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Constructivist-Based Learning on Students Psycho-Productive Skills Performance in Agricultural Science

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Constructivist-based approaches to teaching typically make extensive use of problem-based learning (PBL) and learning-by-doing (LBD) which were used to investigate their effects on psycho-productive skills in Agricultural science in secondary school. The research design adopted was a pre-test, post-test, non-randomised control group quasi-experimental. The sample comprised eighty-four students from three schools (intact classes) with thirty-one, twenty-three and thirty in experimental 1, 2 and control groups respectively. The Psycho-productive Skills Performance Test (PSPT) and Psycho-productive Skills Performance Rating Scale (PSPRS) were the two instruments developed by the researchers and administered as pre and post tests. The PSPT was subjected to content validity and item analysis, its reliability test through spilt-half method gave a co-efficient value of 0.74 and for the PSPRS, using Cohen's Kappa statistic when subjected to inter-rater reliability it gave a value of 0.84. The data collected were analysed with the use of frequency counts, percentages, mean, standard deviation, t-test and ANOVA. The results reveal significant effect of instructional strategy on psycho-productive skills performance in Agricultural Science. Furthermore, it shows no significant effect of parents' education level on the students' psycho-productive skills performance in Agricultural Science. Arising from the findings, it was recommended among others that PBL and LBD learning strategies should be incorporated in the teacher education programmes as part of their training.

Keywords: Problem-Based Learning; learning-by-doing; psycho-productive; intact class; parents' education level; crop husbandry

Introduction

In Nigeria, the National Agricultural Science curriculum is structured to focus on three main areas, thus: production, protection, and economics. Its organization is such that the topics reflect major areas broken into nine themes namely: basic concepts, agricultural ecology, agricultural engineering/mechanization, crop production, forestry, ornamental plants, crop protection, animal production and agricultural economics and extension. For a proper articulation between the two tiers of the secondary school agricultural programme, the spiral approach was adopted in the presentation of the topics cutting across the levels of senior secondary schools. In other words, the present senior secondary school programme is directly related to the junior secondary school programme (NERDC, 2008). This curriculum also highlighted other issues pertaining to instructional delivery approaches and facilities which are quite germane to skills development in agriculture. In the opinion of the researchers, these objectives of enabling the students to acquire basic practical skills development and preparation for occupations in Agricultural Science are not being met as stated (Lawal, et al. 2014). Lawal, et al (2014) proposed that these skills can be achieved through effective use of school farms and participation in other agricultural activities and practical. The skill development is more required especially in the face of increasing need to impart functional knowledge and practical skills for productive life of the citizenry in our country as provided for in the National curriculum.

In line with the enumerated objectives of Agricultural Science and other provisions of the senior secondary education curriculum for Agricultural Science, the guided discovery approach to teaching is recommended as effective instructional delivery approach. Learning-by-doing was also emphasized to ensure that students produce food for themselves and their communities. It further pointed out that suggested activities in the agriculture programme are designed to enhance psychomotor skills development (NERDC, 2008). Based on the foregoing, this study considered the issue of skill development and acquisition as pertinent for attention at this level of our school system; hence, the study gave this a prominent attention in order to set up channels for attaining prescribed national goal of food production. On evaluation techniques, the Senior Secondary Education Curriculum in Agricultural Science suggested that process and product techniques of evaluation should be adopted in assessing specific tasks of each student or group. To meet all the aforementioned, and for adequate exposure to hands-on activities in conjunction with productive skills development, it has become mandatory for schools that are offering Agricultural Science at the senior secondary school level to meet the following:

a. Provide for each student, adequate equipment, farm space, farm structures and other requisite farm inputs.
b. Keep at least one type of ruminant and one type of non-ruminant farm animals.
c. Establish fish pond.

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d. Establish apiary (for bee-keeping).
e. Establish orchards (pineapple, guava, citrus, etc.) (NERDC, 2008: iii - iv)

The changes in the Agricultural Science curriculum present huge implications for its study as an important school subject in Nigeria. One of such is the improvement in the method of presentation and delivery of Agricultural Science concepts in classrooms, laboratories and farms. This should be generally hinged on improved academic achievement, psycho-productive skills acquisition and positive attitude in regard to agricultural science. However, it seems that there has not been much improvement made in this direction. As a result, this study concentrated on the psycho-productive skills acquisition. Besides, the selected topics (crop husbandry) chosen and used in the study was informed by the fact that the National Agricultural science curriculum suggested that students' learning outcome should be continuously assessed through various forms of tests on the field and laboratory practical. This is coupled with the recommendation that individual assessment should be carried out for activities in crop production. The two issues of student learning outcome mode and assessment pattern aligned with the design of the study. In addition to the discussion so far, current trends in research on pedagogy and instructional strategies in education, particularly agricultural science, strongly support building potential to provide students with adequate knowledge and skills (both academic achievement and psycho-productive skills acquisition) to secure gainful employment in agricultural occupations. Andreasen (2004); Roberts (2006); National Research Council (2009); Splan, et al. (2015) support the use of experiential learning models which have been advocated as the hallmark for Agricultural science programmes for decades. According to Knobloch (2003); and Roberts (2006), experiential learning has been a feature of undergraduate agricultural curricula for several years. Experiential learning, as a fundamental component of agricultural science curricula, is aligned with constructivist learning theory (Splan et al. 2015). Constructivist-based teaching methods are based on constructivist learning theory. Constructivist learning theory suggests that all knowledge is constructed from a base of prior knowledge. It is believed that children are not a blank slate and knowledge cannot be imparted without the child making sense of it according to his or her current conceptions (Lombardi, 2011). In other words, children are best described to learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences. One primary goal of using constructivist teaching is that students learn how to learn which in turn gives them the training to take initiative for their own learning experiences. Furthermore, in the constructivist-based classroom, students work primarily in groups where learning and knowledge are interactive and dynamic. Under such a situation, there is a great focus and emphasis on social and communication skills, as well as collaboration and exchange of ideas. This is contrary to the traditional classroom in which students work essentially alone in which case learning is achieved through repetition, and the subjects are strictly adhered to and are guided by textual materials.

Constructivism influences instructional theory by encouraging problem-based learning, learning-by-doing, discovery learning, hands-on learning, experiential learning, collaborative learning, problem solving and task-based learning (Lombardi, 2011). Constructivist-based approaches to teaching typically make extensive use of problem-based learning, learning-by-doing, problem solving, hands-on and minds-on activities, investigative laboratory activities, open-ended questions, inquiry-oriented discussion, co-operative learning, open-ended inquiry and performance assessments as pedagogical tools (Ayoade, 2012). Constructivist-based approaches, unlike traditional methods are regarded as producing greater internalization and deeper understanding. It can then be concluded from the foregoing on constructivism that the primary idea of constructivism is that what a person‟ know" is not passively received, but actively assembled by the learner. In constructivist learning approach, the individual is consciously engaged in the construction of a product (Li, et al. 2013). The constructivist teaching models not only emphasise active and collaborative learning, but also assert that students and teachers would discover and construct knowledge together. They are relevant in Agricultural science curricula especially at the senior secondary school level in Nigeria. In essence, some studies (Okekeokosisi & Okere, 2015) have confirmed the advantages of these models at the secondary school level.

Researchers and scholars have continuously remarked on the drawbacks of teaching with a strict lecture format. The format is usually referred to as a method resulting in long periods of uninterrupted teacher-centered, expository discourse which subjects students to the role of passive 'spectators' in the classroom (Williams and McClure, 2010). Hence, there have been several attempts (Arslan ,Akın & Çitemel,

2013; Eyong, Ugada & Aminu, 2020; Karagöz,2021; Muza,2021) toward the use of other methods and strategies in teaching, including; Demonstration method (Abdulhamid, 2013; Daluba, 2013; Ja'Afar-Furo, et al. 2014; Phipps and Osborne, 1988), Discussion method (Abdulhamid, 2013), Guided Discovery (Ozioko 2015 & Akani, 2017) and Inquiry-Based method (Parr and Edwards, 2004). Various scholars and researchers had made vigorous search for techniques on how to improve quality of instruction in Agricultural science in the country. For example, Okekeokosisi and Okeke (2015) remarked that constructivist approach in Agricultural Science teaching and learning process may boost students' interest which can lead to increasing their achievement in the subject. Specifically, Agbabiaje (1998); Okekeokosisi and Okeke (2015) pointedly recommended learning-by-doing. In a related manner, Savery and Duffy (1995) considered Problem-Based Learning as one of the best examples of constructivist learning environment. Similarly, Afolabi and Akinbobola (2009) explained that Problem-Based Learning is an example of constructivist learning strategy that poses significant contextualised real world situations that provide resources, guidance and instruction to learning to developing content knowledge and problem solving skills. In the light of the foregoing, this study focused on problem-based learning and learning-by-doing as constructivist-based learning approaches to determine the potency of the two strategies in improving performance in psycho-productive skills to Agricultural Science at the senior secondary school level. These two strategies have not yet been found tested as a combination in Agricultural Science in Nigeria despite the fact that some scholars have made suggestions on their usability. This study was aimed at testing the effects of these two strategies of learning over the conventional method.

On skills acquisition, Olaitan (1996) commented that though the secondary school curriculum emphasized acquisition of functional skills and knowledge in all occupation areas of agriculture, most of senior secondary school leavers have not been capable of demonstrating productive skills in agriculture whenever they are required to exhibit them or do so. Therefore, it becomes important to carry out this study to measure the psycho-productive skills of secondary students in Agricultural Science.

Olaitan and Ali (1997) submitted that psycho-productive skills are necessary in all skill learning situations especially where students are exposed to practice of skills and are expected to perform these skills in occupations in which they are employed. It, thus, can be explained that psycho-productive skills emphasise performance which is the most vital aspect of learning for living. According to Igbo and Olaitan (1999) psycho-productive skills are manipulative skills or acquired abilities which signify performance of tasks adequately with the muscles in response to sensory stimuli. Task, according to Merriam Webster Dictionary, (2014) is an activity that needs to be accomplished within a defined period of time or by a deadline. It is basically any piece of work that is undertaken or attempted by the senior secondary student in this study. Task is usually an assigned piece of work often to be finished within a certain short time. Task execution or completion of an assigned activity eventually leads to performance because task in itself is an integral component of performance display. Therefore, in the context of this study, psycho-productive skills performance is the detailed examination of observable activity or behaviour associated with the execution or completion of a required function or unit of work.

Studies on the trend of students to improve in academic achievement has shown to connect to parents' educational status as an important mediating mechanism in Agriculture education studies (Anyanwu, et al. 2014; Egunsola, 2014; Kapinga, 2014; Ogweno, et al. 2014; Osokoya & Adegoke, 2015). Kapinga (2014) found that educated parents tend to motivate their children in matters relating to schooling and supporting them academically. Nonetheless, the outcomes of the various studies are not unexpected because they vary in their learning contexts, population, study area, methodology, instruction delivery settings and the research task. Agricultural Science is an important subject that can be used to boost agricultural production that is meant for food security which can be met with productive skills performance (psychomotor domain). Such an objective has still not been met. Perhaps this is as a result of poor or misdirected pedagogical practices that do not favour skills development in the students. In order to take care of such despair situation in our education sector, it has become expedient to look out for interventions to remedy the situation.

It is on this premise that this study considered the constructivists-based strategies because their potential has not been fully tested in Agricultural Science teaching and learning. In a bid to connect properly this study, it considered the psychomotor domain (i.e psycho-productive skills performance) in Agricultural science. This is as a result of the fact that Secondary Schools' Agricultural Science Curriculum emphasized the acquisition of skills in all occupational areas of agriculture for the school products. Furthermore, evidences showed from the literature gathered so far that parents' education level has not been exhaustively investigated

in studies that involve Agricultural Science concepts among students in Nigeria. Remarkably, this study attempted to manipulate the variable to find out their effects on students' psycho-productive skills performance in Agricultural science in Ogun State, Nigeria. On skills acquisition, Olaitan (1996) commented that though the secondary school curriculum emphasized acquisition of functional skills and knowledge in all occupation areas of agriculture, most of senior secondary school leavers have not been capable of demonstrating productive skills in agriculture whenever they are required to exhibit them or do so. Therefore, it becomes important to carry out this study to measure the psycho-productive skills of secondary students in Agricultural Science. Olaitan and Ali (1997) submitted that psycho-productive skills are necessary in all skill learning situations especially where students are exposed to practice of skills and are expected to perform these skills in occupations in which they are employed. It, thus, can be explained that psycho-productive skills emphasise performance which is the most vital aspect of learning for living. According to Igbo and Olaitan (1999) psycho-productive skills are manipulative skills or acquired abilities which signify performance of tasks adequately with the muscles in response to sensory stimuli. Task, according to Merriam Webster Dictionary, (2014) is an activity that needs to be accomplished within a defined period of time or by a deadline. It is basically any piece of work that is undertaken or attempted by the senior secondary student in this study. Task is usually an assigned piece of work often to be finished within a certain short time. Task execution or completion of an assigned activity eventually leads to performance because task in itself is an integral component of performance display. Therefore, in the context of this study, psycho-productive skills performance is the detailed examination of observable activity or behaviour associated with the execution or completion of a required function or unit of work.

Studies on the trend of students to improve in academic achievement has shown to connect to parents' educational status as an important mediating mechanism in Agriculture education studies (Anyanwu, et al. 2014; Egunsola, 2014; Kapinga, 2014; Ogweno, et al. 2014; Osokoya & Adegoke, 2015). Kapinga (2014) found that educated parents tend to motivate their children in matters relating to schooling and supporting them academically. Nonetheless, the outcomes of the various studies are not unexpected because they vary in their learning contexts, population, study area, methodology, instruction delivery settings and the research task. Agricultural Science is an important subject that can be used to boost agricultural production that is meant for food security which can be met with productive skills performance (psychomotor domain). Such an objective has still not been met. Perhaps this is as a result of poor or misdirected pedagogical practices that do not favour skills development in the students. In order to take care of such despair situation in our education sector, it has become expedient to look out for interventions to remedy the situation. The focus of PBL investigation has been mainly on its effects on students' learning outcomes in comparison with traditional lecture-based instruction mainly in medicine where it originated from. However, its use in recent times has been extended to other areas of scholarship especially in the post-primary or secondary school which is the scope of this study. To consider learning outcome in secondary Agricultural science in this study, it is necessary to capture the variable of learning-by-doing in past studies conducted. Learning by doing has a history in educational theory, even if it is uncommon in practice. John Dewey, experiential education's frontline advocate argues that "there is no such thing as genuine knowledge and fruitful understanding except as the offspring of doing". Learning-by-Doing provides structured time for students to reflect on their service and learning experiences through a mix of writing, reading, speaking, listening and creating small and large groups and individual work (Cooper, 2006). In Alaribe (2010), the study findings revealed, among others, that the students taught pre-planting skills in cassava and maize production through the school farm obtained higher performance score in psycho productive test than those taught the same skills through classroom instructions. In addition, the students taught planting skills in cassava and maize production through the school farm obtained higher performance score in psycho productive test than those taught the same skills through classroom instructions. In the final analysis, Alaribe (2010) reported that the students taught post-planting skills in cassava and maize production through the school farm obtained higher performance score in psycho productive test than those taught the same skills through classroom instructions. In a related study, Ikelusi (2013) the findings showed that there was significant difference between the mean performance scores of students exposed to ergonomic principles in psycho-productive skills in pre-planting operations in maize production and those taught with conventional (lecture) method. It also found that there was a significant difference between the mean performance scores of students exposed to ergonomic principles in psycho-productive skills in post planting

operations in maize production and those taught with conventional method. In another study, Nsa, Akan and Williams (2012) revealed there is no significant effect of discovery learning, guided-demonstration and expository instructional strategies on students' skill acquisition in vegetable sowing activities. The subjects in guided-demonstration group performed significantly better than their counterparts in discovery-learning and expository groups. The implication was that there was significant difference in the level of skill acquisition of students in vegetable sowing activities. The outcome was attributed to the previous experience of the students which was singled out as an important factor thereby facilitated skill acquisition. In a study by Ombugus and Umaru (2016), they found that there is significant difference in the mean performance of three groups of students on the psycho productive skills multiple choice test in grinding operation in the six levels of Simpson's taxonomy. The test revealed that the difference was significant between the high and low ability but was not significant between the high and average abilities when compared. An important variable that the study is interested in giving prominent attention is the parents' educational status in terms of the highest level attained by the students' parents. It is in the pursuit of this that this section is discussed because parents' education has been linked to learning outcomes, participation and students' interest in Agricultural science in our schools. Scholars like, Alokan, et al. (2013) reported that the mean score of respondents from parents with high educational background was 3.1321 with standard deviation of 1.10435 while the mean score of respondents from parents with low educational background was 2.5568 with standard deviation of 1.15476. However, t-calculated was 3.930 while the table value was 1.960. It simply implies that there is significant difference between the academic performance of students from parents with high educational background and students from parents with low educational background. The findings of Abdullahi, et al (2015) showed parent's educational level positively predicted academic achievement of students in Agricultural science among secondary school students in Katsina State, Nigeria. They concluded by explaining that parents' education, amidst other things, positively enhance students' academic achievement in secondary school Agricultural Science. In the same vein, Anyanwu, et al. (2014) revealed in a linear model regression that interest in Agriculture and educational level of parents of Agricultural science at the senior secondary school was statistically significant at 5% level of probability. Tatrah (2000) in a study to find out students' attitudes and perception towards agriculture, agricultural careers and agricultural inputs in Central Region of Ghana. The study revealed that students whose parents had low level of education had a more favourable perception of agriculture than those with educated parents. Students who were studying agriculture as elective and those who were farming at home were willing to farm after school. They gave reasons for this as interest, good income, knowledge and skills in farming. It is on this premise that this study considered the constructivists-based strategies because their potential has not been fully tested in Agricultural Science teaching and learning. In a bid to connect properly this study, it considered the psychomotor domain (i.e psycho-productive skills performance) in Agricultural science. This is as a result of the fact that Secondary Schools' Agricultural Science Curriculum emphasized the acquisition of skills in all occupational areas of agriculture for the school products. Furthermore, evidences showed from the literature gathered so far that parents' education level has not been exhaustively investigated in studies that involve Agricultural Science concepts among students in Nigeria. Remarkably, this study attempted to manipulate the variable to find out their effects on students' psycho-productive skills performance in Agricultural science in Ogun State, Nigeria.

Objectives of the study

The main objective of study investigated the effect of Problem-Based Learning (PBL) and Learning-By-Doing (LBD) as levels of constructivist-based learning on senior secondary students' psycho-productive skills performance in Agricultural Science. In specific terms, the research questions and hypotheses that follow are considered in this study:

Research questions:

1. Which of the treatment groups will yield the highest students' psycho-productive skills performance in Agricultural Science?
2. How does level of parents' education affect students' psycho-productive skills performance in Agricultural Science?

Hypotheses

i. There is no significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students' exposed to the three levels of instructional strategy (PBL, LBD and CM).
ii. There is no significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students' from parents having high and low education levels.

Theoretical framework

As with any instructional model, there are many strategies for implementing Problem-Based Learning. Rather than attempting to provide a general characterization of Problem-Based Learning, the study fashioned a workable format out of Mathews-Aydinli (2007) adapted 5-step student and teacher roles in Problem-Based Learning. In general terms, problem-based classrooms give the teacher opportunity to act as a coach or facilitator of activities that students carry out independently. It is a condition where the teacher does not simply present information or directly control the progression of work. This PBL Format is connected with this study on the premise that the teacher provides students with appropriate problems to work on, assists them in identifying and accessing the materials and equipment necessary to solve the problems, gives necessary feedback and support during the problem solving process, and evaluates students' participation and products, with the goal of helping them develop their problem-solving as well as their proficiency in skills development. For Learning-By-Doing, it made use of the Experiential Learning Theory (ELT) which emphasizes on experience as central role in their theories of human learning and development; which took root in the 20th century scholars work like John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky amongst others creating a dynamic and holistic model of the process of learning from experience; and a multi-dimensional model of adult development. Parasselli and Kolb (2011) posited integrating the work of these foundational scholars which resulted in Kolb (1984) proposed six characteristics of experiential learning. This theory is relevant to this study in that it guided the researcher on the steps to follow during instruction such as planning, organizing, implementing and evaluating instruction during the experiment. This theory is relevant to this study in that it guided the researcher on the steps to follow during instruction such as planning, organizing, implementing and evaluating instruction during the experiment.

Method

Design

The study adopted a non-equivalent pretest, posttest, non-randomised control group quasi-experimental design. Intact classes were randomly assigned to different treatment conditions. The variables (independent and moderator) were crossed in a 3 x 1 x 1 factorial matrix (two treatment groups – Problem-Based Learning Instructional Strategy (PBLIS), Learning-By-Doing Instructional Strategy (LBDIS) and conventional method as control group; two levels of parents' educational level – high and low). The dependent variable was students' psycho-productive skills performance to learning Agricultural Science.

Sample and sampling technique

The sample consisted of only three government-owned senior secondary schools purposefully selected (for purpose of uniform standards) and which offer Agricultural Science up to the Senior Secondary School Certificate (SSSC) level, using multi-stage sampling technique. Three research assistants were part of the study and the total number of students was 84 (eighty-four) offering Agricultural science in classes used in all the three schools that participated in the study.

Table 1: Sample size in each school

Schools/Treatment group	Males	Females	Total
School 1 (Experimental 1)	10	21	31
School 2 (Experimental 2)	11	12	23
School 3 (Control)	15	15	30

The schools selected for the study satisfied the selected criteria like, presentation of candidates for a minimum of five years without a break for external examinations and possess a functionally operated crop farm among others. The three selected schools were randomly assigned to treatment groups (one school for one experimental condition) by lot procedure, using a junior secondary school student. In addition, intact classes were used

while all SSI Agricultural science students in selected arms participated in the study to eliminate bias in the sample. The senior secondary one (SSI) students was selected for this study based on two reasons thus;

i. The content for the study topics used are treated in the SS 1 Agricultural science syllabus.
ii. They do not have any external examination that could easily distract their desirable active participation.

The sample size in each school and each treatment groups are shown in table 1

The topics chosen were those in the production theme which could facilitate skill development. In effect, they could promote psycho-productive skills of the students and will be easy to relate learning objectives to their immediate environment.

Instrumentation

The following instruments were used for the study:

1. Psycho-productive Skills Performance Test (PSPT)
2. Psycho-productive Skills Performance Rating Scale (PSPRS)
3. The instructional guide containing procedural statements that were used by teachers in teaching the topics selected are:
   i. Instructional guide for Problem-Based Learning Instructional Strategy (PBLIS)
   ii. Instructional Guide for Learning-By Doing Instructional Strategy (LBDIS)
   iii. Placebo for Conventional Method (CM)

a. Psycho-productive Skills Performance Test (PSPT)

The PSPT is a four-option multiple choice items designed to measure the seven levels of psychomotor domain as categorized by Simpson (1972); perception, set, guided response, mechanism, complex overt response, adaptation and origination. The instrument was developed by re-modifying and adapting the Standardized Performance Based Test by Fatunsin (1996). The researcher developed ninety items covering SS 1 topics to be taught on crop production (husbandry of selected crops). Each item has four options which include one correct answer and three distractors. The test is drawn to cover specific named crops to be taught during experiment. These include maize, cowpea, cassava, tomatoes, spinach, cocoa, pasture and forage crops. The first step taken was drawing a table of items specification showing the number and categories of test items prepared for the various topics and finally thirty items were selected.

The content validity was done such that, firstly, it was given to three qualified Agricultural science teachers in selected senior secondary schools for their input and perusal about the items in Psycho-productive Skills Performance Test (PSPT) which are in agreement with, the content coverage of the senior secondary Agricultural science curriculum as designed and approved by National Educational Research and Development Council (NERDC). Their various suggestions helped to modify the test items. Furthermore, the test item analysis was done and thirty of the set of items were chosen due to the fact that they discriminated and distracted well satisfactorily hence, they were considered fit for the study. The reliability test was conducted using the split-half method by dividing into two halves, along odd and even numbers. The scores obtained along odd were correlated with even numbers. The result of the reliability test gave 0.74 as coefficient value.

Examples of the PSTP items:

1. The planting materials that can be selected for cassava production are:
(a) Sets of 8gms weight each (b) Cutting of 22cm long
(c) Unbudded seedlings of 3cm tall (d) Tuber sets of 10cm long
2. The seed rate of maize during planting is usually
(a) 22.5 – 28.5 kg/ha (b) 20.0 – 22.5kg/ha
(c) 25.5 – 30kg/ha (d) 28.5 – 32.2kg/ha
3. The weeding of Tomatoes farm should be done
(a) Eight times before maturity (b) Six to eight times before the crop matures
(c) Only once before harvesting (d) Twice or thrice before maturity

b. Psycho-productive Skills Performance Rating Scale (PSPT)

This rating scale was designed to measure skills acquisition capacity of the students particularly in the seven levels of the psycho-productive domain. This is requiring the ability to demonstrate adequately or appropriately various skills that are necessary for certain identified and isolated occupational areas of Agriculture.

This was used to measure practical skills and activities of the tasks given to students. The PSPRS has fourteen outlined major skills to be performed by each student on different occasions during the course of instruction. The rating scale was given to researcher's supervisors, an Agricultural Superintendent who engages undergraduates in similar exercise in the Directorate of General Studies and Entrepreneurship and three graduate Agricultural Science teachers with a minimum of 5 years teaching experience in the secondary school. This was to aid in determining the content validity of the skills performance items. Based on their recommendations and suggestions, the major skills were reduced to fourteen from the initial twenty-one. The reliability was established by giving the instrument to two teachers of Agricultural Science in two different senior secondary schools in Odeda Local Government Area (LGA) to rate. After the collection of their responses, the instrument was subjected to inter-rater reliability. The analysis gave a 0.84 coefficient value using Cohen's Kappa statistic.

The rating scale has a range 1 – 5 (that is, 1, 2, 3, 4, and 5). The student can score a maximum of 5marks and a minimum of 1mark depending on the degree of display or demonstration of the specified sub-skills. In all, the total marks obtainable from the fourteen major skills would be seventy (70). The rating followed thus:

For each major task provided, there are five sub-skills listed for measure. Each sub-skill is rated as 1 mark when performed correctly. Therefore, a major skill carries a maximum of 5marks. In all, the seventy sub-skills gave a total of 70 marks.

Sample of the PSPRS items

S/N	Area of Competency	Grade
	How well does the student perform	
1	Sowing the maize seeds	Selection of correct farm tool, seed viability, Planting depth, No of seeds/hole, spacing technique
2.	Carrying out supplying/thinning operation of maize seedlings	Supplying technique, seedlings vigour, thinning skill, soil compacting around thinned stands, routine maintenance
3.	Fertilizer application on the maize farm	Identification of suitable fertilizer, application of correct rate, application pattern, application method, minimal wastage adherence

Procedure for data collection

The researchers obtained a letter of permission from Ogun State Ministry of Education, Science and Technology, Abeokuta, Nigeria. Thereafter, they proceeded by paying visits to the three selected schools to seek for permission from the principals and the concerned teachers that took part in the study. The researchers trained the participating teachers as a strategy to attract the maximum attention, commitment and cooperation from the teachers. The training given to the research Assistants to intimate them with the strategies and design along with the procedural steps that were involved in the study, was a process that was carried out through a full detailed discussion. A pre-test was conducted by the researcher across the groups in the second week of the study. The researchers initially addressed the subjects in the various groups to solicit their cooperation and active participation in the experiment; they were given a consent form to take home for their parent to endorse the children's consent. Thereafter, the administration of the pre-test was carried out. The teachers, already certified competent, based on the initial training, moved in to train the students in the rudiments of constructivist-based strategy as it related to their experimental group. The whole study lasted for 8 weeks but the intervention (treatment) took 6 weeks, from the 3rd to 7th week of the study; the week 8 was for the post-test.

Data Analysis

The data collected were scored and subjected to both descriptive and inferential statistics for analysis. The frequency counts, simple percentages, mean and standard deviation scores constitute the descriptive statistics used to show magnitudes of the psycho-productive skills performance in Agricultural Science

according to the levels of instructional strategy and parents' education. The one-way analysis of variance test was used for hypothesis 1 and the independent *t*-test of significance for hypotheses 2. The analysis was done at the 0.05 level of significance.

RESULTS

Table 2 describes the distribution of the subjects in accordance with the selected personal characteristics for the study.

Table 2: Distribution of Subjects into different classes of personal characteristics

Title	Category	No	Frequency
Group	Experimental 1	31	36.9
	Experimental 2	23	27.4
	Control	30	35.7
Gender	Male	38	45.2
	Female	46	54.8
Parents' Edu Level	High	42	50.0
	Low	42	50.0
Age range	13 – 15 years	64	76.2
	16 & 17 years	15	17.8
	18 &19 years	5	6.0

A total of eighty-four (84) students offering Agricultural science (fifty-four (54) in experimental group and thirty (30) students in the control group participated in the study. This consisted of thirty-eight (38) males and forty- six (46) females having the average age of 14.75years and the range was 13 – 19 years constituted the sample for the study.

Research Question 1

Which of the treatment groups will yield the highest students' psycho-productive skills performance in Agricultural Science?

The result in Table 3 shows the students' psycho-productive skills performance mean scores in Agricultural Science according to treatment groups.

Table 3: Students' Psycho-productive skills performance according to treatment groups

Treatment Group	N	Mean	S.D.	Minimum	Maximum	Rank
Experimental 1 (PBL)	31	44.55	4.57	37	54	2nd
Experimental 2 (LBD)	23	47.52	4.30	40	53	1st
Control (CM)	30	44.20	3.97	38	52	3rd
Total	**84**	**45.24**	**4.47**	**37**	**54**	

Problem-Based Learning (PBL), Learning-By-Doing (LBD), Conventional Method (CM)

From Table 3, the 31 students exposed to experimental treatment 1 Problem-Based Learning (PBL) recorded psycho-productive skills performance mean score of 44.55 and standard deviation (S.D) of 4.57, their minimum and maximum values are 37 and 54. The 23 students exposed to experimental treatment 2 Learning-By-Doing (LBD) recorded psycho-productive skills performance mean score of 47.52 and standard deviation (S.D) of 4.30, their minimum and maximum values are 40 and 53 while the 30 students exposed to conventional method (CM) recorded psycho-productive skills performance mean score of 44.20 and standard deviation (S.D) of 3.97, their minimum and maximum values are 38 and 52 (S.D. = 3.97. The result in Table 3 thus shows that the LBD treatment recorded the highest psycho-productive skills performance mean score and ranked first followed by the PBL treatment ranked second and the conventional method ranked third in that order. It thus appears that LBD treatment, with the highest psycho-productive skills performance mean score, yielded the highest students' psycho-productive skills performance in Agricultural Science.

In a summary, Table 3 clearly shows that the highest psycho-productive skills performance score of 54 was recorded by a student exposed to the PBL treatment while the least psycho-productive skills performance score of 37 was recorded by a student exposed to the same treatment.

Research Question 2

Which of the students' parents' education levels will yield higher psycho-productive skills performance in Agricultural Science?

The result in Table 4 shows the students' psycho-productive skills performance mean scores in Agricultural Science according to parents' education level.

Table 4: Students' Psycho-productive skills performance by Parents' Education Level

Parents'EducationLevel	N	Mean	S.D.	Minimum	Maximum	Rank
Low	42	44.86	4.87	37	54	2nd
High	42	45.62	4.05	37	53	1st
Total	**84**	**45.24**	**4.47**	**37**	**54**	

From the Table 4, the 42 students whose parents have low level of education recorded psycho-productive skills performance mean score of 44.86 and standard deviation (S.D) of 4.87, their minimum and maximum values are 37 and 54 after exposure to the experimental and control treatments while the 42 students whose parents have high level of education recorded psycho-productive skills performance mean score of 45.62 and standard deviation (S.D) of 4.05, their minimum and maximum values are 37 and 53 after exposure to the experimental and control treatments. The result in Table 4 thus shows that the students whose parents have high level of education recorded higher psycho-productive skills performance mean score ranked first, than the students whose parents have low level of education who ranked second. It thus appears that the students whose parents have high level of education, with higher psycho-productive skills performance mean score, yielded the higher students' psycho-productive skills performance in Agricultural Science.

Table 4 further shows that the highest psycho-productive skills performance score of 54 was recorded by a student whose parents have low level of education while the least psycho-productive skills performance score of 37 was recorded by a student whose parents have low level of education and another student whose parents have high level of education.

Hypothesis 1: There is no significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students' exposed to the three levels of instructional strategy (PBL, LBD and CM).

The result in Table 5 shows the students' mean psycho-productive skills performance scores in Agricultural Science after exposure to the treatments.

Table 5: Analysis of Variance Test of Students' Psycho-productive Skills Performance Scores According to Instructional Strategy

Strategy	N	Mean	S.D.	Std. Error	Minimum	Maximum
Conventional M.	30	44.20	3.978	.726	38	52
Exp. 1 (PBL)	31	44.55	4.574	.822	37	54
Exp. 2 (LBD)	23	47.52	4.305	.898	40	53
Total	84	45.24	4.474	.488	37	54

ANOVA

One-way	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	167.022	2	83.511	4.527	.014*
Within Groups	1494.217	81	18.447		
Total	1661.238	83			

Problem-Based Learning (PBL), Learning-By-Doing (LBD), Conventional Method (CM)

From table 5, the 31 students exposed to PBL treatment (experimental group 1) recorded mean psycho-productive skills performance scores of 44.55 (S.D. = 4.574). The 23 students exposed to LBD treatment (experimental group 2) recorded mean psycho-productive skills performance scores of 47.52 (S.D. = 4.305) while the 30 students exposed to conventional method (CM) recorded mean psycho-productive skills performance scores of 44.20 (S.D. = 3.978). The result of the One-way Analysis of Variance (ANOVA) test in the Table 5 shows significant effect of instructional strategy on psycho-productive skills performance in Agricultural Science ($F_{(2, 81)} = 4.527$, $p < 0.05$). This implies that there is significant difference in the psycho-productive skills performance scores of the students according to instructional strategy. Hence, the null hypothesis 15 (H_{015}) is rejected. Thus, there is significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students' exposed to the experimental and control treatments (PBL, LBD and CM).

The source of the significant difference according to strategy obtained above, using the Scheffe pair-wise comparisons post-hoc analysis, is thus summarized in the Table 6. This is necessary for proper description of the source of the obtained significant difference in the students' mean psycho-productive skills performance in Agricultural Science.

Table 6: Scheffe Pair-wise Comparisons of Psycho-productive Skills Scores on Strategy

Strategy	Mean	(PBL)	(LBD)	CM
Experimental Group 1 (PBL)	**44.55**		*	
Experimental Group 2 (LBD)	**47.52**	*		*
Conventional Group (CM)	**44.20**		*	

* denotes pairs of groups that are significantly different at $p < 0.05$

Problem-Based Learning (PBL), Learning-By-Doing (LBD), Conventional Method (CM)

The result in Table 6 shows that the obtained significant difference in strategy was accounted for by the significant difference in the mean psycho-productive skills performance scores of the students exposed to the pairs of 'PBL treatment versus LBD treatment' and 'LBD treatment versus conventional method (CM)'. This implies that the difference between the mean psycho-productive skills performance scores of the students exposed to the pairs of 'PBL strategy and LBD strategy' as well as 'LBD strategy and CM' are statistically significant at the 0.05 level of significance. However, the difference between the mean psycho-productive skills performance scores of the students exposed to 'PBL treatment versus conventional method' is not statistically significant. Therefore, the significant difference in the mean psycho-productive skills performance scores of the students exposed to the pairs of 'PBL treatment versus LBD' and 'LBD versus CM' are responsible for the obtained significant effect of instructional strategy on the students' psycho-productive skills performance in Agricultural Science.

Hypothesis 2:

There is no significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students' from parents having high and low education levels. The result in Table 7 shows the students' mean psycho-productive skills performance scores in Agricultural Science according to parents' education level after exposure to the experimental and control treatments**.**

Table 7: *t*-test analysis of students' psycho-productive skills performance scores according to parents' education level

Parents' Educ.	N	Mean	S. D.	Std. Error	*T*	Df	Sig.(2-tailed)
Low level	42	44.86	4.877	.753	-.779	82	.438
High level	42	45.62	4.054	.626			

$p < 0.05$

From table 7, the 42 students in the low parents' level of education recorded mean psycho-productive skills performance scores of 44.86 (S.D. = 4.877) while the 42 students in the high parents' education level recorded mean psycho-productive skills performance scores of 45.62 (S.D. = 4.054). The result of the independent t-test analysis in the Table shows no significant effect of parents' education level on the students' psycho-productive skills performance in Agricultural Science ($t = 0.779$, $p > 0.05$). This implies that there is no significant

difference between the psycho-productive skills performance scores of the students from low and high parents' educational levels. Hence, the null hypothesis 16 (H_{016}) is retained. Thus, there is no significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students from parents having high and low level of education.

DISCUSSION

The major finding indicates that there is significant effect of instructional strategy on psycho-productive skills performance in Agricultural Science. This translates to mean that there is significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students exposed to the experimental and control treatments (PBL, LBD and CM). This result can be predicated on the fact that the strategies were innovative in learning psycho-productive skills in Agricultural science. This is because the students have shown clearly that learning results from synergetic transactions between the person and the environment. The significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students exposed to the experimental and control treatments is an indication of the position of Parasselli and Kolb (2011). As a result of this, PBL and LBD can be made desirable teaching strategies in the acquisition of psycho-productive skill performance in Agricultural science. The reason for this opinion is that the result have shown that through active experimentation the students can gain substantially which will lead to having concrete experience. The result of this finding is in tandem with the findings of Alaribe (2010) and Ikelusi (2013) where they found that strategies employed produced significant effect on the psycho-productive skills performance of students in senior secondary schools. This finding also supports Nsa (2012) which revealed that instructional strategies showed significant effect between treatment groups. In a different environment but similar measurement of students' psycho-productive skills outcome, the finding of Ombugus and Umaru (2016) supported this current finding, confirming that there is significant difference in the mean performance of three groups of students on psycho-productive skills multiple choices test in mechanical engineering craft. Therefore, teachers and students of agriculture alike must come to terms with the reality that they should move beyond the 'doing' (Knobloch, 2003) in skills acquisition and make sure that all learning must connect to thinking and knowledge that will be easily remembered so as to apply it later in life to solving societal problems. Another striking revelation shows no significant effect of parents' education level on the students' psycho-productive skills performance in Agricultural Science. It means that there is no significant difference in the psycho-productive skills performance in Agricultural Science of the senior secondary school students' from parents having high and low level of education. This finding might be as a result that parents' education level hinders them from encouraging their children from taking careers in agriculture. These students may fail or be reluctant to pursue careers in agriculture without the approval of their parents based on their level of education. This outcome seems to depart from Alokan (2013) and Abdullahi (2015) whose findings at different times reported that parents' educational level greatly influences skill performance among Agricultural science students. This finding also negates the finding of Tatrah (2000) who revealed that students whose parents had low level of education had a more favourable perception of agricultural skills than those with educated parents. In other words, the parents' education level is not a significant determining factor in psycho-productive skills performance of Agricultural science students in secondary schools.

Conclusion

The study investigated the effect of constructivist-based learning strategies on senior secondary students' psycho-productive skills performance in Agricultural Science resulting in the revelation of certain findings, amongst them is that there is significant effect of instructional strategy on psycho-productive skills performance in Agricultural Science. It may be advanced that the collaborative nature of the learning strategies impacted remarkably on the students given the learning outcomes. This is because the learners were exposed to learning in groups which promoted gaining knowledge guided by interactions and dynamism. The atmosphere provided in the learning environment supported social and communication skills coupled with collaboration and exchange of individual ideas. It further showed no significant effect of parents' education level on the students' psycho-productive skills performance in Agricultural Science. This scenario could be hinged on the parents' attitudes and perception towards agriculture, agricultural careers and engagements on the basis that this field of work (agriculture) is not prestigious and fit enough for their children.

Recommendations

Arising from the findings of the study, the following recommendations are suggested:

i. In Agricultural education, an important area of concern is the provision of instructional strategies that can assist to build and boost learner's psycho-productive skill performance. In as much as this study established that constructivist-based learning strategies of PBL and LBD are potent and present viable platform to conventional method, it has become pertinent to look at its effectiveness in our teacher education programmes. This will lend credence to the fact that teachers' quality cannot be jeopardised if the standard of education must continually be pursued to improve from one generation to another.

ii. The various groups of stakeholders should create opportunities for the training of secondary school teachers in the use of innovative strategies like Problem-Based Learning and Learning-By-Doing in skill learning in Agricultural science. There should be mechanism put in place and concerted efforts are intensified so that Agricultural science students could be constantly made to see the importance of building positive attitude towards the use of school farm in enhancing their ability and competence in psycho-productive skills performance for physical materials and products of agriculture.

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