Organizing Project Method of Teaching for Effective Agricultural Knowledge and Skills Acquisition: Comparison of Individual and Group Student Projects

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Abstract
Agricultural science curricula for Senior High Schools (SHSs) in Ghana is expected to be taught as both science and vocation in order to produce agricultural graduates with the requisite competency and skills to practice agriculture as a vocation or further their education in agricultural related programmes. In achieving this broad objective, several teaching methodologies have been tested and deployed in teaching agricultural science in Ghanaian SHSs. This paper report findings of an action research conducted in Awe Senior High School in the Navrongo Municipality of the Upper East Region of Ghana investigating the best way of deploying project teaching method for effective result. Through simple random sampling, 100 students were sampled and randomly assigned a project of raising tomatoes seedlings in a group of five or individually. Observations, personal interviews, focus group discussion and key informant interviews were employed in gathering data for the study. Discourse analysis, descriptive and inferential statistics were employed in analysing the data gathered. Findings of the study showed that assigning agricultural practical project to students, either individually or in a group of not more than five students, generally contribute significantly in students' knowledge and skills acquisition. However, the group method of organizing student's project was found as most effective in improving students' knowledge and skills. The group method was found to be cost effective and efficient in improving students' knowledge and skills in nursery practices. It is recommended that the school authority and Ghana Education Service (GES) should equipped and encouraged SHSs to deploy project method of teaching in teaching agricultural skills. Also to ensure cost effectiveness and effective knowledge and skills acquisition, project method of teaching should be organized in a group of not more than five students.
Keywords: Project teaching method, agricultural skills, knowledge, Individual projects and Group Projects

1. Introduction

Agricultural science curricula for SHSs in Ghana is being taught as both science and vocation, as such students are expected to have the basic understanding of agriculture as science while acquiring the requisite competency and skills to practices agriculture as a vocation and profession. As such the approaches and strategies used in teaching agriculture science is different from theoretical base subjects. The teaching syllabus for general agriculture science in SHSs in Ghana had been designed in a way that will offer knowledge and skills to students for whom Senior High School education is terminal. Knowledge and practices acquired in this subject 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 SHS' education (GES, 2010).

However, casual observation and interaction with agricultural students, teachers and school authority of Awe SHS in the Navrongo Municipality revealed that the school rare conduct practical lessons, because of large class size, inadequate Teaching and Learning Material (TLMs), poorly functioning school farms and laboratory among other teaching and learning facilities. Consequently, students' agricultural practical skills acquisition is being negatively affected. Identifying the best way of organizing practical lessons which can impart the requisite skills on students, inspite of these constraints was the focus of an action research being reported in this paper. Specifically, the paper analysed the best way of deploying project teaching method on students' knowledge and skills of tomatoes nursery practice among agricultural students of Awe SHS in the Navrongo Municipality of the Upper East Region of Ghana.

1.1 Hypotheses

Ho_1: There is no significant difference in knowledge of students before and after they undertook the project.
Ha_1: There is significant difference in knowledge of students before and after they undertook the project.
Ho_2: There is no significant difference in skills of students before and after they undertook the project.
Ha_2: There is significant difference in skills of students before and after they undertook the project.

Ho_3: There is no significant difference in the knowledge level of students who took the project in groups and those who did it individually.
Ha_3: There is significant difference in the knowledge level of students who took the project in groups and those who did it individually.
Ho_4: there is no significant difference in knowledge improvement between students who did the project in groups and those who did it individually.
Ha_4: there is significant difference in knowledge improvement between students who did the project in groups and those who did it individually.
Ho_5: There is no significant difference in the skills level of students who took the project in groups and those who did it individually.
Ha_5: There is significant difference in the skills level of students who took the project in groups and those who did it individually.
Ho_6: there is no significant difference in skills improvement between students who did the project in groups and those who did it individually.
Ha_6: there is significant difference in skills improvement between students who did the project in groups and those who did it individually.

2.0 Teaching and learning of Practical agriculture

Teaching and learning of practical skills is critical component of agricultural science education. The SHS agricultural science syllabus is designed to impart both science and practical skills on students. Lunetta, Hofstein, and Clough, (2007) define practical teaching and learning as process of creating learning experience in which students interact with materials or with secondary sources of data to observe and understand the natural world. Also Science Community Representing Education (SCORE, 2008) defines practical lesson as any science teaching and learning activity which involves students, working individually or in small groups, manipulating and/or observing real objects and materials, as opposed to the virtual world. The term practical lesson can also be defined as an activity whereby students used their own hands to manipulate real objects during teaching and learning process or observe their teacher manipulating a real object for them to see and practice later. During practical lessons, students observe or manipulate real objects or materials for themselves either individually or in small groups or witness teacher's demonstrations.

2.1 Practical Lessons and Hands - on Experience

Organizing practical learning process in order to create concrete experience for learners have been a concern for researchers, teachers and academics. Practical lessons which is often refers to as practical work or Hands – on experience or sometime experiential learning is aimed at exposing students to practical reality of learning object to enhance students familiarity and mastering of the object of learning. According to existing literature, practical work (practical lesson), is the best way of learning agriculture science, it has also been reported that practical lessons makes learning more enjoyable (Deegan, Wims and Pettit, 2016; Collins, 2011; Osborne & Collins, 2001; Otekunrin, Oni LO and Otekunrin, 2017; Jenkins & Nelson, 2005; Toplis, 2012). Also practical lessons had often been noted as helping 'to arouse and maintain' positive attitudes in students' towards science and other related disciplines (Deegan *et al*, 2016; Hodson, 1990; Swain, Monk & Johnson, 1999). The existing literature has shown that practical lessons help to enhance students' conceptual understanding of science, scientific ideas, and allowing them to see and experience scientific phenomena (Deegan et al, 2016; Otekunrin et al, 2017 and Wellington, 1998).

Also, there is evidence that practical lessons in science help to generate motivation in science and enhance students' understanding of scientific concepts and happenings around them (SCORE, 2008). Beside, practical lesson helps promote 'hands - on' (physical activities) and 'brains - on' activities (mental activities) in inside and outside the laboratory, garden and school farms. Deegan, *et al*, (2016) stressed that blended learning which placed emphasis on students taking charge of their own learning environment is effective in imparting diverse range of practical skills in agricultural on students.

A well planned and effectively implemented practical lesson has the potential of engaging students both mentally and physically due to their direct involvement of practical activities where they used both their hands and brains to perform a particular task especially during field work, science laboratory experiments and simulation experience (Lunetta et al., 2007). There is evidence that practical lessons in agriculture does not only make lesson interesting but also makes learning enjoyable (Deegan et al, 2016; Cerini, Murray, & Reiss, 2003 and Otekunrin et al, 2017). From a Social learning theory perspective group work in the practical learning is believed to help bring to bear the necessary conceptualization and internalization, and provide opportunity for discussion and reflection among learners as well as between the teacher and the students. (Lunetta et al., 2007 and Samuel, Fawole & Badiru, 2016).

Specifically, practical agricultural education encompasses farming and agro-allied business organizations including others involved services and sales in agriculture Deegan et al, 2016; Okorie, 2001; Otekunrin et al, 2017 and Amuel, et al, 2016). The purpose of agricultural science practical lesson is to educate present and prospective farmers for proficiency in farming. The primary role of practical agricultural teaching and learning is to equip students with the requisite knowledge, attitude, practice and skills in undertaking agricultural and farming tasks. Practical skills training of agriculture is also expected to motivate and generate entrepreneurial skills among students (Onuekwusi and Okorie, 2008 and Samuel et al, 2016).

However, studies have shown that very little attention is being paid to practical skills acquisition among SHSs students' studying agriculture (Modebelu and Nwakpadolu, 2013; Darko, Yuan, Okyere, Ansah, and Liu, 2016) which is greatly hampering agricultural students competency and employability. Inadequate TLMs, tools, equipment, laboratory, school farms and gardens, as well as poorly motivated teachers and poor attitude of students' towards agricultural practice have been cited as being responsible for the poor training of agricultural students (Darko et al, 2016; Deegan et al, 2016 and Samuel, et al, 2016). As noted by Darko, *et al*, (2016) that practical teaching of agricultural science in the SHSs in Ghana is greatly impeded by inadequate TLMs, ill equipped school laboratories, school farms and gardens, and poor funding of agricultural practice.

2.2 Teaching and Learning Methods in Agricultural Science

Several methods have been employed in teaching and learning of agriculture to impart the needed knowledge, attitude, practice and skills on students. Some of them are discussed below:

2.2.1 The Demonstration teaching method

Demonstration teaching method refers to the type of teaching method in which the teacher is the principal actor while the learners watch with the intention to act later. Here the teacher systematically shows whatever the learners are expected to do at the end of the lesson by showing them how to do it and explaining the step-by-step process in undertaking the task. Mundi (2006) described it as a display or an exhibition usually done by the teacher while the students watch with keen interest. It is done by explanations by the teacher while the student watches (Nwachukwu, 2001). Agricultural science is a practical oriented course and therefore requires practical instructions and application via effective demonstration strategies.

Mundi, (2006) have highlighted the following as the characteristics and significance of demonstration teaching method:

- It demands certain level of skills and practical;
- It is a good method for introducing new skills;
- It is a good method for developing understanding;
- It is good in showing the appropriate ways of doing things;
- It allows for very low interaction between students and materials in class,
- It helps to enlist the various senses in a human being;
- It helps to motivate students especially when skilled teachers carry it out;
- It saves time and energy especially for the teacher

Also demonstration method is an attention inducer and a powerful motivator in lesson delivery by the agricultural science teacher as it allows the teacher to use activities that ordinary will be too dangerous for the students to handle or carryout themselves e.g. chemical spraying and tractor operation among others. As observed by Umar, Dauda and Mutah, (2016) in a study on the effectiveness of demonstration and lecture methods in teaching secondary school students concluded that demonstration method was more effective than lecture method. Their findings revealed that demonstration group results were significantly higher than lecture group method.

2.2.2 Project Method of Teaching

Project teaching method or otherwise refers to as project work, along with other innovative, complex, and authentic tasks, has been shown to support these goals (Krajcik, Blumenfeld, Marx, & Soloway, 1994; Perry et al., 2004; Perry, Hutchinson, & Thauberger, 2008). Teachers who initiate project work, however, tend to face challenges in enacting it effectively in their classrooms (Fallik, Eylon, & Rosenfeld, 2008; Tse, Lam, Lam, & Loh, 2005).

Project teaching method is based on the conviction that learning by doing, discussing in groups, and revisiting ideas and experiences are superior ways of gaining a better understanding of one's environment (Katz & Chard, 2000; Krajcik, Czerniak, & Berger, 2002). Gültekin (2007) as cited by Jansen, (2012) described project teaching method as "a learning approach based on students working for a period of time in order to intensively investigate the real world issues or problems in an interdisciplinary approach so as to produce something concrete through individual efforts or group work" (p. 96).

Some other definitions of project teaching method highlights the methods, emphasize, flexibility and responsiveness of project teaching methods to students' input, cultural environment, and experiences (Katz & Chard, 2000; Krajcik, Blumenfeld, Marx, & Soloway, 1994). While these definitions of project work leave much room for interpretation, they do identify certain core criteria for project work as observed by Jansen, (2012).

Project-based teaching and learning seems to be one of the most effective methods for teaching science for understanding. Holubova, (2008) observed that it is necessary to provide in-service teachers instruction (seminars) and prepare sample projects with proposals how to develop, run and evaluate interdisciplinary projects.

Thomas (2000) summarized these key features of project teaching method, which since then have been widely applied in research related to Project Based Learning (PBL):

1) The project's topic is central to learning. In project teaching method, projects represent the central learning strategy that helps students learn about concepts. Projects are not unrelated to the curriculum, nor are they there solely to enhance or illustrate the curriculum. Instead, the project becomes the curriculum (Thomas, 2000). It is via the project that students gain knowledge about disciplines and achieve learning goals.

2) The project evolves around driving questions that encourage students to investigate certain concepts (Blumenfeld et al., 1991; Fallik et al., 2008; Rivet & Krajcik, 2002; Thomas, 2000). Unlike tasks, units, or themes, project work structures learning around these purposeful questions. All the activities and investigations that are done throughout a project need to contribute to answering these questions (Blumenfeld et al., 1991; Katz & Chard, 2000).

3) Students are engaged in in-depth investigations that allow them to construct their own knowledge, usually done by a small group, the whole class, or an individual (Katz & Chard, 2000). These investigations engage students in planning, designing, and conducting real-world research, and encourage them to collect and analyse data and draw inferences from those data (Rivet & Krajcik, 2004; Thomas, 2000).

4) There is an emphasis on student input and autonomy. In fact, projects are student-driven to a large degree. Students make decisions throughout all stages of the project, from selecting the topic to designing the project to presenting results. Although teachers may still initiate topics, projects are founded on students' interests (Helm, 2004; Katz & Chard, 2000; Solomon, 2003; Thomas, 2000).

5) Project work needs to be authentic and include complex questions that are relevant and meaningful to students (Buck Institute of Education, 2009). Authenticity implies responsiveness to students' real-world environments, interests, backgrounds, and lived experiences while incorporating concepts from several other disciplines (Blumenfeld & Krajcik, 2006; Fallik et al., 2008; Thomas, 2000).

6) There is an opportunity for collaboration. Projects need to allow students to negotiate, solve problems, and encourage students to provide, accept, and integrate feedback (Gültekin, 2007; Marx et al., 1997; Solomon, 2003).

7) Projects result in final products. These products arise from the process of investigation and represent student understanding in a variety of ways.

3.0 RESEARCH METHODOLOGY

This section presents methodological approach employed in carrying out the research. It presents research approach adopted, description of study area, data collection method and analysis.

3.1 Research Design

Participatory Action Research (PAR) was employed in undertaking this study. In PAR, actors in the research process share ownership over the research process from the design to the results of the research as observed by Kemmis and McTaggart, (2005). In PAR, the researcher does not participate as the professional expert, but as a team member in executing the study (Kidd and Kral, 2005). As the purpose of this study was to investigate the best way of deploying project method of teaching on students' agricultural skills acquisition, PAR seemed desirable and appropriate in achieving the study objective. As the study involve testing for the significant of the effectiveness of project method of teaching, the PAR design was complemented by a pretest-posttest quasi – experimental design.

A pretest-posttest design is usually a quasi-experiment where participants are studied before and after the experimental manipulation. Pretest-posttest design, defined as participants who are studied before and after the experimental manipulation. Pretest-posttest designs are widely used in behavioral research, primarily for the purpose of comparing groups and/or measuring change resulting from experimental treatments (Marsden and Torgerson, 2012 and Dimitrov and Phillip, 2003). Pretest – posttest quasi – experimental design is considered appropriate for this study which sought to assess the effectiveness of project method of teaching on agricultural students' skills acquisition.

3.2 Pre-intervention – Before the action research

Prior to the implementation of the intervention (project method of teaching) students' knowledge and skills on tomatoes nursery practice were assessed and recorded. Questionnaire administration, key informant interviews, focus group discussion and observation were employed to obtained information about the current situation of the school regarding skills acquisition and students' Knowledge, Attitude, Practices and Skills (KAPS).

In-depth interviews with the Headmaster of the School, Head of Agricultural Science Department and agricultural science teachers were undertaken to learn at first hand, the teaching and learning of agriculture science with emphasis on practical skills.

Short quiz and assigning tasks to students to perform were used to gauge students' prior KAPS regarding agricultural tasks in general and nursing practices in particular. The general agriculture science text book provided information for the short quiz and tasks assigned to students to help gauge students' prior KAPS.

3.3 Intervention – Action Research process

The intervention implemented for the Action Research is assigning students the tasks of raising tomatoes seedlings by using project method of teaching. Project method of teaching has evolved from the philosophy of pragmatism which is experience – centered strategy related to life-situation. Successful accomplishments of project-based learning like the project method of teaching have triggered many studies to focus on the justification of participant based learning in achieving learning objectives (Katz and Chard, 2000).

Students were assigned task of undertaking all the activities involved in nursery practices from nursery bed preparation to transplanting of seedlings. They were provided with all the necessary materials, tools and equipment to enable them undertake all the nursery practices by themselves, either in groups or individually. Although they were made to observe the demonstration of the nursery practice after they were taken through a theoretical presentation of raising seedlings based on the general agriculture science textbook. Throughout the process of the project work, students were expected to be actively involved in making decisions about the design, enactment, and representation of the project while they learned through first-hand observations, hands-on experiences, and systematic reflection.

The project work were done in two different type; namely individual project work and group project work. In the individual type, students were undertaking the nursery practice individually. Each student in this category was tasked to raise one nursery bed/box and execute all the nursery practices alone. While in the group type, students were put into group of five students and tasked to undertake the nursery practices as group. These key characteristics of project work have been shown to be important in increasing students' level of engagement, self-confidence, and intrinsic motivation to learn (Ryan and Deci, 2000; Howard, 2000; Meece, Anderman, and Anderman, 2006).

Only second and first year agricultural science students were selected to participate in this research, because the first years were yet to study nursery practices. In all, there were 52 and 57 second and third years' students respectively. However nine (9) students did not report as at the time of the survey, as such 100 students were involved as participants of the action research.

3.4 Post Intervention – After Action Research

After the intervention was successful implemented, data were collected to assess the effect of the intervention. Also review meeting with school authority, head of agricultural science department, agricultural science teachers and selected students were organized to review and assess the implementation of the intervention. All the activities undertaken by the team were reviewed and lessons learnt were documented to guide future projects and implementation of the findings.

During the implementation phase, students' activities were observed guided by observation check list and video recording which were played at the school review and assessment meeting. Also students' KAPS of tomatoes nursery practices were assessed using semi structured questionnaire designed to gauge their knowledge level, attitude, practice and skills acquired by going through the project work.

3.5 Data Collection Method

Observation, personal interviews, key informant interviews and focus group discussion were methods employed in collecting data for this study. Semi-structured questionnaires and observational check list were the data collection instruments used to guide data collection. Semi-structured questionnaires were administered to students before and after the intervention (project teaching method) in which basic personal data, most frequent teaching method used, their understanding of basic concept of agriculture, their skills and practices of agriculture among other were collected. With the aid of check list, agricultural science teachers and Head of Agricultural Science Department were interviewed to obtained in-depth information on the teaching and learning of agriculture in the school. Also with the aid of observational check list, students' practice of tomatoes nursery were observed by both the researchers and teachers as member of the PAR.

3.6 Data Analysis

Brogan and Kutner, (1980) asserts that there is two common methods of analyzing data from a two-group pretest-posttest research design. These are (a) two-sample t test on the difference score between pretest and posttest and (b) repeated-measures/ split-plot analysis of variance. The repeated-measures/split-plot analysis subsumes the t test analysis, although the former requires more assumptions to be satisfied. In this study repeated measures t test or paired t – tested was applied in analysing the data. Prior to the commencement of the study, a pretest was administered to the participants and after the treatment; a posttest was administered by the agricultural science teachers under the supervision of the researchers. A paired t – test was used to test the effects of project teaching method on nursery skills acquisition among students. Also Chi-square analysis was applied to assess if there exist any significant difference in students' knowledge and skills acquisition among the two ways (individual and group project) of organizing project method teaching.

4.0 RESULTS AND DISCUSSION

This section presents results and discussion of the findings of the action research conducted to investigate the effective way of deploying project method of teaching.

4.1 Effectiveness of project method of teaching on students' knowledge and

Students' knowledge on nursery practices were measured on a four point Likert scale of 0 – 3. The general agricultural science textbook for SHSs listed fourteen (14) nursery practices (GES, 2010). If a student is able to recall a practice, he/she is scored 1, if not 0. If a student recall a practice and correctly explained it, he/she is given a score of 2. If such a student also demonstrate how the practice is undertaken he/she is given the maximum score of 3 for that practice.

An index (referred to here as knowledge index) was developed to reflect students average score of all the fourteen nursery practices. A student score for each of the fourteen practices was divided by 3 (maximum score) and sum up. The sum was divided by 14 to obtain the average knowledge score for such a student and this represent the student's knowledge index. Students whose knowledge index was less than 0.25 were classified as having poor knowledge of tomatoes nursery practice, while those whose index were between 0.25 – 0.5 and above 0.5 were classified as having average knowledge and above average respectively.

With regard to students' skills, for each of the nursery practices students were asked to describe the activities involved in undertaking the task. If a student is able to describe the activities involved in the task he/she score '1' otherwise '0'. After describing the task, if a student is able to mention the materials and tools require to accomplish the said task he/she score 2. After which students were offered the opportunity to undertake the activities. Students who were able to correctly undertake the activities involved in the performance of nursery practices were assigned a score of 3. To standardized the score, student score for each of the nursery practices was divided by 3 (the maximum score) and the average score representing students' skills index was calculated for all the students. As such the index was ranging from zero to one.

Students whose skills index were less than 0.25 were classified as being 'Not yet competent', those with skills index of 0.25 – 0.5 were classified as 'averagely competent' and those with index of above 0.5 as 'very competent'.

To test significant difference between pre-intervention knowledge and skills of students and post intervention knowledge, paired t-test were conducted and results shown in Table 1. The test was done to examine the hypotheses:

Ho_1: There is no significant difference in knowledge of students before and after they undertook the project.
Ha_1: There is significant difference in knowledge of students before and after they undertook the project.
Ho_2: There is no significant difference in skills of students before and after they undertook the project.
Ha_2: There is significant difference in skills of students before and after they undertook the project.

As shown in the Table 1, with t value of -13.03 (df = 99; sign = 0.00), the hypothesis H_{o1} was rejected in favour of the alternative. Implying that there is significant difference in students' knowledge index before and after the intervention. As shown in the Table 1, while the average students' knowledge index before the intervention was found to be 0.48, their average score after going through the intervention is 0.68.

This indicates a change of 0.20 between the students' knowledge index of before and after the intervention. Thus after going through the project, students averagely scored 0.2 knowledge index above their pre intervention knowledge index. Thus the intervention have significantly contributed in improving students' knowledge of nursery practice.

Similarly, as shown in the Table 1, with t value of -19.09 (df = 99; sign = 0.00), the null hypothesis Ho_2 was rejected in favour of the alternative. Implying that there is significant difference in students' skills index before and after the intervention. As shown in the Table, while the average students' skills index before the intervention was found to be 0.39, their average skills index after going through the intervention is 0.65.

This indicates a change of 0.26 between the students' skills index before and after they took part in the action research. Thus after going through the project, students averagely scored 0.26 skills index above their pre intervention skills index. Thus the intervention have significantly contributed in improving students' nursery practice skills. This finding agrees well with the view of Chard, (2001); Deci and Ryan, (2000); Howard, (2000); Meece, Anderman and Anderman, (2006) Umar et al, (2016) that project method of teaching creates the learning environment which provides hand – on experience for students and its enable them to better understand and acquire the requisite knowledge and skills.

Table 1: Paired Samples Statistics

Stage of the intervention		Mean	Std. Deviation	Paired Differences		t	df	Sig.
				Mean	Std. Deviation			
Knowledge Index	Before	0.48	0.45	-0.20	0.15	-13.03	99	0.00
	After	0.68	0.33					
Skills Index	Before	0.39	0.40	-0.26	0.14	-19.09	99	0.00
	After	0.64	0.32					

Source: Analysis of field data, 2017

4.2 Effective way of undertaking project method of teaching

The study also assessed the best way of organizing project method of teaching to ensure its effectiveness in imparting knowledge and skills on students. In the action research conducted, students were randomly assigned into two groups, with the first group tasked to undertake the activities of raising tomatoes seedlings individually while the second group undertook their projects in a group of not exceeding five students per group. Students' performance under the two ways (individual and group) of administering project method of teaching were assessed and compared. This section presents results of the analysis and comparison of the two ways in which students can be organized for project method of teaching.

4.2.1 Knowledge level of students in group and individual

To administer the project method of teaching, students were randomly assigned to either undertake raising of tomatoes seedlings in groups of five or individually. After going through the project their knowledge level was assessed and contrasted to test the significant difference between the average performance of students who undertook the project in groups and those who did it individually. This was done to test the hypothesis:

Ho_3: There is no significant difference in the knowledge level of students who took the project in groups and those who did it individually.

Ha_3: There is significant difference in the knowledge level of students who took the project in groups and those who did it individually.

To test the hypothesis students' post intervention knowledge index were subjected to independent t – test and tested at 5 percent level of significant. Result of the t-test is shown in the Table 2.

As shown in the Table 2 with t-value of -2.02 (df =98), implies there is significant difference between average knowledge of students who undertook the nursery practices in group and those who did it individually at 5% level of significant. As such the null hypothesis (Ho_3) which state '*there is no significant difference in the knowledge level of students who took the project in groups and those who did it individually*' is rejected and the conclusion is that there is significant difference in the knowledge level of students who did the project in groups and those who did it individually.

As shown in the Table (Table 2) the average knowledge index of those who did the project in groups was found to be 0.73 compare with the average score of 0.63 for those who did it individually. It therefore clear that students who undertook the project as groups were more likely to score high knowledge index compare with those who did it individually. Apparently because doing it in group offer the students opportunity to discuss and share ideas as they do it together, which is not the case for those who did it individually. Also organizing it in group also reinforces group learning and team building very important in building students' skills acquisition.

Also students' knowledge index which was classified into classes as 'poor', 'average' and 'above average' for knowledge index of less than 0.25, 0.25 – 0.5 and above 0.5 respectively were subjected to Chi - square analysis to test if there is significant difference in students' knowledge category between those who did the project in groups and those who did it individually. Results of the crosstabulation and Chi-square analysis is shown in the Table 3.

As shown in the Table 3, with Pearson Chi-Square (χ^2) = 3.56; df= 1; sig. = 0.046, implies there is significant difference in the knowledge level of students who did the project in groups and those who did it individually at 5% level of significant. As shown in the Table 3, majority (58 percent) of students who did the project in groups scored above average knowledge compare with only 42 percent in the case of those who did it individually.

Table 2: Group Statistics and Independent Samples Test of knowledge before and after

Participation form	N	Mean	Std. Deviation	t	df	Sig.
Individual	50	0.6360	0.32811	-2.021	98	0.0418
Group	50	0.7300	0.33335			

Source: Analysis of field survey data, 2017

Table 3 crosstabulation of participation category and post intervention knowledge

Post intervention Knowledge level			Participation form		Total
			Individual	Group	
Knowledge	Average	Count	29	21	50
		% within Participation category	58.0%	42.0%	50.0%
	Above average	Count	21	29	50
		% within Participation category	42.0%	58.0%	50.0%
Total		**Count**	**50**	**50**	**100**
		% within Participation category	**100.0%**	**100.0%**	**100.0%**

Pearson Chi-Square (χ^2) = 3.56; df= 1; sig. = 0.0460
Source: Analysis of field survey data, 2017

4.2.2 Differential improvement of students' knowledge

Improvement of students' knowledge level after going through the project and whether doing the project in groups and individually bring any significant difference to students' knowledge improvement were examined and tested. The difference of students' knowledge index before and after the project were calculated and compare across the two forms of participation as 'group and individual'. Independent t-test was conducted to test whether there is significant difference in knowledge improvement between students who did the project in groups and those who did it individually. This was to test the hypothesis that:

Ho_4: there is no significant difference in knowledge improvement between students who did the project in groups and those who did it individually.

Ha_4: there is significant difference in knowledge improvement between students who did the project in groups and those who did it individually.

Results of the independent t-test is shown in the Table 4. As shown in the Table 4, with t –value = 1.976 (df = 98) and p = 0.047 indicates that there is significant difference in knowledge improvement between students who did their project in groups and those who did theirs individually at 5% level of significant. As shown in the Table 4, while the average knowledge index of those who did their project in groups increased by 0.22 those who did it individually have theirs increased by 0.18.

Table 4: Independent Samples Test of students' knowledge difference before and after

Participation form	N	Mean	Std. Deviation	t	df	Sig.
Individual	50	0.1800	0.15194	1.976	98	0.047
Group	50	0.2240	0.15649			

Source: Analysis of field survey data, 2017

4.2.3 Skills level students in group and individual

Post intervention skills index of students who did their project in groups was contrasted with those who did theirs individually. This was done to test the hypothesis:

Ho5: There is no significant difference in the skills level of students who took the project in groups and those who did it individually.

Ha5: There is significant difference in the skills level of students who took the project in groups and those who did it individually.

To test the hypothesis students' post intervention skills index were subjected to independent t – test and tested at 5 percent level of significant. Result of the t-test is shown in the Table 5.

With t-value of -1.96 (df =98), as shown in the Table 5, means that there is significant difference between average skills index of students who undertook the nursery practices in group and those who did it individually at 5% level of significant. As such the null hypothesis which state '*there is no significant difference in the skills level of students who took the project in groups and those who did it individually*' is rejected and the conclusion is that there is significant difference in the skills of students who did the project in groups and those who didn't individually. Similar findings were unearthed in Umar et al, (2016).

As shown in the Table (Table 5) the average skills index of those who did the project in groups was found to be 0.71 compare with the average score of 0.61 for those did it individually. It therefore clear that students who undertook the project as groups were more likely to have acquired more skills compare with those who did it individually. Apparently because doing it in group offer the students opportunity to discuss and share ideas as they do it together, which is not the case for those who did their project individually. They can also assist each other in undertaking the activities to achieve collective perfection. Also organizing students' projects in group also reinforces group learning and team building which is very important in building students' skills acquisition.

Also students' skills index which was classified into categories as 'not yet competent', 'averagely competent' and 'very competent' for skills index of less than 0.25, 0.25 – 0.5 and above 0.5 respectively were subjected to Chi - square analysis to test if there is significant difference in students' skills level between those who did the project in groups and those who did it individually. Results of the crosstabulation and Chi-square analysis is shown in the Table 6.

As shown in the Table 6 with Pearson Chi-Square ($\chi 2$) = 3.44; df= 1; sig. = 0.048, implies there is significant difference in the skills level of students who did the project in groups and those who did it individually at 5% level of significant. As shown in the Table 6, many (46 percent) of students who did the project in groups scored very competent in their skills level compare with only 32 percent in the case of those who did it individually. Similarly, more than two-third (68 percent) of students who did their project individually were found to be averagely competent while about half (54 percent) of students of students who did theirs in groups were also found to be averagely competent in their skills level after the intervention.

Table 5: Independent Samples Test of students' skills before and after

Participation form	N	Mean	Std. Deviation	t	df	Sig.
Individual	50	0.61	0.31	-1.968	98	0.046
Group	50	0.71	0.32			

Source: Analysis of field survey data, 2017

Table 6: crosstabulation of participation category and post intervention skills

Post intervention skills level			Participation form		Total
			Individual	Group	
Skill level	Averagely competent	Count	34	27	61
		% within Student category	68.0%	54.0%	61.0%
	Very Competent	Count	16	23	39
		% within Student category	32.0%	46.0%	39.0%
Total		**Count**	**50**	**50**	**100**
		% within Student category	**100.0%**	**100.0%**	**100.0%**

Pearson Chi-Square ($\chi 2$) = 3.442 df= 1; sig. = 0.0481
Source: Analysis of field survey data, 2017

4.3 Improvement of students' skills before and after

Whether doing the project in groups or individual have any significantly varying effect on the improvement of students' skills level was examined. The difference of students' skills index before and after the project were calculated and compared across the two forms of participation as 'group and individual'. Independent t-test was conducted to test whether there is significant difference in skills improvement between students who did the project in groups and those who did it individually. This was to test the hypothesis that:

Ho_6: there is no significant difference in skills improvement between students who did the project in groups and those who did it individually.

Ha_6: there is significant difference in skills improvement between students who did the project in groups and those who did it individually.

Results of the independent t-test is shown in the Table 7. As shown in the Table 7 with t –value = 0.220 (df = 98) and p = 0.22 indicates that there is no significant difference in skills improvement between students who did their project in groups and those who did theirs individually at 5% level of significant. Thus students attained most equal improvement in their skills level whether they did the project in groups or individually.

Table 7: Group Statistics and Independent Samples Test of skills improvement

Student category	N	Mean	Std. Deviation	t	df	Sig.
Individual	50	0.2620	0.13834	0.220	98	0.826
Group	50	0.2560	0.13426			

Source: Analysis of field survey data, 2017

5.0 Conclusion and recommendations

Project method of teaching agricultural practice contributed significant in improving students' knowledge and skills acquisition. There was significant improvement in students' competent in undertaking tomatoes nursery after going through their projects. Assigning project to students in a group of not more than five students is effective in imparting agricultural knowledge and skills on students. The group method was found to be cost effective and efficient in improving students' knowledge and skills in nursery practices. The study therefore recommends that project method of teaching should be employed in teaching agricultural practices as it found to be effective in imparting knowledge and skills on students. Also to ensure cost effectiveness and effective knowledge and skills acquisition, project method of teaching should be organized in a group of not more than five students.

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