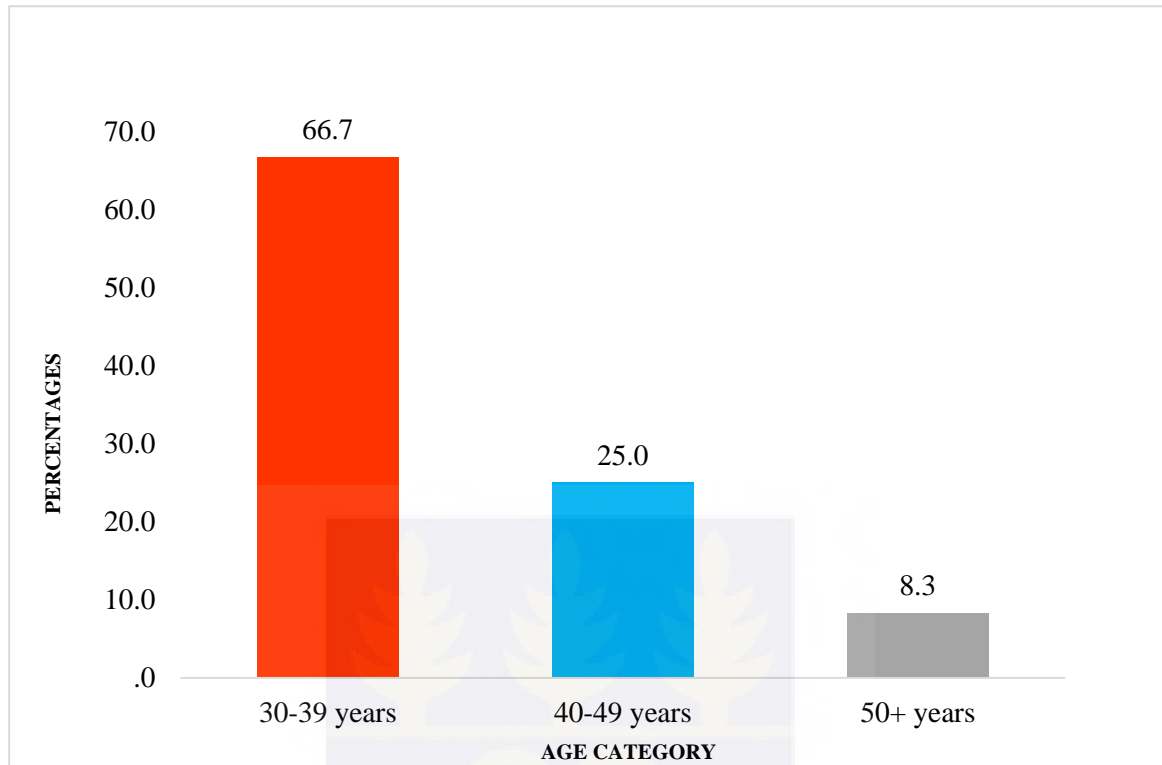


Figure 4.2: Distribution of Agricultural science teachers by age category



Source: Survey Data, 2013

On the other hand, 3 of the respondents were between 40-49 years of age representing 25% while only 8.3% of the respondent was 50 years and above. The implication of this age structural phenomenon is that the Ghana Education Service has both young and old with the youth in majority of 66.7% and the old were in the age bracket between 40-59 years representing 33.3%. Therefore, the average age of the teachers was 38.6 years indicating fairly younger teachers with considerable amount of energy, high emotional maturity and experience to carry out project work with students. The blending of youthful teachers with old teachers of great expertise can go a long way to boost Agriculture Education.

4.2.3 Academic qualification of Agricultural science teachers

With reference to both academic and professional qualifications of respondents, following academic and professional qualifications were obtained by respondents as a prerequisite for

teaching in Senior High Schools in the country. Table 4.3 provides the detailed summary of the findings.

Results in Table 4.3 show that a significant number of respondents had Bachelors of Science degree in Agriculture 66.67%, 16.67% had Bachelor of Science degree in Agriculture (non-professional) while 16.67% were holders of Bachelor of Science degree in Agriculture and none was an HND holder in Agricultural Engineering or Diploma in Agriculture. The reason for this is not far-fetched because in Ghana these days it is very difficult to get appointment in Senior High Schools without having at least a first degree.

Table 4.3: Agricultural science teachers' academic qualification and its impact on the level of knowledge and skills gained by students.

Qualifications	Frequency	Percent
BEd. Agric	8	66.67
BSc. Agric (non-professional)	2	16.67
BSc. Agric(professional)	2	16.67
Total	12	100.0

Source: Survey Data, 2013

It could be deduced from Table 4.3 that majority of respondents 83.3% were made up of Bachelor in Agriculture Education (BEd) teachers and Bachelor of Science in Agriculture teachers while Non-professional Bachelor of Science Agricultural teachers formed the minority of 17% indicating that majority of Agricultural Science teachers had requisite academic and professional competence to effectively handle the various subjects in Agricultural science programme to promote adequate acquisition and application of Agricultural knowledge and skills among students.

This could be explained by research in recent years which has given strong evidence that the best way to improve academic achievements of students is having an effective Agriculture teacher in every classroom and an effective Agriculture Administrator in every school (Leithwood et al., 2004).

4.2.4 Teaching experience of Agricultural science teachers

The respondents were asked to state the number of years they have been teaching Agricultural science subjects after training. The Table 4.4 indicates the number of years the respondents have been teaching in Senior High Schools.

Table 4.4: Agricultural science teachers teaching experience (years) and its impact on the level of knowledge and skills gained by students.

Years	Frequency	Percent
0-2 years	4	33.33
3-5 years	4	33.33
6-8 years	3	25.0
9 years +	1	8.33
Total	12	100.0

Source: Survey Data, 2013

Teacher experience is the number of years a teacher has taught. The education of a teacher is based firmly on a foundation of general education including mastery of subject matter and insight in the inter-relation and professional preparation. General education contributes to growth as a person, specialization provides scholarly knowledge of the subjects to be taught and integrated with professional Education leading to new understandings and skills for professional

performance (Nayak & Rao, 2002). Competent teachers apply broad, deep and integrated sets of knowledge and skills as they plan for, implement, and revise instruction.

Observations from Table 4.4 revealed that between 0-2 years and 3-5 years, respondents from each of the categories were 4 representing 33.33% respectively. The respondents could be considered as less experienced teachers because length of time they served in the service was relatively short with more than half of them having percentage value of 66.66%. This could affect teaching and learning of Agricultural science initially but could improve with time.

On the other hand, respondents who served 6-8 years and (9and above) years could be considered as well experienced teachers with many years of teaching Agricultural science subjects. The percentage values for these two categories were 25% and 8% respectively. When the percentages were summed up, 33.33% was recorded for more experienced teachers. This clearly shows that experienced teachers compared with less experienced teachers 67% are thought to be in short supply which could be attributed to high attrition rate among experienced teachers as a result of low remuneration and lack of motivation. Meanwhile, teaching experience mean of the respondents was 4.25 years indicating less teaching experiences on the part of the Agricultural science teachers in the selected schools.

This finding supports Olulobe (2004), who indicated that increased motivation of Agricultural science teachers' leads to increase in productivity that gives boost to the educational systems, hence the function of education motivational methods cannot be underemphasised. Again, motivation is significant contributor in teachers' performance in delivering of students as global citizens and master of their specialised field of endeavour.

4.3 The impact of Agricultural Science Teachers' teaching values on acquisition of Agricultural knowledge and skills

The following were the teaching values the Agricultural Science teachers indicated to have possessed in the teaching of Agricultural Science to promote knowledge and skills in Agriculture:

- Innovativeness in teaching of Agricultural Science at the Pre-university level.
- Ability to tolerate colleague teachers and Agricultural Science students.
- Hard work.
- Seeking the welfare of both students and teachers.
- Volunteerism at workplace.
- Interacting with students on equal basis
- Creating room for students to ask and answer questions in class.
- Involving students in teaching and learning processes.
- Rewarding students in class to encourage positive reinforcement and punishing students in class to discard bad behaviours.
- Self-motivation.
- Punctuality to school and at class.

4.4 Motivation of the Teacher

Agricultural science teachers in secondary school, like employees of any other levels of education, need to be motivated in order to meet individual needs and also achieve the organizational goals of improving the quality of education in the nation. To improve performance of teachers, motivation is necessary.

Over the years teachers in Ghana (including agricultural science teachers) and their unions have complained and embarked on various strike actions to demand improvement in salary and other work conditions (Osei, 2005). These strike actions normally affect the students and consequently the future leaders and frontiers of Agriculture and national development. Identifying factors that affect teacher motivation could serve as a guide for policy formulation that would help improve teachers' motivation and performance.

The survey requested respondents to indicate the extent of their agreement on whether the following financial and non-financial packages motivate them in teaching of Agricultural science subjects in Senior High Schools in the country. The Table 4.5 indicates whether or not respondents are motivated by motivational packages in teaching process.

Table 4.5: Motivational packages for effective and efficient teaching of Agricultural science subjects

Financial/Non-financial Motivational Packages	Distribution of Responses				Total	
	Agree		Disagree		Freq	%
	Freq	%	Freq	%		
Availability of Agricultural Science Tools	9	75.00	3	25.00	12	100
Availability of teaching and learning materials	11	91.67	1	8.33	12	100
Adequate Agricultural Science Syllabai	7	58.33	5	41.67	12	100
Availability of Agricultural Science textbooks	7	58.33	5	41.67	12	100
Enhanced monthly salary	6	50.00	6	50.00	12	100
Periodic In-Service Training/Refresher courses	7	58.33	5	41.67	12	100
Availability of school farm and garden	8	66.67	4	33.33	12	100
Embarking on fieldtrip using school bus	7	58.33	5	41.67	12	100
Availability of Animal farm	7	58.33	5	41.67	12	100

Source: Survey Data, 2013

The following results were obtained in Table 4.5. It is worth noted that majority of the teachers surveyed agreed that the above mentioned Packages motivate them in teaching process. The extent of agreement ranges from 50% to 92% with the “Enhanced monthly salary” being the lowest and the “Availability of teaching and learning materials” as the highest among the motivational packages that motivate Agricultural teachers to give off their best. This means that if respondents were provided with above mentioned packages in sufficient amount in each school, job satisfaction and motivational level for the teachers would be very high.

In order of preference, the above motioned motivational packages could be provided for teachers first by:

- Provision of teaching and learning materials = 92%
- Provision of Agricultural Science Tools = 75%
- Provision of school farm and garden = 67%
- Provision of Agricultural Science textbooks, Provision Adequate Agricultural Science Syllabai , Periodic In-Service Training/Refresher courses , Embarking on fieldtrip using school bus , Provision of Animal farm are in the same percentage bracket of = 58%.

Lastly, on the Enhanced monthly salary, exactly half of the teachers 50% indicated that it motivated them to deliver their professional duties to the latter while the remaining 50% also disagreed. The implication of this finding is that extrinsic factors only do not motivate employees to work but also intrinsic factors such as achievement, recognition, work itself, responsibility and advancement can produce job satisfaction in participants with the motivation to work (Herzberg, 1966).

However, a small number of the teachers 36.1% indicated that the factors did not motivate them. It is important to recognize this so that the Government and G.E.S. can put some measures in place to motivate these categories of teachers to give off their best.

4.5 Students' Perception of the Impact of Teaching Methodologies on Acquisition of Agricultural Knowledge and Skills

Although there is no single teaching method that is best suited for teaching all subjects, a combination of methods based on the objectives of teaching are recommended to ensure learning by students. The objective of this study was to identify the frequency of use of teaching methods by teachers and their relative impact on the acquisition of Agricultural knowledge and skills by students. The methods employed are either Traditional teaching methods or Project-Based Learning methods. This refers to all the observable activities that take place between teachers and students in class; how teachers teach, how students respond and so forth.

Table 4.6 shows correlation between various teaching strategies or methodologies available to teachers and perceived Agricultural knowledge and skills gained by students in Senior High Schools in the Volta Region. The relationship between the frequency of use of the various methods used by teachers to teach Agricultural Science topics and the perceived Agricultural knowledge and skills gained by students were the variables investigated.

With regards to teaching methods, 13 items of teaching methods were provided for students to indicate the frequency of use of the methodologies with fair representations of both Traditional teaching methods and Project-Based learning methods but they were not in any particular order. The teaching methods items include Lecture method, Group discussion, Writing notes on the chalkboard, Questions and answers, Demonstration, Use of posters and charts and Reading of Agricultural textbooks in class are for Traditional teaching methods and Project-Based learning

methods also include Project works, Visit to nearby farms, Exhibition, Role play, Supervised practical at school farms and gardens and Problem solving/ discovery methods.

After completion of the questionnaires by respondents, both Project-Based learning methods and Traditional teaching methods were sorted out for the purposes of analysis. The response rating with regards to methodologies of teaching included: 1=Always, 2=Often, 3= Sometimes, 4=Rarely, 5=Never. Therefore the highest a respondent could score on the 13 items for “Always” on the scale should be “13” and the lowest score was “65” for “Never”. These scores were summed for each case. The mean score was found to be 32.5. Based on this mean score, scores equal to 32.5 and below were recorded as high while scores above 32.5 were recorded as low.

The Agricultural knowledge that respondents perceived to have acquired during teaching and learning process using the various teaching methods were also scored on a five-point Likert type scale for 15 cases where 5=Very high, 4=High, 3=Average, 2=Low, 1=Very low. The highest score for 15 cases was “75” (15x5) while the lowest score was “15” (that is 15x1). The range “46-75” on the scale was recorded as 1=High Agricultural knowledge gained while the range “15-45” was also recorded as 2= Low Agricultural knowledge gained among students. The data on the responses were subjected to statistical analysis using Pearson correlation. The Analysis of the data collected is displayed in Table 4.6

Table 4.6: Correlation between frequency of use of teaching methodologies and perceived Agricultural knowledge gained by students in Senior High schools.

		Knowledge in crop production	Knowledge in livestock production	Knowledge in farm management
Traditional teaching methods	Pearson correlation	0.284**	0.219*	0.163*
	Sig. (2-tailed)	0.000	0.666	0.026
	N	150	150	150
Project based learning methods	Pearson correlation	0.334**	0.245*	0.215*
	Sig. (2-tailed)	0.000	0.000	0.005
	N	150	150	150

Source: Survey Data, 2013

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed).

A cursory look at Table 4.6, has shown that both Traditional teaching methods and Project-Based learning methods were found to have positive correlation and significant relationships with the following dependent variables such as knowledge in crop production, knowledge in livestock production and knowledge in farm management perceived to be acquired by Senior High students at 0.01 and 0.05 alpha levels.

Both Traditional teaching methods and Project-based learning methods indicated positive correlation and significant relationships with crop production related knowledge ($r=0.284 \cdot p<0.01$) and ($r=0.334 \cdot p<0.01$) respectively at the 0.01 levels perceived to be acquired by students during instructions. It could be deduced from the analysis that even though both methods were significant at the 0.01, Project-based learning methods had stronger relationship with crop related knowledge than Traditional teaching methods hence Project-based learning

methods are the better option to be used to teach Agricultural science subjects in Senior High schools in Ghana that would result in acquisition of more Agricultural knowledge the with the compliment of Traditional teaching methods.

Again, both Traditional teaching methods and Project-based learning methods had positive correlation with knowledge in livestock production ($r=0.219 \cdot p<0.05$) and ($r=0.245 \cdot p<0.05$) respectively and again, both had positive correlation with knowledge in farm management ($r=0.163 \cdot p<0.05$) and ($r=0.215 \cdot p<0.05$) respectively and all the 0.05 significant levels. In all cases, Project-based learning methods had stronger relationships with knowledge in livestock production and knowledge in farm management than Traditional teaching methods respectively. Therefore, Project-based learning methods is highly recommended to be used to teach Agricultural science subjects that would result in acquisition of more Agricultural knowledge. Meanwhile, crop production related knowledge gained by students in Senior High schools are:

- Methods of planting crops
- Different forms of land preparation
- Methods of controlling weeds
- Measurement of herbicides for use
- Harvesting techniques
- Vegetable production
- Methods of controlling pests in farms

Livestock production related knowledge gained by students in Senior High schools are:

- Types of castration in ruminants
- Animal nutrition
- Farm sanitation

- Animal breeding
- Animal health
- Prevention of animal diseases

Farm management related knowledge skills gained by students in Senior High schools are:

- Farm management/ Farm Accounting
- Report writing format

In relation to teaching methods, 13 items of teaching methods were provided for students to indicate the frequency of use of the methodologies with fair representations of both Traditional teaching methods and Project-Based learning methods but they were not in any particular order. The teaching methods items include Lecture method, Group discussion, Writing notes on the chalkboard, Questions and answers, Demonstration, Use of posters and charts and Reading of Agricultural textbooks in class are for Traditional teaching methods and Project-Based learning methods also include Project works, Visit to nearby farms, Exhibition, Role play, Supervised practical at school farms and gardens and Problem solving/ discovery methods.

After completion of the questionnaires by respondents, both Project-Based learning methods and Traditional teaching methods were sorted out for the purposes of analysis. The response rating with regards to methodologies of teaching included: 1=Always, 2=Often, 3= Sometimes, 4=Rarely, 5=Never. Therefore the highest a respondent could score on the 13 items for “Always” the on the scale should be “13” and the lowest score was “65” for “Never”. These scores were summed for each case. The mean score was found to be 32.5. Based on this mean score, scores equal to 32.5 and below were recorded as high while scores above 32.5 were recorded as low. The Agricultural skills that respondents perceived to have acquired during teaching and learning process using the various teaching methods were also scored on a five-point Likert type scale for

15 cases where 5=Very high, 4=High, 3=Average, 2=Low, 1=Very low. The highest score for 15 cases was “75” (15x5) while the lowest score was “15” (that is 15x1). The range “46-75” on the scale was recorded as 1=High Agricultural skills gained while the range “15-45” was also recorded as 2= Low Agricultural skills gained among students. The data on the responses were subjected to statistical analysis using Pearson correlation. The Analysis of the data collected is displayed in Table 4.7

Table 4.7: Correlation between frequency of use of teaching methodologies and perceived Agricultural skills gained by students.

		Skills in Crop Production	Skills in Livestock Production	Skills in Farm management
Traditional teaching methods	Pearson Correlation	0.286**	-0.011	0.174*
	Sig. (2-tailed)	0.000	0.896	0.033
	N	150	150	150
Project-Based Learning methods	Pearson Correlation	0.332**	0.015	0.204*
	Sig. (2-tailed)	0.000	0.857	0.012
	N	150	150	150

Source: Survey Data, 2013

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed).

As shown in Table 4.7, positive correlation and significant relationships were found between Traditional teaching methods such as lecture, question and answer technique, use of poster and charts, etc with the following variables :Crop production related skills students perceived to have been acquired during instructions ($r=0.286, p<0.01$) and Farm management related skills ($r=0.174, p<0.05$). This means that both crop production and farm management, Agricultural skills acquired by students correlated with Traditional teaching methods and were significant at 0.01 and 0.05 alpha levels respectively.

Meanwhile, Project-Based Learning methods such as Project-work, Problem solving method, Exhibition, Discovery method etc also indicated positive correlation and significant relationships with Crop production ($r=0.332$, $p<0.01$) and Farm management ($r=0.204$, $P<0.05$) significant at 0.01 and 0.05 alpha levels respectively. The interpretation of the findings are that even though both Traditional teaching methods and Project-Based Learning methods had positive relationships with crop production and farm management related skills, Traditional methods had a weak relationships with crop production and farm management related skills while Project-Based Learning methods had slightly stronger relationships with crop production and farm management related skills. In terms of significant levels, Project-Based learning methods had better ($p\text{-value}=0.012$) with farm management than Traditional teaching methods of ($p\text{-value}=0.033$) indicating that Project-Based learning methods are a better option that could be used to teach farm management skills.

The implication of the positive relationships between Project-based learning methods in both Crop production and Farm Management is that the more teachers focus on the use of Project-based learning methods, the likelihood is that students will acquire more skills in Crop production and Farm management.

While not significant at 0.05 level by both Traditional teaching methods and Project-Based Learning methods with Livestock production related skills, the Traditional teaching methods had negative correlation with livestock production related Agricultural skills at ($r= -0.011$, $p >0.05$) but Project-Based learning methods indicated positive correlation with livestock production skills at ($r=0.015$, $p > 0.05$) even though the relationship was weak.

The negative relationship between Traditional teaching methods with livestock production related skills acquisition suggested that Traditional teaching methods used in teaching livestock production do not necessarily result in any significant increase in Agricultural skills acquired by

students. This result agrees with the finding of Schneider (2005), which indicated that learners have the opportunity to work more autonomously and build their own skills and that a traditional classroom setting which is teacher-centered, with lecture and note taking as key components is not able to achieve but project-based setting is student-centered with student inquiry and exploration as key elements.

Also, substantial research has validated the important role prior skill plays in student's academic success is the ability of the formative experience or prior Agricultural skills to connect new material into existing skills, construct new understandings, and revise current beliefs or theories as needed (Dolezal, 2003). Students who lack prior Agricultural skills or are not able to achieve what they know often struggle to progress in a particular subject area (Educational Research Service, 2006). It could be concluded that there is significant evidence to reject null hypothesis. That is, the students in the Project-Based Learning class outperform their peers who had traditional instruction. The use of project-based instruction in teaching Agricultural science subjects leads to higher student achievement than Traditional methods. Meanwhile, crop production related skills gained by students in Senior High schools are:

- Use of herbicide
- Nursery practices
- Row planting
- Land preparation
- Pesticide use
- Handling of knapsack sprayer
- Harvesting of crops

Livestock production related skills gained by students in Senior High schools are:

- Treatment of animal diseases
- Detecting sick animals and culling them
- Farm sanitation
- Breeding of ruminants
- Feeding of livestock
- Castration of ruminants

Farm management related skills gained by students in Senior High schools are:

- Farm record keeping
- Report writing

4.6 The Impact of Teacher-Student Interaction and Behaviour Settings in Teaching and Learning Process

Positive student-teacher relationships are characterized by open communication, as well as emotional and academic support that exist between students and teachers. Student-teacher relationships become particularly important during early adolescence, as students move from the supportive environment of Junior High School to the more disjointed atmosphere of a Senior High School. Table 4.7 presents the perceptions students hold about Teacher-Student interactions and the behaviour setting in teaching and learning process.

Table 4.8: The perception students hold about student-teacher interaction and behaviour setting

Statement(s)	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Total %
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	
Agricultural Science teachers help explain difficult concepts when I approach them	74	49.3	54	36.0	17	11.3	3	2	2	1.3	100
Agricultural Science teachers treat students fairly	29	19.3	50	33.3	33	22	22	14.6	16	10.6	100
Agricultural Science teachers are not patient with students	10	6.6	11	7.3	25	16.6	59	39.3	45	30	100
Agricultural Science teachers give immediate feedback to students on assignments, homework, class work, exercise and project work	44	29.3	47	31.3	29	19.3	21	14.0	9	6	100
Agricultural Science teachers understand their subject matter well	73	48.6	56	37.3	17	11.3	2	1.3	2	1.3	100

in teaching and learning process

Source: Survey Data, 2013

From Table 4.8 students were asked to indicate the extent to which they agreed or disagreed with the questions indicated in Table 4.8. The following findings were found. Majority 85.3% of the respondents agreed to the statement “Agricultural science teachers help explain difficult concepts when I approach them” and only 3.3% disagreed with the statement while 11.3% of the respondents were undecided on the statement whether “teachers actually help them by explaining difficult concepts in Agricultural science”. This means that most of the Agricultural science teachers are approachable to their students and students would be willing to ask questions for more clarification for acquisition of more knowledge and skills in Agriculture.

Hamre and Pianta (2001) stated that students react to their relationships with their teachers when students perceive that they have close and positive relations with teachers, they are more inclined

to trust and like those teachers and thus they are more motivated to succeed. In contrast, when students perceive that they have conflictual and negative relationships with teachers, they do not like or trust the teachers, are not motivated to succeed and may be defiant towards the teachers (Pianta et al, 1995; Hamre & Pianta, 2001). On the other hand, more than half 52.6% of the respondents agreed that they were fairly treated by Agricultural science teachers during the instructional period while 25.2% were of the opposite opinion that they were not treated well by their teachers. Again, 22% of the respondents were neutral with the statement that “Agricultural science teachers treat students fairly”. On the statement “Agricultural Science teachers are not patient with students”, majority of the respondents 69.3% disagreed with statement. Students also claimed that Agricultural science teachers rather had patience with them during and after normal instructional periods or contact hours. But 13.9% of the respondents agreed that teachers did not have patience for them while 16.6% declined to either support or disagree with the statement.

When the respondents were asked to indicate whether “Agricultural Science teachers give immediate feedback to students on assignments, homework, class work, exercise and project work” majority of respondents 60.6% accepted that they normally receive the feedback of these academic exercises promptly on time to see their performance in each case while 20% were in total disagreement of the statement that “Agricultural Science teachers give immediate feedback to students on assignments, homework, class work, exercise and project work”. Quite apart from these findings, 19.3% remained neutral to the statement.

Assessment made by respondents on whether “Agricultural Science teachers understand their subject matter well or not”, this revealed that over-whelming majority 86% of the respondents agreed in the affirmative that their teachers know their subject matter because their lessons delivery were superb but negligible percentage 2.6% of the respondents held divergent view that their teachers did not know their subject matter. Notwithstanding these findings, 11.3% of the

rest of the respondents either supported or disagreed with the positions of the two groups. On the whole, the student-teacher interaction and relationship had positive impact of acquisition of Agricultural knowledge and skills.

4.7 The Modes of Assessment of Project Works given to Agricultural Science

Students by their Teachers and knowledge and skills gained

Goal-directed, intentional learning has a component in which students and teachers evaluate achievement of corresponding learning goals. According to General Agricultural science syllabus (2010) for Senior High Schools in Ghana, the three profile dimensions required for teaching, learning and testing with their corresponding percentage weights are Knowledge and understanding 40%, Application of knowledge 30% and Practical skills 30% . The weights indicate the relative emphasis that the teacher should give in teaching, learning and testing processes. The teaching and assessment of practical skills should involve experiments, projects, case studies and field studies. The skills required to be developed for effective practical work include: equipment handling, observation, manipulation, measuring, reporting, recording, creativity and communication. The assessment procedures normally used by teachers in testing students' understanding include class test, end of term examinations, home works, projects, interviews etc. Any of these procedures must be developed in such a way that it will consist of a sample of the important objectives taught over a period.

From the Table 4.9, majority of the respondents 9 representing 75% were in an agreement that the best way to assess students' project work was to allow them to do presentation on the said project work executed to ascertain its authenticity in relation to the authors claim. This category of the respondents also indicated that this assessment procedure also measures equipment handling, observation, manipulation, measuring, reporting, recording, creativity and communication skills of students than any other assessment procedures. Notwithstanding, 25%

were against the view that “presentation on the detailed Project work report individually or in group” was not the best option to go.

Table 4.9: Distribution of mode of assessment of Agricultural science students’ project works by their teachers and its impact on the level of knowledge and skills gained by students.

Mode of Assessment of students project works	Distribution of Responses				
	Agree		Disagree		Total
	f	%	f	%	%
By examining the procedural write-up of the Project work	6	50.0	6	50.0	100
Through interview on the work done	5	41.6	7	58.3	100
Conducting quizzes/class tests on the executed Project	7	58.3	5	50.0	100
By doing presentation on the detailed Project work report individually or in group	9	75.0	3	25.0	100
By conducting terminal examination on the Project work executed	3	25.0	9	75.0	100

Source: Survey Data, 2013

It is worth mentioning that 3 respondents 25%, 5 respondents 42%, 6 respondents 50% and 7 respondents 58% held different views of assessing project works such as conducting terminal examination on the Project work executed, through interview on the work done, examining the procedural write-up of the Project work and conducting quizzes and class tests on the executed Project respectively. These and other assessment procedures used by the respondents supports American Association for the Advancement of Science, (2000) that the evaluation of learning is manifold and it implies self-evaluation and the use of different kinds of formative and summative assessment procedures. Therefore teachers are not limited to only one assessment procedure but to many procedures provided it is suitable for assessing a particular test material.

4.8 The Perceived Benefits Agricultural Science Students derive from Project-Based Learning

The following were the perceptions Agricultural Science teachers outlined as the benefits students of Agriculture are likely to gain in Project work activities in promoting acquisition of Agricultural knowledge and skills:

- Gives hand on experience or employable skills to students before employment.
- Encourages participatory Agriculture.
- Increases desire to engage in Practical Agriculture.
- Enables students to relate principles of Agriculture to practical situations.
- Promotes critical thinking.
- Gives students analytical and evaluative skills.
- Builds students confidence level.
- Encourages students to take risks without fear.
- Promotes easy understanding of Agricultural concepts.
- Helps slow learners to understand better.
- Promotes acquisition of leadership skills.
- Increases students' report writing skills.

These findings of the benefits students derive from Project-Based Learning by the respondents are in alignment with George Lucas Educational Foundation (2001) who stated that a growing body of academic research supports the use of project-Based Learning in school to engage students, cut absenteeism, boost cooperative learning skills, and improve academic performance.

4.9 Factors that Constrain the Use of Project-Based Learning Techniques by Agricultural Science Teachers

Teachers who bring Project-Based learning into the classroom may have to adopt new instructional strategies to achieve success because Project-Based Learning possesses a lot of challenges for the teacher despite its numerous advantages associated with it. Some of the key constraints identified by Agricultural Science teachers in an attempt to use Project-Based learning in the classroom during instruction were: inadequate Agricultural tools, absence of school farms, absence of school gardens, lack of teacher motivation and poor funding of PBL activities. The Table 4.9 shows the rankings of the factors that constrain the use of Project-Based Learning in some selected Public Senior High Schools in the Volta Region of Ghana.

Table 4.10: Ranking of factors that constrain the use of Project-Based Learning by Agricultural science teachers and its effect on teaching and learning of Agricultural science.

Constraints	Mean Rank
Inadequate Agricultural tools	3.17
Absence of school farms	3.33
Absence of school gardens	3.17
Lack of teacher motivation	3.42
Poor funding of PBL activities	1.92
Kendall's W ^a	0.151

F Statistics= 0.05

Source: Survey Data, 2013

It could be deduced from Table 4.10 that there was some level of agreement between the rankings of the Project-Based Learning constraints by Agricultural science teachers with significant kendall's coefficient of concordance (W) value of (0.151). After ranking the constraints in the order of least constraints to most constraints, it was identified that poor funding of Project works by school authorities' recorded the least mean rank of 1.92 (refer to Table 4.10) indicating that it was the most worrisome constraint inhibiting teaching and learning of Agricultural science subjects using Project-Based Learning while lack of teacher motivation was identified as the

least constraint with a mean rank of 3.42. To test the hypothesis of the finding in Table 4.10, the null and the alternate hypotheses were:

Ho: There is no relationship among Agricultural science teachers in rankings of factors that constrain the use of Project-Based learning.

Ha: There is relationship among Agricultural science teachers in rankings of factors that constrain the use of Project-Based learning.

Since, the calculated chi-square value of 7.267 was less than critical value of 9.49 at 0.05 significant level, the null hypothesis (Ho) was accepted and the alternate hypothesis (Ha) rejected (refer to Appendix D). This indicates that there is no relationship among Agricultural science teachers in rankings of factors that constrain the use of Project-Based Learning.

4.10 Projects Executed by Agricultural Science Students under the Project- Based Learning

According to General Agricultural Science syllabus (2010), Agricultural science students are expected to carry out projects in farm works including plant and animal, experiment and investigative study. The segments of the project will be carried out each term toward the final project completion at the end of the year. The Table 4.11 provides the visual picture of the extent to which Agricultural science teachers give projects to students to execute for a particular period in the selected schools for the study.

Table 4.11: Multiple responses of Projects executed by Agricultural science students under Project-Based Learning strategy and the level of knowledge and skills gained.

Projects executed	Responses (N=150)	
	N	Percent of cases
Construction of rabbit hutches for rearing of rabbits	28	18.60
Cultivation of vegetable	116	77.30
Rearing of snail	30	20.00
Beekeeping	20	13.30
Construction of local water/feed troughs	25	16.60
Budding of citrus seedlings	27	18.00
Presentation of report after field-trips	43	28.60
Construction of weed Album	72	48.00
Formulation of varieties of animal feeds	42	28.00
Preparation of organic insecticides from neem seeds/leaves	15	10.00
Drawing of plants/farm animals into Biological drawing book	64	42.60
Experimentation/findings	77	51.30

Source: Survey Data, 2013

As shown in Table 4.11 it could be observed that majority of the respondents 77.3% indicated that they cultivated variety of vegetables in their schools with at least 10.0% of respondents admitting to have prepared organic insecticides from neem seeds/leaves. This implies that students depend largely on chemical insecticides during the cultivation of vegetables and other crops.

Regarding “experimentation”, “construction of weed Album” and “drawing of plants/farm animals into Biological drawing book”, the following were recorded 51.3%, 48.0% and 42.6% respectively. The highest percentage recorded against cultivation of vegetables could be due to availability of school garden as one of the school facilities to be provided by the school to promote practical skills of students. This is supported by the view of Adaralegbe (2003) who

posits that “the type of atmosphere required for effective learning is that consisting of better school buildings, more and better teaching facilities”.

Seemingly low percentages in “formulation of varieties of animal feeds” 28.0% and “presentation of report after field-trips” 28.6% could be attributed to low level of animal production and low patronage of fieldtrips in schools in these days. Non-traditional farming including rearing of snail and beekeeping recorded marginal percentages of 20.0% and 13.3% respectively indicating that less attention has been paid to non- traditional farming in schools offering Agricultural science programme. The rest worth noting include construction of local water and feed troughs 16.6%, budding of citrus seedlings 18.0%, and construction of rabbit hutches for rearing of rabbits 18.6%. It could be concluded that quite apart from high increase in production of vegetable production in Senior High schools as a project, leap service has been paid to animal and other related projects therefore the impact is less felt.

4.11 Effects of Project-Based Learning on Students Ability to Establish Personal Garden and Rearing of Small Ruminants

The utilization and transfer of agricultural knowledge from classroom to field experimentation and implementation among students of Agriculture is largely affected by amount of Agricultural knowledge and skills acquired by students, access by the students to cultivable farmland, the space available in the house to rear animals, the willingness to put theory into practice by students and the type of livelihood strategies of their parents.

From Table 4.12, it could be observed that 150 respondents were asked to indicate whether they possessed personal garden at home or not. The responses revealed that only 42% of the respondents established garden at home to grow vegetables, cereals and other leguminous crops to augment the dietary needs of the home. However, majority of the respondents more than half 58% indicated that they did not establish garden at home.

Table 4.12: Distribution of personal garden established by Agricultural science students at home and the level of knowledge and skills gained.

Personal garden established by Agricultural Science students at home	Frequency of Responses	Percentage
Yes	87	58
No	63	42
Total	150	100

Source: Survey Data, 2013

It could be deduced from the result that the ability of 58% of the students to establish home garden, is an evidence of high level of exposure of students to the theory and practice of farming.

It could be deduced also that Project-Based Learning in schools is given the major boost in terms its frequent use but not its funding.

Agricultural science students are expected to put what has been taught in the classroom into practice both at school and at home. Table 4.13 provides the results indicating whether students rear small ruminants at home or not.

Table 4.13: Distribution of Agricultural science students that rear small ruminants at Home and the level of knowledge and skills gained.

Small ruminants reared at home by Agricultural Science students	Frequency of Responses	Percentage
Yes	75	50
No	75	50
Total	150	100

Source: Survey Data, 2013

As indicated in Table4.12, 50% of the respondents reared small ruminants at home while 50% of the respondents also did not rear small ruminants at home. It could be deduced from the result that there is a little parental involvement in animal production. The parental assistance is consistent with Christenson (1992) findings which indicated that parental expectation and aspiration, home environment and parental involvement in their child's education, such as

creating conducive home environment and the consistent provision of assistance in their studies, are the main factors that could affect the student's academic achievement.

4.12 Ambition of Agricultural Science students after Completion of Course of Study with the Agricultural Knowledge and Skills gained under Project- Based Learning

The content of General Agricultural Science syllabus has been designed in a way that will offer knowledge and skills to students for whom Senior School education is terminal. Knowledge and practices acquired in General Agricultural Science will enable such students to work on their own, or seek employment in Agricultural establishments. The syllabus also provides adequate foundation knowledge and skills for students who will want to pursue further education and training in Agriculture after Senior High Education in Ghana (General Agricultural science syllabus, 2010). Table 4.13 indicates the distribution of individual ambition of Senior High School graduates after going through Project-Based Learning.

Table 4.14: Distribution of ambition of graduate Agricultural science students and the level of Agricultural science knowledge and skills gained.

Ambition after completion of course of study	Distribution of Responses	
	Freq	Percentage (%)
To further Agriculture Education in Higher Institutions	92	61.33
To change Agriculture Education entirely because Agriculture knowledge and skills are not properly gained	16	10.66
To work with any Agriculture Establishment or Agro-Based industry	15	10.00
To venture into Agriculture because sufficient knowledge and skills are properly gained in Agriculture Education	27	18.00
Total	150	100

Source: Survey Data, 2013

Table 4.14 is on respondents' ambition after completion of course of study with Agricultural knowledge and skills under Project-Based Learning indicates that major of respondents 61.33% had an intention to pursue further education and training in Agriculture.

Only 10.66% of the respondents expressed strong dissatisfaction that Agricultural knowledge and skills were not properly gained hence their intention to discontinue with Agriculture education. This disturbing trend of discontinuation of Agriculture education 10.6% of the respondents may be due to mismatch between students learning style and teachers teaching style in Agricultural subjects. Therefore, there is a clear case of consistency between the finding of this study and that of Lindsay (1999) who stated that a match between learning style and teaching style reveals increases in student achievement and satisfaction. The seemingly increase in the number of Senior High School graduates to pursue further education and training in Agriculture might have stemmed from the fact that such students might have developed their self-efficacy as, "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments".

Bandura (1997) indicated that, "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true". Therefore, in an educational setting, self-efficacy can influence achievement and attitudes of students (Pajares, 2002).

Again, 27 of the respondents representing 18% admitted that Agricultural knowledge and skills gained under Project-Based Learning was sufficient to enable them venture into Agriculture related enterprises without difficulty while 10% of them preferred to work with any Agriculture establishment or Agro-Based industry. This means that only 18% of the respondents would be willing to create Agricultural related jobs thereby creating employment avenues for the teeming unemployed youth in the country. This low percentage of the graduates venturing into

Agriculture could be due to lack of initial capital to start Agribusiness since Agricultural ventures are capital intensive. Restructuring of the General Agriculture Science syllabus to involve the frequent use of project works to whip the enthusiasm of Agricultural Science students will go a long way to create more entrepreneurial skills in students before completion. From the results, it could be concluded that Project-Based Learning had higher positive impact on students' ability to further Agriculture Education in Higher institutions than to venture into Agricultural enterprises and to work with any Agricultural establishment or Agro-Based industry respectively.

Table 4.15: Application of Agricultural science students' knowledge and skills in Agriculture under Project-Based Learning and its impact on the establishment of personal Agricultural enterprise

Agricultural knowledge and skills gained can enable me establish my own Agricultural enterprise	Frequency of Responses	Percentage (%)
Yes	40	73
No	110	27
Total	150	100

Source: Survey Data, 2013

From Table 4.15 respondents were asked specifically to indicate whether Agricultural knowledge and skills gained under Project-based learning can enable them establish their own Agricultural enterprises or not. Over-whelming proportion of 73% of the respondents confirmed that Agricultural knowledge and skills gained under Project-based learning could enable them establish their own Agricultural enterprises while few of the respondents 27% denied the statement that "Agricultural knowledge and skills gained can enable me establish my own Agricultural enterprise". When 73% of respondents who agreed to the statement "Agricultural knowledge and skills gained can enable me establish my own Agricultural enterprise" were later

interviewed about their willingness towards establishment of Agricultural enterprises, the following were strongly expressed by respondents as push factors assisting in the establishment of Agricultural enterprises. The notable among them in the order of magnitude thus from the biggest to the smallest included:

- Sufficient of both managerial and entrepreneurial skills to start a business.
- Sufficient Practical lessons.
- Availability of start-up capital to venture into Agribusiness.
- Availability of land as one of the factors of production.
- Sufficient knowledge is gained about Agricultural Enterprise establishment and Agribusiness.
- The knowledge and skills gained in Agricultural Science subjects are deep enough to be used to establish an enterprise.

From the findings above, it could be deduced that the major “push factors” encouraging students of Agriculture after completion of course of study from venturing into Agricultural related job opportunities was found to be sufficient of both managerial and entrepreneurial skills development in the students and sufficient Agricultural knowledge and skills gained.

4. 13 Summary

The study specifically compared the impact of Project-Based learning methods (PBLMs) with Traditional teaching methods (TTMs) in the acquisition of Agricultural knowledge and skills. The results revealed that Agricultural science teachers at the Senior High schools with their high level of teaching experience, teacher-student relationship, motivation, and academic qualification had led to effective teaching and learning of Agriculture at the Senior High schools in the acquisition of Agricultural knowledge and skills. Also, Agricultural science students' Prior

knowledge and skills in Agriculture from the home also affected amount of new knowledge and skills gained in Agriculture at school. Meanwhile, PBLMs correlated positively with students' knowledge and skills in crop and animal production and general farm management. Students in Project-Based learning outperformed their peers who had Traditional instructions.



CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter concludes the study by providing the summary of the main findings of the study and the conclusions drawn out of the findings. It also proposes the best ways to teach Agriculture science subjects to promote adequate acquisition of Agricultural knowledge and skills by students in Senior High Schools.

The study puts forward on the basis of the findings, recommendations for considerations by the Government, Teachers and School authorities, Parents and Development agencies for enhancing Senior High school Agriculture Education in Ghana.

5.1 Summary and Conclusions

The section summarises the main findings of the study investigated, the impact of Project-Based Learning on acquisition of Agricultural knowledge and skills in Senior High Schools in the Volta Region. In all, 150 final year students from three selected Public Senior High schools and 12 Agricultural science teachers of the final year students were selected to answer specific questions on the questionnaire presented to them.

With the age distribution, majority of the respondents 101 out of 150 were between the ages of 19-21years indicating that most of the respondents are physiologically mature to grasp Agricultural knowledge and skills in sufficient among whenever they are taught. The mean age of all the respondents was 19years.

To find out how many hours respondents used to study Agricultural science notes, the data analysis indicated that the average hours used by respondents was 2.5 hours with majority of the

respondents 122 used 1-2 hours to study Agricultural notes while only 28 respondents used 3-4 hours to study. This suggests that there are more Low-achievers than High-achievers in the schools under investigation.

Teachers from the selected Public schools are male dominated with 75% while their female counterparts recorded only 25%. This huge gender disparity is likely to affect academic output of most of female students since their role models are few in supply in secondary schools.

In relation to percentage distribution of teachers' age, there are more youthful Agricultural science teachers 66.6% than older teachers 33.3%. This holds a brighter future for Agriculture education because more students would be motivated to learn harder since their teachers are youthful and full of energy to conduct practical activities with them. In addition, the study also found out that all the Agricultural science teachers were holders of University degree in Agriculture with 83.3% being regarded as professional teachers while 16.6% of them were non-professional teachers. It therefore, means that majority of Agricultural science teachers were professionals with repertoire of both Agricultural science content and teaching pedagogies to instil the right amount of Agricultural knowledge and skills in students.

Of the 12 respondents 91.67% indicated that the provision of teaching and learning materials could motivate them to impart Agricultural knowledge and skills in students than enhanced monthly salary indicated by respondents 50% in another case. The implication is that if teaching and learning materials are provided in sufficient amount, teachers would be able to give off their best.

Both Traditional teaching methods and Project-based learning methods indicated positive correlation and significant relationships with crop production related knowledge ($r=0.284 \cdot p<0.01$) and ($r=0.334 \cdot p<0.01$) respectively at the 0.01 levels perceived to be acquired by students during instructions. Again, both Traditional teaching methods and Project-based

learning methods had positive correlation and significant relationship with knowledge in livestock production ($r=0.219$, $p<0.05$) and ($r=0.245$, $p<0.05$) respectively and again, both had positive correlation and significant relationship with knowledge in farm management ($r=0.163$, $p<0.05$) and ($r=0.215$, $p<0.05$) respectively and all the 0.05 significant levels. But in all cases, Project-based learning methods had stronger relationships with knowledge in livestock production and knowledge in farm management than Traditional teaching methods respectively. Therefore, Project-based learning methods is highly recommended to be used to teach Agricultural science subjects that would result in acquisition of more Agricultural knowledge.

In comparing the impact of Traditional teaching methods with Project-Based Learning teaching methods that could lead to greater acquisition of Agricultural skills, it was found out that Project-Based Learning had higher positive and significant relationship with crop production ($r=0.322$, $p<0.01$), Farm management ($r=0.204$, $p<0.05$) at 0.01 and 0.05 levels respectively than Traditional teaching methods with crop ($r=0.286$, $p<0.01$), Farm management ($r=0.174$, $p<0.05$). Even though both Traditional teaching methods (teaching methods) and Project-Based Learning methods had no significant relationship with animal production, but Project-Based Learning had positive relationship with animal production ($r=0.015$) while Traditional teaching methods had negative relationship with animal production ($r=-0.011$). It could be concluded from the analysis that Project-Based Learning had more positive impact on acquisition of Agricultural skills than Traditional teaching methods.

The perception students hold about student-teacher interaction was found to be cordial in the sense that 85.3% of the students agreed that Agricultural science teachers help to explain difficult concepts to them while 3.3% of them disagreed and 11.3% of them remained neutral about the

statement. Again, 52.6% of the students admitted that they were treated fairly by their teachers while 25.2% disagreed and 22% were undecided about the statement.

Some of the benefits students derive from Project work identified by their teachers included: gaining of employable skills, promotion of participatory Agriculture, increasing students desire in practical Agriculture, developing critical thinking of students and building students confidence level in life in general.

Despite the numerous benefits of Project-Based Learning, the teachers again expressed some key constraints inhibiting the use of Project-Based learning such as: inadequate Agricultural tools, absence of school farms, absence of school garden, lack of teacher motivation and poor funding of Project-Based learning. Poor funding of Project-Based learning had been identified as most pressing constraint with teacher motivation as least constraint.

Execution of Project works revealed that most schools over concentrated on cultivation of vegetables 77.3% to the neglect of non-traditional projects including Beekeeping 13.3% and snail rearing 20.0%. Preparation of organic insecticides from neem seeds or leaves recorded the lowest percentage of 10% of Project work carried out indicating that Project-Based Learning had positive impact on acquisition of Agricultural knowledge and skills.

58% of the respondents were able to put the theory of crop production into practice through home gardening while 42% of them did not make an effort. With animal production, 50% of respondents reared small ruminants at home while the same percentage of respondents 50% did not rear small ruminants at home. This means that Project-Based Learning had average positive impact in the lives of some of the respondents.

The ambition to further Agricultural Education in Higher Institution due to the impact of Project-Based Learning is the major ambition of many respondents 61.33% after completion of course

of study. Only 18% of the respondents expressed readiness to venture into Agriculture as a full time business which means that Project-Based learning had positive impact on students' ambitions in life.

Finally, 73% of respondents who formed the majority affirmed that they would be able to establish personal Agricultural enterprise while minority of the respondents 27% indicated that they would not be able to establish Agricultural enterprise because Agricultural knowledge and skills were not properly gained. When the 73% of respondents of this category were further interviewed, to find out why they would be able to establish Agricultural enterprises, the following were expressed as push factors assisting in the establishment of Agricultural enterprises in order of magnitude thus from the biggest to the smallest. Sufficient of both managerial and entrepreneurial skills to start a business, sufficient practical skills, availability of start-up capital to venture into Agribusiness, availability of land as one of the factors of production and knowledge and skills gained in Agriculture science subjects are deep enough to be used to established an enterprise.

5.2 Recommendations

The following are a number of recommendations based on the results of this research that need to be considered by the Government, School authorities and teachers, Parents and Developmental agencies in order to improve acquisition of Agricultural knowledge and skills in Senior High Schools using Project-Based Learning methods.

5.2.1 Recommendations for government

The study, therefore recommends that the Curriculum Research and Development Division of G. E. S in collaboration with the Ministry of Education should restructure the content of the Senior High Agricultural science syllabai of the various subjects in Agriculture, placing more emphasis on the use of Project-Based Learning by teachers since the study revealed that

Traditional ways of learning are no longer fully adequate unless correctly augmented by variety of student activities (Student-centered methods such as Project work).

The results of the study show the need for governments to motivate Agricultural science teachers to exhibit high level of commitment and professional competency in teaching agriculture. Highly motivated teachers usually have their morale boosted and will collaborate to ensure that the goal of teaching students to acquire requisite knowledge and skills are achieved. Motivation could also be in the form of provision of teaching and learning materials, Agricultural tools, syllabai, school bus, equipped Agricultural laboratories and good remuneration. In addition, regular seminars and workshops and symposia need to be organised to keep Agricultural science teachers informed of latest developments in the field of Agriculture and how best to communicate them to students.

Finally, Government as a matter of urgency should disburse Public school grants on time to schools for Agricultural science teachers to get their due for PBL activities in Senior High School in Ghana since poor funding of PBL activities had been found to be the most constraint inhibiting Project-Based Learning in schools.

5.2.2 Recommendations for school authorities and teachers

Agricultural science teachers should use Project-Based Learning in teaching of Agricultural science subjects to facilitate easy understanding of the topics being taught because it had been discovered that Traditional teaching methods especially lecture method lacks the potential of promoting learning effectiveness.

Also, school Heads should promptly release money for Project-works in Agriculture and take keen interest in the supervision of Agricultural science teachers activities in relation to execution of Agricultural science Projects in schools.

5.2.3 Recommendations for parents and development agencies

Parents, private sector, communities and non-governmental organisations (NGOs) can supplement the efforts of Government in the provision of teaching facilities. Parents in particular should provide their wards with cultivable land and animal pen at home to encourage their wards to practise what has been taught in the classroom in order to develop in them employable skills leading to job creation.

The Agricultural extension agents of Ministry of Food and Agriculture can also collaborate in the establishment and supervision of school farms, school garden, snailery and apiary with agricultural science teachers in schools. They can also demonstrate important skills in Agriculture to teachers and students.

5.3 Recommendations for further Research

Since the study was limited to only three Public schools in the Volta Region, it will be difficult to generalise the findings in every Public school in Ghana. It is therefore recommended that further investigation should be carried out to cover the entire country of Ghana on the same topic, the impact of Project-Based Learning on acquisition of Agricultural knowledge and skills in Senior High Schools in Ghana.

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LIST OF APPENDICES

APPENDIX A: Questionnaire for Senior High Agricultural science students

The questionnaire seeks to ascertain “**The impact of Project-Based learning on acquisition of Agricultural knowledge and skills in Senior High Schools in the Volta Region**”.

Background information of students

SECTION A: Demographic Data of Agricultural Science Students

Research study: The impact of Project-Based learning on acquisition of Agricultural knowledge and skills in Senior High Schools in the Volta Region.

Serial number----- []

1. Name of student-----

2. Name of school-----

3. Name of hometown/village-----

4. Sex----- Male [] Female []

5. Which of the age categories do you belong?

A. 16-18years []

B. 19-21years []

C. 22-24years []

6. What is your father’s occupation? -----

7. What is your mother’s occupation? -----

8. What is your religious affiliation?

A. Traditional []

B. Christianity []

C. Islam []

D. Other (specify) -----

9. Name of last Junior High School attended-----

10. Mention your initial programme you intended to do at the senior high school when you were at junior high school.-----

11. What programme do you do currently at the senior high level?-----

12. If you have changed the programme you intended to do at the senior high school when you were in junior high school, could you please give reason(s) for the change of mind.

A.-----

B.-----

C.-----

13. Please, mention the Grades you obtained at BECE.

A. English Language []

B. Mathematics []

C. Religious and Moral Education []

D. General Science []

E. Social Studies []

F. Vocational skills []

G. Ghanaian Language []

H. French []

14. List your Elective subjects.

A.-----

B.-----

C.-----

D.-----

15. Do you accompany your parents to farm? YES [] NO []

16. If your answer to question 15 is YES, state five(5) farm activities you undertake to help your parents on the farm.

A.-----

B.-----

C.-----

D.-----

E.-----

17. Do you have your personal garden at home? YES [] NO []

18. If your answer is YES to question 17, mention the crops in the garden.

A.-----

B.-----

C.-----

D.-----

E.-----

19. Apart from crop farming, do you rear small ruminants? YES [] NO []

20. If your answer is YES, list the small ruminants you rear.

- A. -----
 B. -----
 C. -----
 D. -----

21. How much time do you spend on Agricultural Science Assignments in a week?

- A. None []
 B. Less than one hour []
 C. One to two hours []
 D. More than three hours []

22. How much time, do you study Agricultural Science notes on each day after classes?

- A. One hour
 B. two hours
 C. three hours
 D. four hours

SECTION B: The perceptions students hold about teacher-student interaction and behavioural settings during Agricultural lessons.

For questions 23 to 27, please state how much you agree or disagree with the following teacher/student interaction and classroom behaviours during Agricultural Science lessons.

No.	Statements	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
23.	Agricultural Science teachers help explain difficult concepts when I approach them after lessons.					
24.	Agricultural Science teachers treat students fairly in class.					
25.	Agricultural Science teachers are not patient with students.					
26.	Agricultural Science teachers give immediate feedback to students on Assignments, homework, class exercises and project works.					
27.	Agricultural Science teachers understand their subject matter well.					

SECTION C: Teachers' teaching strategies and their effects on students learning outcomes.

Tick in the perceived frequency of use of teaching methods or strategies by Agricultural Science teachers in promoting learning outcomes of Agricultural Science students.

No.	Teaching methods or strategies	Perceived frequency of use of teaching strategies and methods by Agricultural Science teachers.				
		Always	Often	Sometimes	Rarely	Never
28.	Role play					
29.	Lecture method					
30.	Group discussion					
31.	Project work					
32.	Exhibition					
33.	Writing notes on the chalkboard					
34.	Questions and answers					
35.	Demonstration					
36.	Visit to nearby farms					
37.	Supervised practical at school farms and gardens					
38.	Reading of Agricultural textbooks in class.					
39.	Use of posters and charts					
40.	Problem solving/ discovery method					

SECTION D: Projects executed by students under Project-Based learning strategy used by Agricultural teachers.

41. Which of the following Projects have you undertaken in your school in a group or as an individual? Tick which are/is applicable.

- A. Construction of rabbit hutches for rearing of rabbits. []
- B. Cultivation of vegetables. []
- C. Rearing of snail. []
- D. Beekeeping. []
- E. Construction of local water/feed troughs. []
- F. Budding of citrus seedlings. []
- G. Presentation of Report after field-trips. []
- H. Construction of weed Album. []
- I. Formulation of varieties of animal feeds. []
- J. Preparation of organic insecticide from neem seeds/leaves []
- L. Drawing of plants/farm animals into Biological drawing book. []
- M. Experimentation/ findings. []

SECTION E: Perceived Agricultural knowledge and skills acquired by students.
Tick YES or NO if knowledge or skill is gained from the following Agricultural tasks undertaken and Agricultural topics treated and also indicate the level of knowledge and skill gained

5= Very high 4= High 3=Average 2= Low 1= Very low 0= Not taught

No	Topics treated	Knowledge gained		Level of knowledge gained					
		YES	NO	5	4	3	2	1	0
42	Methods of planting crops								
43	Types of castration in ruminants								
44	Different forms of land preparation								
45	Methods of controlling pests in farms								
46	Methods of controlling weeds								
47	Measurement of herbicides for use								
48	Harvesting techniques								
49	Farm management/ Farm Accounting								
50	Animal nutrition								
51	Farm sanitation								
52	Vegetable production								
53	Report writing format								
54	Animal breeding								
55	Animal health								
56	Prevention of animal diseases								

5= Very high 4= High 3=Average 2= Low 1= Very low 0= Not taught

No	Tasks undertaken	Skills gained		Level of skills gained					
		YES	NO	5	4	3	2	1	0
57.	Row planting.								
58.	Castration of ruminants.								
59.	Land preparation.								
60.	Pesticide use.								
61.	Use of herbicides.								
62.	Handling of knapsack sprayer.								
63.	Harvesting of crops.								
64.	Farm record keeping.								
65.	Feeding of livestock.								
66.	Farm sanitation.								
67.	Nursery practices.								
68.	Report writing.								
69.	Breeding of ruminants.								
70.	Treatment of animal diseases.								
71.	Detecting sick animals and culling them.								

72. What do you want to do with the Agricultural knowledge and skills you have gained after completion of your course of study?

A. To further Agricultural Education in Higher Institutions. []

B. To change Agriculture Education entirely because knowledge and skills are not properly gained. []

C. To work with any Agric. farm or Agro-based Industry. []

D. To venture into Agribusiness because sufficient knowledge and skills are gained in Agriculture Education. []

73. Do you think the Agricultural knowledge and skills you have gained can enable you establish your own Agricultural enterprise? YES [] NO []

74. If your answer to question 58 is YES, what are your reason(s)

A. -----

B. -----

C. -----

D. -----

75. If your answer to question 58 is NO, what are your reason(s)

A. -----

B. -----

C. -----

D. -----

13. How long have you been teaching Senior High School Agricultural Science?

- A. 0-2years []
- B. 3-5years []
- C. 6-8years []
- D. 9years and above []

14. What are your teaching values as a teacher?

- A. -----
- B. -----
- C. -----
- D. -----

15. To what extent do you agree that motivation leads to teachers' job satisfaction in teaching of Agricultural Science.

- A. Strongly agree []
- B. Agree []
- C. Not certain []
- D. Disagree []
- E. Strongly disagree []

16. Which of the following motivates you to teach Agricultural Science effectively and efficiently? Please **tick** whichever is/are applicable.

Motivational packages	Tick column
A. Availability of Agricultural tools	
B. Availability of teaching and learning materials	
C. Adequate syllabi	
D. Availability of Agricultural textbooks	
E. Enhanced salary	
F. Periodic In- service training/Refresher courses	
G. Availability of school farm/garden	
H. Embarking on Field trips	
I. Availability of Animal farms	

17. What is your relationship with Agricultural students in your school?

- A. excellently cordial []
- B. very cordial []
- C. somehow cordial []
- D. very bad []

SECTION B: The impact of teacher-student interaction and behaviours in acquisition of Agricultural knowledge and skills.

For questions 18 to 23, please state how much you agree or disagree to the following statements.

No.	Statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
18.	Teachers interact with students on equal basis.					
19.	Students willingly approach teachers for academic assistance.					
20.	Students answer questions freely in class without intimidations.					
21.	Students are motivated by teachers' teaching methods to learn harder.					
22.	Teachers actively involve students in the teaching process					
23.	Teachers ask sufficient questions in class during and after lessons.					

From questions 24 to 27, indicate the extent to which you agree to the following statements that follow.

No	Statements	Always	Very often	Often	Occasional	Never
24.	How often do you shout at students in class?					
25.	How often do you reward students for good behaviour in class?					
26.	How often do you punish students for any wrong doing in class?					
27.	How often do you engage students' attention in class?					

SECTION C: The impact of teaching methodologies on acquisition of Agricultural knowledge and skills

28. Which of the teaching method(s) do you normally use in teaching Agricultural Science? (Please, tick all that apply).

A. Supervised practical at school farm or garden	
B. Lecture method	
C. Group Discussion	
D. Demonstration	
E. Visit to nearby farms or Agricultural Institutions (field trips)	
F. Questions and answer techniques	
G. Use of poster and charts	
H. Use of Agricultural resource person	
I. Role play of issues	
J. Class exercises and homework	
K. Reading of Agricultural textbook with students	
L. Writing of notes on the blackboard for students to copy	
M. Project works	
N. Exhibitions	
O. Problem solving/Discovery method	

For questions 29 to 43, rate the following teaching methods on a scale of 1-5, 1 being the least appropriate and 5 being the most appropriate methods in promoting acquisition of both Agricultural knowledge and skills.

No	Teaching Methods	Rating				
		1	2	3	4	5
29	Supervised practical at school farm or garden.					
30	Lecture method.					
31	Group discussion.					
32	Demonstration.					
33	Visit to nearby farms or Agricultural Institutions (field trips)					
34	Questions and answers techniques.					
35	Use of posters and charts.					
36	Use of Agricultural resource person.					
37	Role play of issues.					
38	Class exercises and homework.					
39	Reading of Agricultural textbook with students.					
40	Writing of notes on the chalkboard/marker board for students to copy					
41	Project works.					
42	Exhibitions.					
43	Problem solving/Discovery method.					

44. Do you think that Project work as a teaching method promotes collaborative problem-solving and creative thinking? YES [] NO []

45. If your answer to question 44 is YES, state five (5) other benefits students may derive from project work in teaching and learning of Agricultural science.

- A.-----
- B.-----
- C.-----
- D.-----
- E.-----

46. How many project works do you give out to students in term?

- A. None []
- B. 1 []
- C. 2 []
- D. 3 []
- E. Other (please specify)-----

47. How do you assess students' completed project works? (Please, tick as applicable)

- A. By examining the procedural write-up of the project work. []
- B. Through interview on the work done. []
- C. Conducting quizzes/class tests on the executed project. []
- D. By doing presentation on the detailed project work report individually or in group []
- E. By conducting terminal exams on the project work executed []

48. Which of the following product(s) do students present for inspection as a result of Project Based learning (PBL)? (Please, tick whichever is applicable)

	Projects	Tick column
A	Weed Album	
B	Harvested vegetables from school garden	
C	Animal feed Album	
D	Constructed water trough/feed trough	
E	Budded citrus plants	
F	Results from Agricultural experimentations	
G	Reports from farm visits	
H	Constructed rabbit hutches	
I	Prepared silage/hay	
J	Biological drawings on plants and animals	
K	Prepared organic matter from school garden	
L	Cultivated pasture	
M	Prepared yam mini-setts	
N	Prepared plantain mini-setts	
O	Prepared organic insecticide from neem seeds and leaves	

SECTION D: Agricultural skills perceived to be acquired through Project-Based learning (PBL).

Please, for questions 49 to 63 indicate the grade of proficiency of your Agricultural students on acquisition of Agricultural skills by performing the following tasks during Project-Based lessons.

No.	Task(s)	Grade of proficiency of Agricultural skills of students		
		Low	Medium	High
	Crop Production			
49	Plant nutrient and plant growth analysis			
50	Fertilizer Application			
51	Land preparation			
52	Pests and Diseases control			
53	Planting and Harvesting			
	Livestock Production			
54	Breeding of farm animals			
55	Feeding of farm animals			
56	Housing of farm animals			
57	Handling of farm animals			
58	Diseases and Pests control			
	Farm management			
59	Record keeping			
60	Financial management			
61	Marketing			
	Miscellaneous			
62	Experimentation			
63	Report writing			

SECTION E: Factors that constraint the use of Project-Based technique in acquisition of Agricultural knowledge and skills.

64. Rank the following constraints that inhibit effective use of (PBL) in acquisition of Agricultural knowledge and skills on the scale of 1 to5. 1 being the most constraint and 5 being the least constraint in that order.

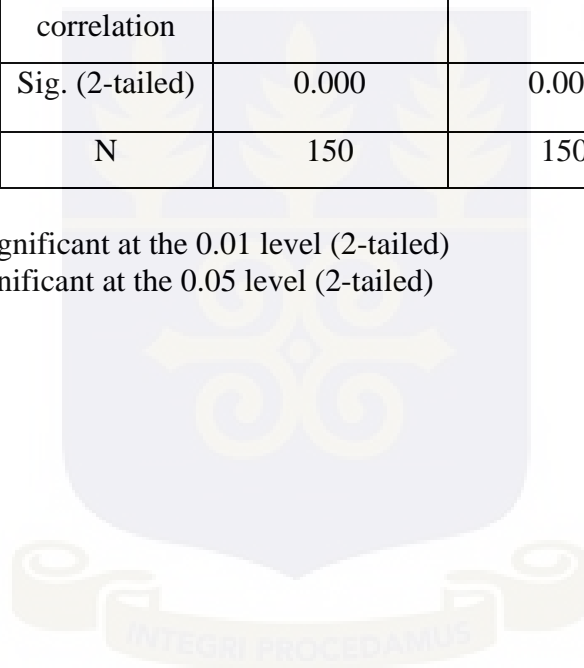
	Constraints	Ranking				
		1	2	3	4	5
A	Inadequate Agricultural tools					
B	Absence of school farms					
C	Absence of school gardens					
D	Lack of teacher motivation					
E	Poor funding of PBL activities					

Appendix C: Correlation between frequency use of teaching methods and perceived Agricultural knowledge gained by students in Senior High schools.

		Knowledge in crop production	Knowledge in livestock production	Knowledge in farm management
Traditional teaching methods	Pearson correlation	0.284**	0.219*	0.163*
	Sig. (2-tailed)	0.000	0.666	0.026
	N	150	150	150
Project based learning methods	Pearson correlation	0.334**	0.245*	0.215*
	Sig. (2-tailed)	0.000	0.000	0.005
	N	150	150	150

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed)

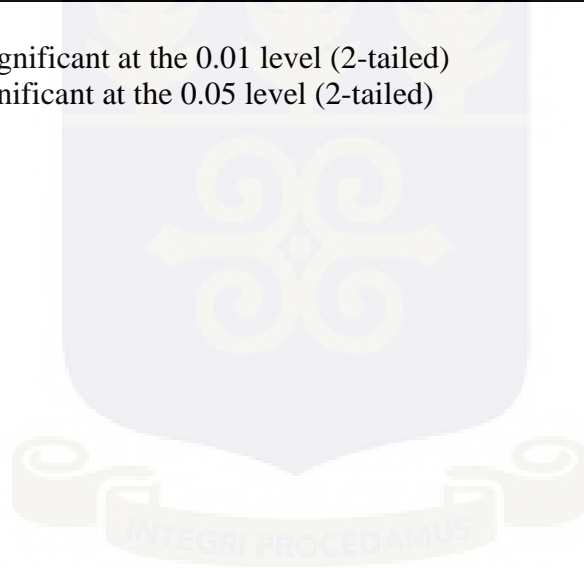


Appendix D: Correlation between frequency use of teaching methods and perceived Agricultural skills gained by students in Senior High schools.

		Skills in Crop Production	Skills in Livestock Production	Skills in Farm management
Traditional teaching methods (Teacher Centered Methods)	Pearson Correlation	0.286**	-0.011	0.174*
	Sig. (2-tailed)	0.000	0.896	0.033
	N	150	150	150
Project-Based teaching methods (Student Centered Methods)	Pearson Correlation	0.332**	0.015	0.204*
	Sig. (2-tailed)	0.000	0.857	0.012
	N	150	150	150

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed)



Appendix E: Kendall's coefficient of concordance (W) analysis and summary of results

Constraints	Mean Rank
Inadequate Agricultural tools	3.17
Absence of school farms	3.33
Absence of school gardens	3.17
Lack of teacher motivation	3.42
Poor funding of PBL activities	1.92

Test Statistics

N	12
Kendall's W ^a	0.151
Chi-Square	7.267
df	4
Asymp. Sig.	0.122

Appendix F: Interview schedule for Agricultural Science Students

1. What are the perceived benefits you have derived under Project-Based Learning in Agricultural Science?
2. What are the push factors that would enable you to establish Agricultural Enterprise after school?
3. Do you apply the Agricultural knowledge and skills you have gained at school in your parents' farm? How?



Appendix G: Interview schedule for Agricultural Science Teachers

1. What are your teaching values as a teacher that can affect acquisition of Agricultural knowledge and skills in Senior High schools.
2. Is there a need for change in methods of teaching Agricultural science?
3. Is your teaching, teacher-centered or child-centered? Why?
4. What are the Agricultural knowledge and skills your students have acquired so far.
5. What are the factors that constrain the teaching and learning of Agriculture?

