Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana

Amuriyaga Isaac Diise¹  *Hudu Zakaria² and Abujaja Afishata Mohammed³

¹Educational Supervisor, Ghana Education Service, Navrongo Municipality of the Upper East Region  
²Department of Agricultural Extension, Rural Development and Gender Studies, Faculty of Agribusiness and Communication Sciences, University for Development Studies (UDS), Tamale, Ghana  
³Department of Agricultural and Consumer Science Education, Faculty of Agriculture, University for Development Studies UDS, Tamale, Ghana

Agricultural education and training is expected to produce graduates with the requisite agricultural knowledge, skills and practice needed to meet the job market demand and to generate interest in farming. In this paper finding of a study which examined effectiveness of a project method of teaching agricultural skills and practice on students’ agricultural competency is presented. The study was conducted among agricultural science students of Awe Senior High School in the Upper East Region of Ghana. Participatory Action Research methodology with pretest-posttest quasi – experimental design was employed in conducting the study. Through simple random sampling, 100 students were sampled and randomly assigned a project of raising tomato 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. Repeated measures t-test or paired t-test was applied in analyzing the data and testing the hypotheses. Results of the study found project method of teaching to be effective in imparting agricultural knowledge, skills and practice on students. It is recommended that project method of teaching should be employed in teaching agricultural skills as it was found to be effective in imparting knowledge and skills on students.

Key words: Project method of teaching, agricultural practical, nursery practices, skills acquisition, action research

INTRODUCTION

In the midst of rising youth unemployment, the requirements of the job market in terms of skills and experience keep on changing and unleashing stiffer competition among job seekers. In some instances, the curricula and training of educational systems have failed to produce graduates with the requisite technical skills and competencies demanded by employers (CBI 2011 and UKCES, 2011). The skills gap is often attributed to the non-responsiveness of the educational system to the labour market requirement in their curricula development and instructional methods, and techniques employed in training students.

Responsive educational system must focus on assisting the development of employable skills needed to facilitate students’ ability to meet the expectations of employers and to generate self-employment opportunities. The stiff competition in today’s job market is eminent for students to develop technical skills apart from general employable

*Corresponding Author: Hudu Zakaria, Department of Agricultural Extension, Rural Development and Gender Studies, Faculty of Agribusiness and Communication Sciences, University for Development Studies (UDS), Tamale, Ghana. Email: hzakaria@uds.edu.gh
skills. It is therefore, incumbent on the education system to develop curricula and employ pragmatic teaching methods which will equip students with the requisite employability skills and the needed entrepreneurial skills to enable them take up self-employment.

It is a firm belief that the best and sustainable way of dealing with joblessness among Ghanaian youth is for the educational institutions to design and implement responsive and labour market oriented educational training which impart both technical and entrepreneurial skills onto students. Entrepreneurial and self-employment generation have been noted as the lasting and sustainable way of dealing with the problem of youth unemployment in Ghana. Owusu-Ansah and Kofi (2012) noted that entrepreneurial education and training, and the promotion of creativity and self-employment among school leavers is the best way of sustainable dealing with the situation of graduate unemployment in Ghana. Similarly, Zakaria and Alhassan (2018) in their studies which assessed the employability of students in two Ghanaian tertiary students concluded that there is the need for entrepreneurial training and orientation of students in tertiary institutions in order to equip and inspire them in terms of self-employed enterprise creation and skills development.

However, Diise, Zakaria and Mohammed (2018a) observed that the ineffectiveness of practical skills training as a result of challenges confronting school authorities and teachers in the teaching and learning of practical agricultural is the reason for the general lack of technical and employable skills of Ghanaian graduates of agricultural educational institutions

Problem Statement

It is an understatement to say that the skills and competences required of agricultural science students exceed those found among ‘regular’ Senior Secondary School leavers. It is expected that agricultural science graduates of Senior High Schools (SHSs) would have the basic understanding of agricultural science concepts, and possess the required skills and needed competencies in agricultural practices and the right attitude to enable them take up professions in agricultural sector or further their education in different aspects of agriculture. However, graduates of agricultural science often lack the required skills and competencies in basic agricultural practices making them unable to engage in agricultural production as professionals (Darko et al., 2015 and Blackie, et al., 2009).

Also their employability is often challenged because they often lack the basic skills in agricultural practices required by employers. Similarly, Ghanaian agricultural science graduates often lack the requisite entrepreneurial skills and the right mindset to engage in self-employed agribusiness enterprises. The educational system is expected to focus on imparting employable skills to students and facilitate their ability to meet the expectations of employers or be able to create and run agricultural enterprises as self-employer. Information gathered from literature have attributed the phenomenon of unskilful agricultural graduates to ineffective teaching and learning of practical agriculture, and incompetent agricultural instructors and teachers, lack of basic teaching and learning materials among others (Alkali, 2010; Darko et al., 2015; Diise, Mohammed and Zakaria, 2018b; Olaiyam and Ojo, 2008 and Shimaye, 2007).

Alkali (2010) bemoaned the over reliance of lecture teaching and demonstration methods usually used in teaching agricultural skills, which often failed to impart to students the required skills and attitude to be able to take up farming after graduation. He indicated that only 3% of those who were trained in agricultural institutions take to agriculture after leaving school. He attributes this to ill preparation of the graduates whose training does not equip them with the requisite knowledge and practical skills in agriculture. Also Olaniyan and Ojo (2008) reported that the increase in students' enrolment in most secondary schools in recent times has created large class sizes that make it difficult for a single teacher to manage practical lessons in such a way that he/she offer every student the opportunity to practice. As such emphases are placed on theoretical agriculture to the detriment of practical lessons, thus producing students who are ill equipped with the needed skills and competent in agricultural practices.

In finding effective solutions to dealing with the obvious skill gap of graduates of agricultural schools, research attention has now been focused on investigating effective approach of organizing teaching and learning of practical agriculture to ensure that graduate produced possess need skills. Varied strategies; instructional materials and methods; and different types of assessment are employed in the teaching of practical Agriculture in Senior Secondary Schools (Anthony, Idris and Pev, 2016). Teaching of practical agriculture is often given less attention and important in comparison with theoretical agriculture. Olutunji, and Wigwe (2011) observed that SHSs students are often exposed to less than a third of agricultural science practical lessons prescribed in the curricula. A study by Darko et al. (2016) established that practical teaching of agricultural science in the SHSs in Ghana was greatly impeded by lack of school garden, animal farm, educational trips, demonstration plots, and well-equipped laboratory. Their study also found lack of funds to be the major challenge to practical work in agricultural Science in the SHSs

Theresa (2015) investigated the effect of video-taped instruction on the acquisition of slashing and raking skills in practical agricultural science among male and female secondary school students and concluded that video-taped instruction impacted positively on agricultural skills
acquisition. Also Samuel (2012) commented that students who participated in nurturing school farm is bound to acquire the needed skills and appreciation of relevance agricultural practices. As cited in Theresa (2015), FAO, 2012 observed that, in secondary schools in particular, the familiarization of students with up-to-date methods for improved sustainable production of food that are applicable to their homesteads or farms is a potentially powerful tool for improving students’ skills and competencies in agriculture. A study by Deegan, Wims and Pettit (2016) on the practical skills training in agricultural education stressed the suitability of blended learning not only when it was found that there was no significant difference between method of teaching and skill acquisition but also when it was revealed that student demographics had no major influence on skill acquisition. It is in furtherance to the efforts of searching for effective and best way of organizing teaching and learning of agriculture in SHSs to ensure the acquisition of requisite skills and practice among students, that this paper presents findings of a study investigating the effectiveness of a project method of teaching on students’ acquisition of tomatoes nursery skills and practice among agricultural students of Awe SHS in the Navrongo Municipality.

**Hypotheses**

The paper specifically tested the following hypotheses:

H01: There is no significant difference in knowledge of students before and after they undertook the project.

H1: There is significant difference in knowledge of students before and after they undertook the project.

H02: There is no significant difference in skills of students before and after they undertook the project.

H1: There is significant difference in skills of students before and after they undertook the project.

**REVIEW OF RELEVANT LITERATURE**

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 science, it has also been reported that practical lessons makes learning more enjoyable (Osborne & Collins, 2001; Jenkins & Nelson, 2005; Toplis, 2012). Also practical lessons had long been noted as helping ‘to arouse and maintain’ positive attitudes in students’ towards science and other related disciplines (Hodson, 1990; Swain, Monk & Johnson, 1999).

In the past quarter of a century, educational researchers and policy makers have called for a focus on the development of students’ deep understanding, higher thinking skills, and problem solving skills (Darko et al., 2016; Deegan et al., 2016; Krajcik, McNeill, and Reiser, 2007; Perry, Phillips, and Dowler, 2004). Project teaching method or otherwise refers to as project work, along with other innovative, complex, and authentic tasks, has been shown to be effective in imparting skills (Deegan et al., 2016; 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 (Diise et al., 2018b; 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 highlight the methods, emphasize, flexibility and responsiveness of project teaching methods to students’ input, cultural environment, and experiences (Helm & Katz, 2001; 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).

Thomas (2000) summarized the key features of project teaching method as:

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.

2) The project revolves around driving questions that encourage students to investigate certain concepts (Blumenfeld et al., 1991; Fallik et al., 2008; Rivet & Krajcik, 2002; Thomas, 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).

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.
5) Project work needs to be authentic and include complex questions that are relevant and meaningful to students (Buck Institute of Education, 2009).
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.

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 analytical techniques employed.

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 assess the effectiveness of project method of teaching on students' agricultural skills acquisition, employing PAR seemed desirable and appropriate. As the study involve testing 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-experimental design where participants 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 because its provides scientific and statistical basis of comparing results before and after.

Pre-intervention

Through the right community and school entering techniques, leadership of School Management Committee (SMC), Headmaster and teachers of Awe SHS was engaged. School authority, head of agricultural science department and teachers was briefed on the purpose of the action research and the procedure which will be embarked on in executing the research. Facilities such as land for the nursery practices, tools and equipment were all arranged with approval of the school authority. Prior to the implementation of the intervention (project method of teaching) students’ knowledge and skills on tomato 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 was 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 nursing practice 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.

Intervention

The intervention implemented for the Action Research is testing the effectiveness of Project Teaching Method on students’ knowledge and skills of tomatoes nursery practices. 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 practice by themselves, either in groups or individually. Although they were made to observed demonstration of the nursery practice after theoretical presentation of raising seedling 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 learn through first-hand observations, hands-on experiences, and systematic reflection.

The project work was 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 practice alone. While in the group type, students were put into group of five students and tasked to undertake the nursery practice 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; Meece, Anderman, and Anderman, 2006).

Only second and third years’ 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.

Post Intervention

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 tomato 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.

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 Departments of agriculture were interviewed to obtained in-depth information on the teaching and learning of agriculture in the school. Also with the aid of observation check list, students’ practice of tomatoes nursery were observed by both the researchers and teachers as member of the PAR.

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 – tests was applied in analysing the data. Prior to the commencement of the study, a pretest was administered to the participating students and after the treatment for four weeks; 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.

RESULTS AND DISCUSSION

This section contains results and discussions on pre – and post intervention assessments of students’ knowledge and skills of tomato nursery practice.

The Project teaching method which has evolved from the philosophy of pragmatism and experience – centered strategy related to life-situation, was employed to impart tomato nursery practice skills on students. Katz and Chard, (2000) observed that 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.

Students were assigned task of undertaking all the activities involved in nursery practices from nursery bed/box preparation to transplanting of seedlings. They were provided with all the necessary materials, tools and equipment to enable them undertake nursery practice by themselves, either in groups or individually.

To scientifically examine the effectiveness of this intervention on students’ nursery skills acquisition, data on students’ prior knowledge and skills on nursery practices were gathered and analysed. All students who participated in this study have gone through nursery practices in their general agricultural science course. As such it was proper to examine their knowledge and skills level before they were assigned the project work of raising tomato seedlings.

Students’ pre intervention knowledge and skills

This section presents results of analysis of students’ knowledge and skills of nursery practices before they undertook the project work.

Students’ Prior Knowledge

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 recalls a practice and correctly explained it, he/she is given a score of 2. If such a student also demonstrates 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 measure 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 tomato 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. Figure 1 presents results of students’ prior knowledge score on all the fourteen nursery practices. And that of table 1 presents distribution of students’ knowledge classification prior to the intervention.

As shown in the figure 1, respondents generally could recall most of the fourteen activities involved in nursery practices. About 80 percent, 73 percent and 71 percent could recall site selection, preparing nursery bed/box respectively. Also 80 percent, 79 percent and 80 percent could respectively recall seed sowing, weed control and watering of seedling. However, few of them could recalled shading of seedlings in nursery bed (43 percent), picking out (41 percent), stirring of soil (32 percent), pest and disease control (31 percent) and hardening off of seedlings (32 percent).

Students were also required to explain these nursery practices by highlighting what they are and their relevant. As shown in the figure 1, close to two-third (61 percent) of the students could explain site selection, while 52 percent could explain preparation of nursery beds and 75 percent could explain sowing of seeds in nursery bed. However, very few students could explain picking out (33 percent), pest and disease control (26 percent) and hardening off (23 percent).

However, students generally were found wanting when asked to demonstrate these nursery practices. The results as shown in the figure illustrates that with the exception of site selection, preparation of nursery bed, sowing of seeds and watering of seedling where 52 percent, 46 percent, 54 percent and 52 percent respectively could correctly demonstrate how to do it, only few students could demonstrate how to perform the other activities. For instance, as shown in the Figure 1, only 30 percent could demonstrate shading of seeding in nursery beds, 23 percent could demonstrate stirring of soil, and 26 percent and 23 percent could respectively demonstrate pest and disease control and hardening off of uproot seedlings.

Figure 1: Pre intervention knowledge on nursery practices

Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana
In general, just about a third (37 percent) have their knowledge index being above 0.5 and as such classified as having above average knowledge before the intervention of project teaching method was implemented (see table 1). Also 41 percent have their knowledge index being less than 0.25 and as such classified as having poor knowledge. As shown in the table about a quarter (22 percent) scored a knowledge index of 0.25 - 0.5 and were classified as having average knowledge of tomatoes nursery practices.

Many of the students (41 percent) inspite of have been studied nursery practices in their general agricultural science demonstrate poor knowledge in nursery practices. With some of them not being able to recall the practices and explain them. Majority of them were unable to demonstrate how to perform the tasks involved in nursery practices. It can therefore be argued that the current way in which the teaching and learning of agriculture is done in the school need to be reviewed. It is obvious that lecture and classroom demonstration method of teaching agricultural practices are failing in imparting the requisite knowledge and understanding on students. Similarly, observations were made in Alkali, (2010), Darko et al., (2016), Darko et al., (2015) and Olaiyam and Ojo, (2008).

<table>
<thead>
<tr>
<th>Table 1: Prior Knowledge level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Knowledge pre-intervention</td>
</tr>
<tr>
<td>poor</td>
</tr>
<tr>
<td>average</td>
</tr>
<tr>
<td>above average</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Source:** Analysis of field data, 2017

**Students Prior Skills**

A four point Likert type scale was developed to measure students’ level of skills in undertaking nursery practices. Students’ skills were assessed by their ability to describe the tasks, mention the materials and tools require accomplishing the task and actual performance of the task. The bar graph shown in the figure 2 present frequency distribution of number of students who were able to describe the task, mention what is require to perform the task and actual performance of the task for each of the nursery practices.

As shown in the figure, student performed fairly well in describing the tasks involved in each of the nursery practices. As shown in the figure 2, about half (49 percent) of the students’ participants could describe the task involved in site selection, 43 percent could describe the tasks involved in preparing nursery beds, 51 percent and 49 percent could describe the activities involved in the performance of seed sowing and watering of seedlings respectively. However, for some tasks such as shading seedling in nursery beds (27 percent), picking out (20 percent), pest and disease control (23 percent) and hardening off of uprooted seedlings before transplanting (20 percent) only very few students were able to describe the tasks involving in performing them.

Similarly, with regard to students’ ability to identify the tools and materials require in performing nursery practice, students performed fairly well for some activities and very poorly for others. About 44 percent of students could identify tools and material required to assist in selecting site for nursery, 38 percent could identify the material and tools for preparing nursery beds and 45 percent could mention the tools and materials required for sowing. However, only 30 percent, 27 percent, 17 percent and 15 percent could mention the tools and materials required in undertaking fertilizer application, watering after planting, hardening off and pest and disease control respectively. Regarding actual performance of the various tasks, the results as shown in the figure 2 indicates that only 40 percent could correctly undertake site selection activities, while 30 percent and 41 percent could correctly execute nursery bed preparation and sowing respectively. Similarly, only 22 percent could correctly practice shading seedlings in nursery beds, while 17 percent and 27 percent could actually practice stirring of soil in nursery beds and fertilization respectively. In addition, only 14 percent could practice pest and disease control while 30 percent and 22 percent could practice transplanting and watering after transplanting respectively. It was surprising to discover that some students could not correctly handle watering cane and demonstrate watering of tomato seedlings on nursery beds.

For each of the nursery practices students were asked to describe the activities involved in undertaking the task. If a student describes accurately activities involved in the performance of a task, he/she scores ‘1’ otherwise ‘0’. If a student in addition to describing activities involved the task accurately, mention materials and tools require in accomplishing the said task he/she scores 2. After which students were offered the opportunity to under 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.

Students with skills index less than 0.25 were classified as ‘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’. Frequency distribution of students’ skills level is shown in the table 2. As shown in the table 2 about two –third (61 percent) of the students were not yet competent in undertaking nursery practices while 19 percent and 20 percent could be described as averagely competent and very competent respectively.
Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana

Zakaria et al.

1. Introduction

The study assesses the effectiveness of project method of teaching on agricultural knowledge and skills acquisition among agricultural science students of Awe Senior High School in the Upper East Region, Ghana. The study aims to evaluate the impact of project-based learning on student engagement, understanding, and skill development in agricultural sciences.

2. Methodology

The study employs a qualitative research design, using a combination of classroom observations, interviews, and student surveys to gather data. The research method involves the implementation of a project-based learning approach, where students are tasked with designing and executing agricultural projects.

3. Results and Analysis

- **Figure 2**: Students' pre-intervention skills level of nursery practices

  - **Source**: Field Survey, 2017

  - **Table 2**: Prior intervention skills level

    | Skill level before intervention | Frequency | Percent (%) |
    |---------------------------------|-----------|-------------|
    | Not yet competent               | 61        | 61.0        |
    | Averagely competent             | 19        | 19.0        |
    | Very competent                  | 20        | 20.0        |
    | **Total**                       | **100**   | **100.0**   |

  - **Source**: Analysis of field data, 2017

**Post Intervention Analysis**

After students were tasked to undertake nursing of tomato seedling by practically carrying out the necessary practices in groups and individually, their knowledge and skills were again assessed. The result of the assessment referred to as post-intervention knowledge and skills is presented in this section. Figure 3, shows group of students working on their tomatoes nursery projects.

**Figure 3**: Group of students working on their tomatoes nursery projects

**Source**: Field Survey, 2017

- **Post Intervention Knowledge**

  After the intervention students' ability to recall, explain and demonstrate the various nursery practices were analysed and the results shown in the figure 4. As shown in the figure, majority of the students could recall site selection (90 percent), nursery bed preparation (86 percent), seed sowing (86 percent), shading of seedlings (78 percent), picking out (77 percent), weeding (76 percent) stirring of soil (76 percent), hardening off (76 percent) and transplanting (76 percent). This was much improvement over their pre-intervention ability to recall nursery practices as shown in the figure 1. For instance, before the intervention only 41 percent, 32 percent and 34 percent could recall picking out, stirring of soil and pest and disease control respectively as compare with post intervention results which shows that about 77 percent can now recall picking out, 76 percent for stirring of soil and 76 percent for disease and pest control.

  Similarly, much improvement was seen in students' ability to explain the various necessary practices after they have gone through their respective projects. As shown in the Figure 4, about 80 percent of the students can now explain how to undertake site selection for nursery practices compare with 61 percent who could do so before the intervention. Also 77 percent can now accurately explain the process of nursery bed preparation compare with 55 percent who could do so before the intervention. Similarly only 30 percent of the student participants could explain how to undertake stirring of soil in nursery bed before the intervention, which have seen more than two fold (72 percent) increased after the intervention.
Also, before the intervention, only 23 percent of the student participants could explain how to undertake hardening off of seedling before transplanting. This figure had increased to 70 percent of the respondents now being able to explain hardening off after the intervention. It can therefore be argued that the intervention have positive impacted on students’ ability to understand the nursery practices. Their understanding of the nursery practices had seen much improvement after going through their projects of undertaking nursery practices.

With regard to students’ post intervention ability to demonstrate how to practice the various nursery practices, drastic improvement were observed. While only 52 percent of the respondents could demonstrate how to undertake site selection before the intervention, 77 percent of them can now demonstrate how to undertake site selection after they have undertaken their project. Similarly, while 70 percent of student participants were able to demonstrate how to practice picking out of seedling from nursery beds, after going through the project compare with only 33 percent who could do so before the intervention. Also, while only 30 percent were able to demonstrate how to undertake shading of seedlings in nursery beds before the intervention, after the intervention 64 percent can now be able to demonstrate the practice of shading seedlings on nursery beds.

All participants of this study demonstrated high level of knowledge of nursery practices after going through their projects assigned them as part of the intervention. Analysis of students’ knowledge index, which measure students’ ability to recall, explain and demonstrate the activities of the nursery practices, reveals much improvement on students overall knowledge level. The analysis revealed that none of the students have knowledge index of less than 0.25 after going through the project compare with 41 percent who scored less than 0.25 before the intervention. Also 50 percent scored knowledge index of more than 0.5 after the intervention compare with only 37 percent before the intervention.

**Post Intervention Skills level**

Students’ level of skills regarding tomato nursery practices were measured by their ability to describe task involved in carrying out nursery practices, understanding of tools and
materials required to undertake the activities and actual performance of the activities. Result of the analysis of students’ score for each of the three criteria is shown in the figure 5. As shown in the figure, there have been appreciable increased in students’ skills level after the implementation of the intervention. After students have gone through their projects, students who could accurately describe the task involved in undertaking site selection increased from 49 percent to 83 percent. Similarly, while 44 percent and 27 percent respectively could accurately describe the tasks involved in undertaking nursery bed preparation and shading of seedlings in nursery bed before the intervention, the figure sharply increased to 77 percent and 76 percent respectively who could now describe the tasks involved in undertaking nursery bed preparation and shading of seedlings in nursery after they gone through their respective projects (see figure 2 and 5). Also, as shown in the figure 5, about 72 percent and 70 percent of the students after going through their projects can now described stirring of soil in nursery beds and pest and disease control respectively. This represent substantive improvement compare with only 25 percent and 23 percent who were able to described the tasks involved in undertaking stirring of soil in nursery beds and pest and disease control respectively before the intervention.

Similarly results of improvement in students’ ability to identify the tools and material required in undertaking the various nursery practices after intervention was obvious. Overwhelming majority (77 percent) after going through the project method of teaching tomato nursery practices were able to mentioned all the necessary tools and equipment needed to identify appropriate site for siting nursery compare to 44 percent who were able to do so before the intervention (see figure 2 and 5). Also as shown in the figure 2 and 5, while only 34 percent and 28 percent respectively could mentioned the necessary tools and equipment require to undertake the tasks of carrying out shading of seedlings in nursery and picking out of mature seedling for transplanting, after going through the project method of teaching proportion of students who could do that now increased to 74 percent and 69 percent respectively.

Similarly, students ability to actual perform the various nursery practices was greatly enhanced after they have gone through the project method, where they were offered the opportunity to actual practice the various nursery practices in groups and individually. As shown in the figure 2 and 5, while only 30 percent of the students could actually prepare nursery bed before the intervention, analysis of post intervention score revealed that overwhelming majority (70%) of the students were able to perform preparation of nursery bed after the intervention. Also students’ ability to undertake shading of seedlings on nursery bed and practice picking out of mature seedling from nursery bed/box for onward transplanting witnessed much improvement after students have been taken through project method of teaching. As shown in the figure 2 and 5, while only 22 percent and 25 percent respectively were able to accurately practices shading of seedling on nursery bed and picking out of seedling for transplanting before the intervention, after going the intervention 70 percent and 67 percent have been able to perform shading of seedlings on nursery bed and practice picking out of seedlings from nursery respectively. Similarly, after going through the project method of teaching, 63 percent and 67 percent respectively have been able to respectively undertake hardening off of uprooted seedlings before transplanting and pest and disease control compare with only with only 14 percent who were do so before the intervention (see figure 2 and 5).
Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana

This section presents results and discussion of findings of the study relating to effect of the intervention in improving students’ knowledge and skills of nursery practice.

**Effect of the intervention on students’ knowledge**

Based on students’ knowledge index which was calculated as aggregate of students score on their ability to recall all the activities in nursery practices, explain the activities and demonstrate how to undertake the activities involved in nursery practices, students were categorised as poor (if score knowledge index less than 0.25) average (if score knowledge index of 0.25 – 0.5) and above average (if score knowledge index of more than 0.5). Figure 6 presents students’ knowledge level before and after going the intervention.

As shown in the figure 6, while 41 percent of the students assessed were classified as having poor knowledge based on their knowledge index before the intervention, after going through the project all of the students scored above poor. Also while only 22 percent of the student participants were found in the pre intervention assessment to have average knowledge of nursery practice, after going through project 50 percent, were found to have average knowledge in the post intervention assessment. Similarly, while 37 percent of the students in the pre-intervention assessment were found to have above average knowledge on nursery practices, after going through the intervention, the figure increased to 50 percent.
To test significant difference between pre-intervention knowledge of students and post intervention knowledge, paired t-test were conducted and results shown in table 3 and 4. The test was done to examine the hypothesis:

**Ho:** There is no significant difference in knowledge of students before and after the intervention

**Ha:** There is significant difference in knowledge of students before and after the intervention

As shown in the table 4, with t value of -13.029 (df = 99; sign = 0.000), the null hypothesis was rejected in favour of the alternative. Thus there is significant difference in students’ knowledge before and after the intervention. As shown in the table 3, while the average students' knowledge index before the intervention was found to be 0.48 compare with 0.68 average score after they gone through the intervention.

This indicates a change of 0.20 between the students' knowledge index 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 had significantly contributed in improving students’ knowledge of nursery practice.

**Table 3: Paired Samples Statistics**

<table>
<thead>
<tr>
<th>Stage of the intervention</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Index Before</td>
<td>0.4810</td>
<td>100</td>
<td>0.45097</td>
<td>0.04510</td>
</tr>
<tr>
<td>Knowledge Index After</td>
<td>0.6830</td>
<td>100</td>
<td>0.33244</td>
<td>0.03324</td>
</tr>
</tbody>
</table>

Source: Analysis of field data, 2017

**Table 4: Paired Samples Test**

<table>
<thead>
<tr>
<th>Stage of the intervention</th>
<th>Paired Differences</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge Index Before</td>
<td>-0.20200</td>
<td>0.15504</td>
<td>-13.029</td>
<td>.000</td>
</tr>
<tr>
<td>Knowledge Index After</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Analysis of field data, 2017

**Effect of the intervention on students’ skills**

Students’ pre intervention skills on nursery practices were assessed and compared with their post intervention skills to assess the effect of the intervention on students’ skills. Students’ skills was assessed based on their ability to describe the activities involved in undertaking the various nursery practices, mentioned the tools and materials required to perform the tasks and actual performance of the task. Students were scored under these three criteria and their skills index representing their aggregate score on all the three indicators was calculated. Based on the skills index students were graded as not yet competent (if student scored less than 0.25 skills index), averagely competent (for skills index of 0.25 – 0.5) and very competent (if student scored skills index of above 0.5). Figure 7 presents bar graph of students’ skills level before and after the intervention.

As shown in the graph, all the students, after going through the project, were found to be either averagely competent and very competent, while majority (60 percent) were found to be ‘not yet competent’ before the intervention. Thus in the pre intervention assessment, 60 percent of the participants were found to be not yet competent while only 19 percent and 20 percent were averagely competent and very competent respectively. However, after they went through the project, 61 percent and 39 percent respectively were found to be averagely competent and very competent respectively. Thus all the 61 students who were found not be competent before the intervention are now either averagely competent or very competent. In general the intervention had much positive effect on students’ skills acquisition and competency.

**Figure 7: Bar graph of student skills level before and after the intervention**

Source: Analysis of field survey data, 2017

To examine whether the intervention have significantly improved students’ skills level paired t-test were conducted and results shown in table 5 and 6. The test was done to examine the hypothesis:

**Ho:** There is no significant difference in skills of students before and after the intervention

**Ha:** There is significant difference in skills of students before and after the intervention

As shown in the table 6, with t value of -19.092 (df = 99; sign = 0.000), the null hypothesis was rejected in favour of the alternative. Thus t there exist significant difference in students’ skills index before and after the intervention. As shown in the table 5, 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’ knowledge index of before and after. Thus after going
through the project, students averagely scored 0.26 skills index above their pre intervention skills index. Thus the intervention had significantly contributed in improving students’ nursery practice skills. After going through the intervention the students ‘average skills index have increased by 0.26. It can then be concluded that, project method of teaching significantly help in improving agricultural students’ skills acquisition and technical competency. This finding agrees well with the view of Chard, (2001); Deci and Ryan, (2000); Meece, Anderman and Anderman, (2006) 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 5: Paired Samples Statistics

<table>
<thead>
<tr>
<th>Skills level</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills Index Before</td>
<td>0.3900</td>
<td>100</td>
<td>0.39962</td>
<td>0.03996</td>
</tr>
<tr>
<td>Skills Index After</td>
<td>0.6490</td>
<td>100</td>
<td>0.31734</td>
<td>0.03173</td>
</tr>
</tbody>
</table>

Source: Analysis of field data, 2017

Table 6: Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Paired Differences</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills Index Before – Skills Index After</td>
<td>-0.25900</td>
<td>0.13566</td>
<td>-19.092</td>
<td>99</td>
</tr>
</tbody>
</table>

Source: Analysis of field data, 2017

CONCLUSION AND RECOMMENDATIONS

Project method of teaching is found to be effective in contribution to improvement of students’ knowledge on nursery practices. There was significant improvement of students’ knowledge after they undertook their projects. Similarly the project also contributed significantly in improving students’ skills acquisition of nursery practice. There was significant improvement in students' competency in undertaking tomato nursery after going through their projects. Project method of teaching should be employed in teaching skills as it found to be effective in imparting knowledge and skills on students.

REFERENCE


CBI (2011) Working towards your future: making the most of your time in higher education. London: CBI.


Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana


Owusu-Ansah W. and Kofi P. (2012), ‘Entrepreneurship Education, a Panacea to Graduate Unemployment in Ghana?’ International Journal of Humanities and Social Science Vol. 2 No. 15; August 2012


Accepted 2 November 2018.

Citation: Diise AI, Zakaria H, Mohammed AA (2018). Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana. World Journal of Educational Research and Reviews, 4(1): 062-075.

Copyright: © 2018 Zakaria et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are cited.