

Effect of Demonstration, Peer-Tutoring, and Lecture Teaching Strategies on Senior Secondary School Students' Achievement in an Aspect of Agricultural Science.

Y.M. Adekoya¹, M.Ed. and R.A. Olatoye, Ph.D.²

¹Institute of Education, Faculty of Education, Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria.

²Department of Science, Technology, and Mathematics Education, College of Education, Ipetu-Ijesa Campus, Osun State University, Osogbo, Osun State, Nigeria.

E-mail: olarayo200888@yahoo.com¹
kingdemola@yahoo.com²

ABSTRACT

This study investigated the effect of three teaching strategies; demonstration, peer-tutoring, and lecture strategies of teaching on students' achievement in pasture and forage crops which is an aspect of agricultural science. Lecture strategy served both as a teaching strategy as well as control since it is assumed to be a conventional strategy of teaching. A 3X2X2 pre-test, post-test experimental design with a control group was used in which a hundred and fifty randomly selected Senior Secondary School II (SSS II) Agricultural Science students were drawn from three schools.

The data was analyzed using ANCOVA and Scheffe post-hoc analysis. There is significant main effect of treatment on student achievement in an aspect of agricultural science that is, pasture and forage crops [$F_{2, 137} = 7.072$; $p < 0.05$]. Also, students performed significantly at different levels in the three groups. There is no significant interaction effect of treatment and gender on students' achievement in pasture and forage crops [$F_{2, 137} = 0.561$; $p > 0.05$].

Demonstration and peer-tutoring strategies of teaching are potent in raising students' achievement. Thus, in-service training in form of workshops, seminars and symposia should be organized for teachers from time to time to update their knowledge on how to adopt appropriate teaching strategies.

(Keywords: demonstration, peer-tutoring, lecture, agricultural science, achievement test, teaching of pasture and forage crops)

INTRODUCTION

The poor performance of students in science subjects has assumed a dangerous dimension. In light of this, science educators need to seek suitable ways of tackling the current mass failure if they are to halt the drifts of students to arts and social science subjects (WAEC Reports, 2008). The relevance and importance of agricultural science amongst the science subjects and its importance to economic development cannot be overemphasized. Hence, the need for proper teaching of the subject in secondary schools so that students' scores in internal and external examinations will be high, thereby making the candidates' entrance into higher institutions easier.

It is now being recognized that there are better ways to learn than through the traditional methods (Wood and Gentile, 2003). Educators are beginning to show an increased awareness of the importance of the way students learn. Many of our standard methods of conveying knowledge have been shown to be relatively ineffective in the students' ability to master and then retain important concepts. Learning through some methods of teaching is passive rather than active. The traditional methods (lecture, laboratory, recitation) do not tend to foster critical thinking, creative thinking, and collaborative problem-solving (Wood and Gentile, 2003).

The understanding of peer-tutoring adopted in this study is similar to the description of peer-tutoring or peer-learning by Boud, Cohn, and Sampson (2001). They define peer-tutoring as involving students' learning from and with each other in ways which are mutually beneficial and involve sharing knowledge, ideas, and

experiences among participants. The emphasis is on the learning process, including emotional support that learners offer one another, as much as the learning itself. Peer-tutoring has been shown to be effective even in teaching students identified as disabled in learning (Telecsan, Slaton and Stevens, 1999). Peer-tutoring has also been demonstrated to be effective irrespective of student level or grade.

According to Longareth, Godinho, Parr, and Wilson (2009), peer-tutoring enhances motivation, improved cognition, and social outcomes in learning, increased sense of responsibility for one's own learning and improved meta-cognitive skills. However, Boud, Cohn, and Sampson (2001) showed that students who resisted the peer-tutoring experience referred to dissatisfaction about the uneven distribution of workload for the peer-tutoring. Some students argued that the class time spent on peer-tutoring was at the expense of teaching the course content. Longaretti *et al.* (2009) suggested having smaller groups to reduce potential for serious conflict, less place for individual to 'hide' in the process, allowing students to choose topics that interest them and readiness of the teacher to assist at every point.

Peer-tutoring is an instructional strategy that consists of student partnerships, linking high-achieving students with low-achieving students or those with comparable achievement, for structured reading and study sessions. According to Rohrbeck, Ginsburg-Block, Fantuzzo, and Miller (2003), peer-tutoring is "systematic, peer-mediated teaching strategies". Peer-tutoring and demonstration teaching strategies have been found to be a powerful tool for meeting both the academic and social needs of students in schools at all levels of education irrespective of gender, age and socio-economic background.

The peer relationships often have less rigid characteristics than teacher-student interactions in a school setting. Peer tutoring has been demonstrated to be successful in promoting the academic and social skills of general education students as well as special education students, including students who were identified as 'at-risk' (Nazzal, 2002). Peer-tutoring has been demonstrated to be successful in promoting the academic and social skills of general education and special education students (Nazzal, 2002). Peer-tutoring is an instructional strategy that actively engages students in learning and

promotes mastery, accuracy, and fluency in content learning.

Peer-tutoring has been commonly implemented in education settings. Research has shown that peer-tutoring has a positive impact on academic outcomes such as reading (Klingner and Vaughn, 1996), mathematics (Fuchs, Fuchs and Karns, 2001), spelling and other subjects (Riggio, Fantuzzo, Connelly and Dimeff, 1991). Several reviews have employed meta-analysis to systemically review the effect of peer-tutoring empirically. However, many of these meta-analyses are outdated. For example, the meta-analytic review done by Cohen, Kulik, and Kulik (1982) was confined to literature published prior to 1980. The recent meta-analyses examining peer-tutoring which adopt at least some of the current advances in methodology are confined to certain populations such as elementary school children (Rohrbeck, Ginsburg-Block, Fantuzzo, and Miller, 2003) or are based on adult sample (teachers, adult volunteers or college students) as tutors instead of using peers (Elbaum, Vaughn, Hughes, and Moody, 2000).

Demonstration strategy involves the teacher showing learners how to do something. For example, how to change a tire, prepare a recipe, or make a tie knot. It is a way of teaching good practices. This technique allows the teacher to show the results that can be obtained from experimenting with objects, plants and other materials. It could be demonstrated, for example, what happens to a white cloth when blue dye is added to the water. This technique is one of the most effective teaching tools (Abdullahi, 1982).

Demonstration strategy has been shown to be effective with both large and small groups. The greater the degree of participation and sensory involvement by the learner, the more effective learning will be. Newby, Stepich, Lehman, and Russel (1996) identified ways teacher can improve the use of demonstration method in the classroom. They suggest that teacher should allow students to use several senses by allowing them to see, hear and possibly experience. Also, ideas should be presented to stimulate interest. If these precautionary measures are not taken, demonstration can limit student participation.

Uhumuavbi and Mamudu (2009) found that demonstration strategy of teaching is sensitive to gender. They reported that exposing students to demonstration strategy yielded a better

performance for male students than their female counterparts. It is therefore necessary to verify such claim. In this study gender is one of the moderating variables because it is important to find out if the treatments are truly sensitive to gender.

Instructional strategies are tools for reaching the set goals and objectives. The effective teacher has many teaching methods at his or her disposal and can select the ones that will be most effective for leading the learner to desired behavior. The level of students' performance in the internal and external examinations cannot improve until teachers are able to employ appropriate strategies to impact desired knowledge and skills on the learners.

Research has found that diverse students benefit immensely when they have the opportunity to interact with materials, participate in activities, and manipulate objects and equipment (Carrier, 2005; Prpic and Hadgraft, 2009). Through laboratories, demonstrations, educational games, simulations, field trips, and other interesting activities, students in secondary school classes have many opportunities to be engaged actively in the learning process (Blair, Schwartz, Biswas, and Leelawong, 2007).

Demonstration strategy has emerged to become an instructional approach that is gaining growing interest within the engineering education community (Hadim and Esche, 2002). Duch (2002) described demonstration strategy as an instructional strategy that challenges students to "learn how to learn," working cooperatively in groups to seek solutions to real world problems. Prpic and Hadgraft (2009) addressed the key ingredients of demonstration strategy and postulated that it should not be confused with design projects or case studies where the focus is predominantly on the application of existing knowledge and integration of what is already known. Demonstration strategy goes beyond this, students will encounter some concepts for the first time and therefore they need strategies for acquiring this new knowledge (Prpic and Hadgraft, 2009).

No one can deny that schools are becoming diverse in terms of student backgrounds and abilities, and teachers are being ever more challenged to find effective ways to meet diverse needs of their students. Educators confront classrooms in which students exhibit assorted

academic and behavioral characteristics and they are increasingly looking for successful instructional and classroom management techniques (Tournaki and Criscitiello, 2003). As educators face more demands and more diverse student needs, research is showing that schools may benefit by using peer-mediated interventions which are consistently producing academic gains (Ryan, Reid, and Epstein, 2004).

With many countries striving to educate all their citizens, education professionals are seeking research-supported practices that are applicable in classrooms and can facilitate students' access to the mastering of concepts in agricultural science. There is therefore the need to introduce modern instructional strategies such as demonstration and peer-tutoring teaching strategies that do not only create cooperative pleasant atmosphere but enhance peer relations and also increase academic achievement of students. Also, the importance of science and technology in the growth and development of any nation cannot be over emphasized and it is apparent that technology cannot thrive without using appropriate instructional teaching strategies to teach the students. This is because future development of any nation in the fields of sciences depends on how well the science subjects are taught.

Gender has remained a burning issue and has also remained relevant in education because it has been linked to achievement and participation in certain professions (Sotonade, 2004). Certain cultures restrict particular gender to certain professions like farming, engineering and trading (Erinosho, 1997; Olatoye and Afuwape, 2004). Therefore, using gender as a moderating variable in an experimental study can yield useful practical information. However, there have been conflict findings on how gender influences academic achievement. It seems the influence of gender varies according to school subjects. For example, Olatoye (2008) reported there is no significant difference between male and female achievement in science. Tamir (1990) reported there is no significance difference between male and female achievement in biology and chemistry but reported a significant difference in physics (boys scoring higher).

Kumar and Morris (2005) advocated for consideration of gender in studies involving achievement and scientific understanding in the biological and physical sciences. Lee (1998)

observed that educators perhaps unknowingly had for many decades considered reading and literature as female domains and mathematics and science as male domains. While understanding the need to address gender difference represents a vital step, making education gender-responsive will require a genuine commitment to provide teaching-learning experiences that reflect female and male difference. Lee further noted that males tended to do much better in the physical sciences (like physics), while females held a modest advantage in the life science (like biology and agricultural science). Johnson, Wardlow and Franklin (1998) found that student achievement in Agricultural science is not influenced by gender.

Sanchez and Roda (2006) defined self-concept as the set of knowledge and attributes, that a person has about himself or herself; the perception an individual assigns to herself/himself, the characteristics or attributes that a person uses to describes himself or herself. In experimental studies, there is normally social interaction among the students themselves and between the students and their teacher. It is therefore important to also consider a moderating variable like self-concept which may influence student interaction and possibly achievement in the class. Self-concept is a strong predictor of student academic achievement (Olatoye, 2008; Lang, 2006). Also, self-concept can be developed or constructed by individuals through interaction within the environment and reflecting on that interaction (Huitt, 2004). Thus self-concept is a variable that can be enhanced in students through conscious efforts of the teacher and counselor. Including a moderating variable like this in the study will enable teachers and experts in the field know if the treatment is sensitive to self-concept or not and enhance precautionary measures they should take in adopting the teaching strategies. Olatoye (2008) asserted that any student characteristics that can change because of training and exposure to counseling can be very important in enhancing students' academic achievement.

Many reports on demonstration and peer-tutoring strategies continue to come from developed countries. It is therefore necessary to also find out how effective these teaching strategies are suitable in improving achievement in developing countries like Nigeria. Though, teachers have begun to take a closer look at demonstration strategy of teaching as a tool in their array of

teaching techniques, yet there has not been much research report of their effectiveness. It is against this backdrop that experimental investigation into effect of demonstration and peer-tutoring strategies of teaching on senior secondary school students' achievement in pasture and forage crops become imperative.

RESEARCH HYPOTHESES

The following research hypotheses were generated for the study:

H₀₁: There is no significant main effect of treatment on students' achievement in an aspect of agricultural science (pasture and forage crops)

H₀₂: There is no significant main effect of gender on students' achievement in an aspect of agricultural science (pasture and forage crops)

H₀₃: There is no significant main effect of self-concept on students' achievement in an aspect of agricultural science (pasture and forage crops)

H₀₄: There is no significant interaction effect of treatment and gender on students' achievement in an aspect of agricultural science (pasture and forage crops)

H₀₅: There is no significant interaction effect of treatment and self-concept on students' achievement in an aspect of agricultural science (pasture and forage crops)

H₀₆: There is no significant interaction effect of gender and self-concept on students' achievement in an aspect of agricultural science (pasture and forage crops)

H₀₇: There is no significant interaction effect of treatments (demonstration and peer-tutoring teaching strategies), gender and self-concept on students' achievement in an aspect of agricultural science (pasture and forage crops)

METHODOLOGY

Research Design

The research design used for this study was a 3x2x2 pre-test, post-test experimental design with two experimental groups and one control group. Self-concept and gender were used as

moderating variables. The same pre-test was initially administered to the agricultural science students in the three groups before the treatment. Demonstration strategy was used in the first group; peer-tutoring strategy was used in the second group while the lecture strategy was adopted in the third group which served as control. At the end of the six-week treatment, a post-test was conducted in these three groups.

teaching strategy group (2nd experimental group)

X_P represents the treatment for peer-tutoring teaching strategy group (2nd experimental group)

O_{1L} represents the pre-test scores for control group strategy

O_{2L} represents the post-test scores for control group strategy

Table 1: Randomized Control-Group Pre-test Post-test Design

Group	Pre-test	Treatment	Post-test
1 st experimental Group	O_{1D}	X_D	O_{2D}
2 nd experimental Group	O_{1P}	X_P	O_{2P}
Control Group	O_{1L}		O_{2L}

Where:

O_{1D} represents the pre-test scores for demonstration teaching strategy group (1st experimental group)

O_{2D} represents the post-test scores for demonstration teaching strategy group (1st experimental group)

X_D represents the treatment for demonstration teaching strategy group (1st experimental group)

O_{1P} represents the pre-test scores for peer-tutoring teaching strategy group (2nd experimental group)

O_{2P} represents the post-test scores for peer-tutoring

Target Population and Sample

The population for this study comprised of all Senior Secondary School-two (SS II) agricultural science students in Ijebu-Ode Local Government Area of Ogun State. A total of one hundred and fifty senior secondary school two (SSS II) students purposively selected from the three schools constituted the sample for the study. Fifty two students (representing the number in a group) were selected from each school. The schools were purposively selected so that they would be far apart enough not to allow interference.

Research Instruments

The instruments used for the study were: teaching manual on pasture and forage crops, common grasses and legumes samples, grasses and legumes album, self-concept questionnaire as well as a twenty-item select response questions used for the pretest, post-test tagged Agricultural Achievement Test (AAT).

Table 2: Randomized Control-Group Pre-Test Post-Test Design.

Group	Male		Female		Total
	High Self-concept	Low Self-concept	High Self-concept	Low Self-concept	
Project-Based	13	13	13	13	52
Peer-Tutoring	13	13	13	13	52
Control	13	13	13	13	52
Total	39	39	39	39	156

Validation of Research Instruments

The research instruments used for the pretest, post-test was tagged Agricultural Achievement Test (AAT) 1 and 2. Items were generated from the West African Examinations Council (WAEC) and National Examinations Council (NECO) agricultural science past questions.

Despite using standardized items from these popular national examination bodies, the selected items on pasture and forage crops were still given to experienced teachers for critique and suggestions. This led to the modification and rejection of some items. Prior to the commencement of the experiment, the test items were administered to fifty non-participating students but of the same cultural background and also offering agricultural science as a subject. This was done to determine the consistency of the items. The test was administered twice with two weeks interval on these 50 students who did not participate in the major study. Thus, a test-retest reliability co-efficient of 0.78 was obtained for the achievement test. Similarly, a test-retest reliability co-efficient of the self-concept questionnaire is 0.714

Data Collection Procedure

The research involved two main stages, which were the administration of pre-test and post-test that contained the same items arranged in different order. The study was conducted for a period of six weeks during which the topic, pasture and forage crops was covered. The pre-test was administered in the first week of the research exercise to the whole students before the experimental groups were subjected to treatments. All the practical sessions were held on the school farm with the materials provided by the schools. Six students dropped out before the post-test was administered making the sample size to drop from 156 to 150.

After the administration of the pre-test, students in all the groups, they were taught various aspects of the topic; pasture and forage crops. The detailed breakdown of topics into weeks is presented in the teaching manual. The objectives of teaching are also presented:

Teaching Manual

Topic: Pasture and Forage Crops

Objectives: At the end of the lessons, students should be able to:

- Define pasture and forage crops;
- List and explain the uses of pasture and forage crops;
- Differentiate between the two types of pasture using their characteristics;
- Give the common names of grasses and legumes with their botanical names;
- Discuss the characteristics of some pastures crops;
- Group, state and discuss the factors affecting this distribution of pasture;
- Explain the factors to be considered when establishing the pasture and steps involved;
- State and explain the common management practices in pasture.

WEEK 1: Administration of self-concept questionnaire
- Meaning of pasture and forage crops.

WEEK 2: Uses of forage crops
-Types of pasture.

WEEK 3: Characteristics of Natural and Artificial pasture

WEEK 4: Common Grasses and legumes of livestock and their botanical names.

WEEK 5: Characteristics of some pasture crops
-Factors affecting the distribution of pasture
-Factors affecting the productivity of pasture

WEEK 6: Establishment of pasture
-Common pasture management practices
-Revision and conduct of post test

Students in the first group (demonstration method) were given one week to read about the topic and make the list of materials and specimens required for the experiments. The group was divided into eight sizable sub-groups on the school farm to make demonstration by the teacher meaningful. Two practical exercises were carried out in a week.

The researcher used samples of grasses and legumes on the school farm, models of different grass vegetations to demonstrate their characteristic features to the students on the farm. Questions were entertained during the practical sessions from the students.

The second group was exposed to peer-tutoring teaching strategy during the weeks of the research exercise. Students in this group were always asked to read ahead about the topics and make list of specimens required for the experiment. The group which comprised 52 students was divided into eight sub-groups, each sub-group comprising of between 6 and 7 students. The tutor give basic explanation of the topics and later thoroughly engage the students to teach themselves in the sub-groups while the tutor was also available to direct discussion and provide further explanation when necessary.

The third group comprised of students in the control group. They were taught the theory and practical using lecture/traditional teaching strategy. The teaching process also lasted for six weeks and a post-test was administered to all the students.

Method of Data Analysis

The data collected were analyzed using ANCOVA to compare the means of the scores of the students and also Scheffe post-hoc analysis to identify the most effective strategy. The analyses of the results were carried out at $p = 0.05$ level of significance.

RESULTS

In Table 3 there is significant main effect of treatment on students' achievement in an aspect of agricultural science that is, pasture and forage crops [$F_{2, 137} = 7.072$; $p < 0.05$]. However, there is no significant effect of gender on students' achievement in an aspect of agricultural science that is, pasture and forage crops [$F_{1, 137} = 0.558$; $p > 0.05$]. Thus, gender (whether students are males or females) does not influence achievement in an aspect of agricultural science. Likewise, self-concept does not have significant main effect on achievement in an aspect of agricultural science (pasture and forage crops) [$F_{1, 137} = 0.311$; $p > 0.05$].

Table 3: ANCOVA of Effect of Treatment and Moderating Variables on Students' Achievement in an Aspect of Agricultural Science.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Correlated Model	468.117	12	39.010	3.628	.000
Intercept	622.803	1	622.803	57.917	.000
Agric-pretest	170.376	1	170.373	15.844	.000
treatment	152.102	2	76.051	7.072	.001*
gender	5.999	1	5.999	.558	.456
self-concept	3.348	1	3.348	.311	.578
treatment x gender	12.057	2	6.028	.561	.572
treatment x self-concept	3.013	2	1.507	.140	.869
gender x self-concept	3.184	1	3.184	.296	.587
treatment x gender x self-concept	10.052	2	5.026	.467	.628
Error	1473.216	137	10.753		
Total	20534.000	150			
Corrected Total	1941.333	149			

*Significant ($p < 0.05$)

Two-way interaction effect of treatment and gender does not have effect on achievement in pasture and forage crops [$F_{2, 137} = 0.561$; $p > 0.05$]. Since the main effect of treatment is significant but the interaction effect with gender is not significant, it then means that the treatment does not depend on gender to be effective. In other words, the treatment is not gender sensitive and will be effective irrespective of students' gender.

Also, two-way interaction effect of treatment and self-concept on students' achievement in an aspect of agricultural science is not significant [$F_{2, 137} = 0.140$; $p > 0.05$]. This implies that the treatment will be effective irrespective of student self-concept (either high or low). Similarly, gender and self-concept have no significant interaction effect on students' achievement in an aspect of Agricultural Science [$F_{1, 137} = 0.296$; $p > 0.05$].

Three-way interaction effect of treatment, gender, and self-concept has no significant effect on students' achievement in an aspect of Agricultural Science [$F_{2, 137} = 0.467$; $p > 0.05$]. Thus, the treatment will work irrespective of students' gender and self-concept. In summary, all the null hypotheses are being upheld except hypothesis one that states: there is no significant main effect of treatment on students' achievement in an aspect of Agricultural Science (Pasture and Forage Crops).

In Table 4 there is significant difference in the students' mean scores among the three groups; demonstration, peer-tutoring and lecture strategies [$F_{2, 137} = 7.072$; $p < 0.05$]. Thus, students performed significantly at different levels in the three groups. This indicated that the treatment may not be equally effective. It is therefore important to compare the three groups two-by-two to find out the group(s) that cause(s) the difference. This is why the next table (Table 5) is important.

The essence of pair wise comparison is to explain the cause of the significant difference reported in Table 4. In Table 5, there is pair wise comparison. The groups are compared two-by-two. There is no significant mean difference between peer-tutoring and lecture strategies. However, there is significant difference between demonstration and lecture strategies. Demonstration strategy is significantly better than lecture strategy. There is also significant difference between demonstration and peer-tutoring strategies. Demonstration strategy is significantly better than peer-tutoring strategy.

The findings in Table 6 above are graphically presented in Figure 1. The interpretation follows the figure.

Table 4: Univariate Tests of the Mean Scores of the Three Groups.

	Sum of Squares	Df	Mean Square	F	Sig
Contrast	152.102	2	76.051	7.072	.001*
Error	1473.216	137	10.753		

*Significant ($p < 0.05$)

Table 5: Pair-Wise Comparison of the Three Groups.

(I) treatment	(J) treatment	Mean Difference (I-J)	Std. Error	Sig.
Lecture	peer-tutoring	.379	.723	.601
	demonstration	-2.021	.726	.006
Peer-tutoring	lecture	-.379	.723	.601
	demonstration	-2.400	.678	.001*
Demonstration	lecture	2.021	.726	.006
	peer-tutoring	2.400	.678	.001*

*The mean difference is significant at the .05 level

Table 6: Mean Scores of Male and Female Students in the Three Groups.

Treatment	Gender	Mean	Std. Error
Lecture	female	10.339	.761
	male	10.759	.645
Peer-tutoring	female	10.563	.772
	male	9.777	.629
Demonstration	female	13.011	.674
	male	12.129	.705

In Figure 1 above, demonstration strategy is the best strategy of teaching pasture and forage crops in Agricultural Science. Besides lecture strategy, female students performed better than male students in the other groups (demonstration and peer-tutoring). However, the difference in male and female students' achievement is not significant according to the presentation in table 3. In table 3, gender alone has no significant effect on students' achievement.

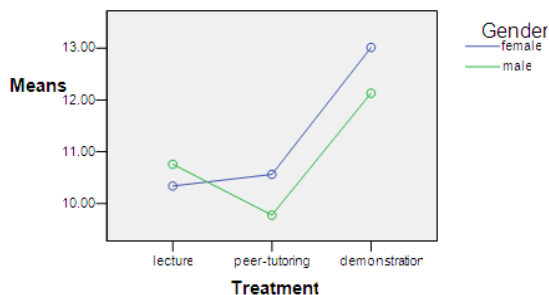


Figure 1: Mean Plot of Interaction Effect of Treatment and Gender.

The findings in Table 7 are graphically presented in Figure 2.

In Figure 2, demonstration strategy is the best strategy of teaching pasture and forage crops in Agricultural Science. Besides demonstration strategy where the mean scores for students of high and low self-concept tied, students with high self-concept performed better in both lecture and peer-tutoring strategies. However, the interaction effect of treatment and self-concept is not significant according to the findings earlier presented in Table 3.

The findings in Table 8 above are graphically presented in Figure 3.

In Figure 3 above, female students with high self-concept have higher scores in pasture and forage crops test than female students with low self-concept. However, males of high and low self-concept have almost the same mean scores. It should be noted that the interaction effect of gender and self-concept have no significant effect on achievement as presented in Table 3.

Table 7: Mean Scores of Students with High and Low Self-concept in the Three Groups.

Treatment	Self-concept	Mean	Std. Error
Lecture	low self-concept	10.191	0.714
	high self-concept	10.906	0.700
Peer-tutoring	low self-concept	10.060	0.662
	high self-concept	10.280	0.691
Demonstration	low self-concept	12.572	0.787
	high self-concept	12.568	0.584

Table 8: Mean Scores of the Male and Female Students with High and Low Self-Concept.

Gender	Self-concept	Mean	Std. Error
Female	low self-concept	10.998	.571
	high self-concept	11.611	.590
Male	low self-concept	10.885	.584
	high self-concept	10.892	.472

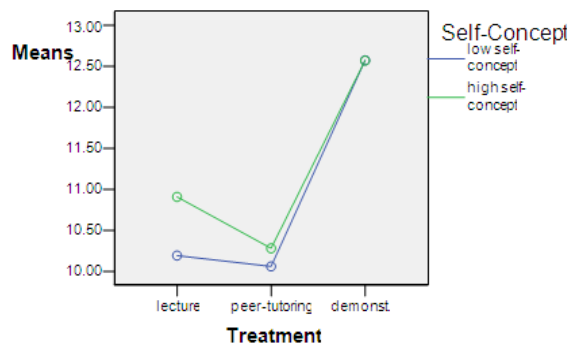


Figure 2: Mean Plot of Interaction Effect of Treatment and Self-Concept.

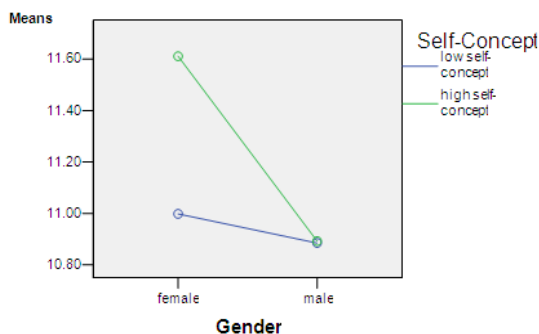


Figure 3: Mean Plot of Interaction of Gender and Self-Concept.

DISCUSSION

The analyses and results of this study showed that the demonstration strategy brought about the most significant change in the achievement of students. This might be due to the interaction and friendliness that the strategy provided for the students. Students in the demonstration strategy group were better motivated to learn; this might be

as a result of the opportunity to interact with the teacher and also ask questions in a friendly environment. Webb (1982) had opined that the more the interaction among students and teacher, the better the performance. The demonstration learning strategy encourages collaboration in some form, either through small groups, student-led presentations, or whole-class evaluations of project results (BIE, 2002). Demonstration strategy of learning shares some overlapping characteristics with peer-tutoring teaching strategy and appears to be an equivalent or slightly better model for producing gains in academic achievement, although results vary with the quality of the project and the level of student engagement (Dohn and Wagne, 1999; BIE, 2002).

Furthermore, the demonstration and peer-tutoring strategies also yielded a significant difference when compared with the control group. The lecture method is the most widely used form of presentation and may be combined with other teaching strategies to give added meaning and direction. The students in this study are conversant with demonstration and peer-tutoring strategies as their teachers often used them because of their adaptability to many different settings, including either small or large groups.

Dynamic Flight (2003) gave an illustration on selection of appropriate teaching method(s) for science lesson. Teaching methods should be compared to maintenance technician's box. The instructor's tools are the teaching methods. Just as the technician uses some tools more than the others, there will be times when a less used tool will be the exact instrument needed for a particular situation. The instructor's success is determined to a large extent by the ability to organize materials and to select and utilize teaching methods most appropriate to a particular lesson.

In selecting teaching method(s) for a science class, Abdullahi (1982) enjoined the teacher/instructor to consider the following factors:

- The learners' age, their previous knowledge on the topic and their ability.
- The method should be suitable to the topic being taught.
- The science teacher should select the method he/she can effectively handle.
- The time the lesson will take place.
- The size of the class where the lesson is being taught.
- The resources that are at the disposal of the teacher.

Thus the fact that a method is suitable for the teaching of pasture and forage crops does not mean it will be a suitable topic for teaching another topic even in the same subject. There are times Agricultural science teacher may need to combine different methods to teach a particular topic. Olatoye (2006) identified methods that can be used to teach science effectively. These methods include demonstration, discussion, individualized, field-trip method and computer-based instruction.

CONCLUSION

In our society, modern technology involves agricultural science. Learning agricultural science leads to the development of thinking skills and understanding of the other sciences. Demonstration teaching strategy has been found challenging but can be evaluated as a rewarding exercise and an overall success as a result of its capability to help the students learn to develop the ability to think critically and analytically. A high degree of independence is required as the students have to learn how to identify resources and how to communicate effectively and this no doubt helps the learners to comprehend abstract concepts.

The demonstration teaching strategy in this paper produces significantly better performance in the Agricultural Achievement Test than the peer-tutoring and lecture teaching strategies. Thus, demonstration teaching strategy is an effective mode of instruction for students in the secondary schools. However, a teaching method is seldom used alone.

In a typical lesson, an effective instructor normally uses more than one method. The findings of this

study has revealed that demonstration and peer-tutoring teaching strategies can be used for teaching and learning processes depending on the topic but demonstration strategy is the most effective because it afforded the students the opportunity to study on their own. Thus, while making attempts to improving the utilization of the regular school hours of the students; the provision of learning by "doing" is a strategy that could be adequately employed in our classrooms. This paper concludes that the use of demonstration method of teaching should be embraced by all senior secondary school science teachers.

RECOMMENDATIONS

In view of the results of these findings and conclusion reached in this paper, the following recommendations are hereby offered:

- Teachers occasionally should give students topics to go and make inquiry about, so that before the teacher teaches a new concept, students will be able to explain in their own terms what they know about the new concepts. That is, students' explanation will be regarded as hypothesis to be discussed and tested. If the teacher can create an atmosphere in the classroom of a kind in which the students can express themselves without bordering about making mistakes, their hypotheses can be used to illustrate their concepts.
- Governments should be implored to give enough grants to equip laboratories with tools, specimens and also to provide useful materials and appropriate teaching aids. For example, in the case of demonstration, this cannot be effectively carried out in schools where the libraries are not well stocked and also where there are no personal computers. Shortage of laboratory equipment can hinder teacher from using good instructional strategies.

Teachers should be encouraged to go for regular workshops and seminars where they can be enlightened on the use of appropriate teaching strategies for different aspects of their subjects.

REFERENCES

1. Abdullahi, A.M. 1989. *A Survey of Resources and their Utilization in Schools*. University Press: Ibadan, Nigeria.
2. Blair, K., Schwartz, D.L., Biswas, G., and Leelawong, K. 2007. "Pedagogical Agents for Learning by Teaching: Teachable Agents". *Educational Technology*. 47(1):56-61.
3. Boud, D., Cohen, R. and Sampson, J. 2001. *Peer-Learning in Higher Education: Learning from and with each other*. Gogan Press: London, UK.
4. Carrier, K. 2005. "Key Issues for Teaching Learners in the Classrooms". *Middle School Journal*. 37(4):17-24.
5. Cohen, P.A., Kulik, J.A., and Kulik, C.C. 1982. "Education Outcomes of Tutoring: A Meta-Analysis of Findings". *American Educational Research Journal*, 19.
6. Duch, B. 2002. "Problem-based Learning". Published by University of Delaware, Retrieved on 15th January, 2010 at <http://www.udel.edu/pbl>
7. Dynamic Flight. 2003. "Teaching Methods". Retrieved on 12th January, 2003. <http://www.dynamicflight/avcfibook/methods>
8. Elbaum, B., Vaughn, S., Hughes, M.T. and Moody, S.W. 2000. "How Effective are One-to-One Tutoring Programs in Reading for Elementary Students At-Risk for Reading Failure?: A Meta-Analysis of the Intervention Research". *Journal of Educational Psychology*. 6(1):67-86.
9. Erinosh, S.Y. 1997. *Female Participation in Science: An Analysis of Secondary School Science Curriculum Materials in Nigeria*. Abridged Research Report No 29. Nairobi Academic of Science Publisher: Nairobi, Kenya.
10. Fuchs, L.S., Fuchs, D., and Karns, K. 2001. "Enhancing Kindergartners' Mathematical Development: Effects of Peer-Assisted Learning Strategies". *The Elementary School Journal*. 101.
11. Hadim, H. A. and Esche, S.K. 2002. "Enhancing the Engineering Curriculum through Project-Based Learning". *Proceedings of the 32nd ASEE/IEEE Frontiers in Education Conference*. IEEE Press: Boston, MA.
12. Huitt, W. 2004. "Self-Concept and Self-Esteem. Valdosta State University: Educational Psychology Interactive, Retrieved 6th May 2009 from: <http://www.chiron.valdosta.edu/whuitt/col/regsys/self.html>
13. Johnson, D.M., Wardlow, G. W. and Franklin, T.D. 1998. "Methods of Reinforcement and Student Gender Effect on Achievement in Agricultural Science Education". *Journal of Agricultural Education*. 39(4):18-27.
14. Klingner, J.K. and Vaughn, S. 1996. "Reciprocal Teaching of Reading Comprehension Strategies for Students with Learning Disabilities who use English as a Second Language". *The Elementary School Journal*. 96(1):89-101.
15. Kumar, W.S. and Morris, J. 2005. "Predicting Scientific Understanding of Prospective Elementary Teachers: Role of Gender, Education Level, Courses in Science and Attitude toward Science and Mathematics". *Journal of Science Education and Technology*. 14(4):387-391.
16. Lang, H.G. 2006. *Science Education for Deaf Students: Priorities for Researcher and Instructional Development*. Rochester Institute for the Deaf: Rochester, NY.
17. Lee, M.M. 1998. "Gender Differences in Young Adolescents' Mathematics and Science Achievement". *Childhood Education*. 2:123-134.
18. Nazzal, A. 2002. "Peer-Tutoring and At-Risk Students: An Exploratory Study". *Action in Teacher Education*. 24(1):68-80.
19. Newby, T J. Stepich, D.A., Lechman, J.D., and Russel J.D. 1996. *Introduction to Instructional Technology, Instructional Technology for Teaching and Learning*. Educational Technology Publications: Englewood Cliffs, NJ. 48.
20. Noell, G.H., Duhon, G.J., Gatti, S.L., and Connell, J.E. 2002. "Consultation, Follow-up and Implementation of Behavior Management Interventions in General Education". *School Psychology Review*. 31(1): 21-34.
21. Olatoye, R.A. and Afuwape, M.O. 2004. "Emergent Issues in Enhancing Teaching and Learning of Science in Schools". In: O.A Afemikhe and J.G Adewale (Eds). *Issues in Educational measurement and Evaluation in Nigeria*. Institute of Education, University of Ibadan: Ibadan, Nigeria.
22. Olatoye, R.A. 2006. "Raising the Standard of Science Teaching for Great and Dynamic Economic Development in Nigeria". *Journal of Qualitative Education*. 2(1):39-46.
23. Olatoye, R.A. 2008. "Self-Concept and Science Achievement in Co-Educational and Single-Sex Junior Secondary School in Ogun State, Nigeria". *Review of Higher Education and Self-Learning*. 1(1):69-74. <http://www.intellectbase.org>.

24. Prpic, J.K. and Hadgraft, R.G. 2009. "What is Problem-Based Learning?". Retrieved on 3rd December, 2009 at <http://www.dlsbweb.rmit.edu.au/eng/beng0001/learning/strategy>
25. Riggio, R.E., Fantuzzo, J.W., Connelly, S., and Dimeff, L.A. 1991. "Reciprocal Peer-Tutoring: A Classroom Strategy for Promoting Academic and Social Integration in Undergraduate Students". *Journal of Social Behavior and Personality*. 6(1): 90-109.
26. Rohrbeck, C.A., Ginsburg-Block, M.D., Fantuzzo, J. W., and Miller, T.R. 2003. "Peer-Assisted Learning Interventions with Elementary School Students: A Meta-Analytic Review". *Journal of Educational Psychology*. 95:77-89.
27. Ryan, J.B., Reid, R., and Epstein, M.H. 2004. "Peer-Mediated Intervention Studies on Academic Achievement for Students with EBD". *Remedial and Special Education*. 25(6). Retrieved February 21, 2006 from EBSCO database.
28. Sanchez, F.J.P. and Roda, M.D.S. 2006. *Electronic Journal in Psychology and Psychopadagogy*. 1(1):95-120.
29. Sotonade, O.A.T. 2004. "Gender Issues as Perceived by Nigeria Parents". *Journal of Education Focus*. 5:68-80.
30. Tamir, P. 1990. "Ethnic Origins and Science Learning of Israel High School Students". *Studies in Educational Evaluation*. 16:373-397.
31. Tournaki, N. and Criscitiello, E. 2003. "Using Peer-Tutoring as a Successful Part of Behaviour Management". *Teaching Exceptional Children*. 36(2). Retrieved February 21, 2006 from EBSCO database.
32. Uhumuavbi, J.A. and Mamudu, J.A. 2009. "Relative Effects of Programmed Instruction and Demonstration Methods on Students' Academic Performance in Science". *College Students Journal*. 2(4):46-57.
33. WAEC Reports. 2008. *Chief Examiners' and Team Leaders' Report*. West African Examinations Council: Yaba, Lagos, Nigeria.
34. Wood, W.B and Gentile, J.M. 2003. "Teaching in a Research Context". *Science*. 302:1510.

ABOUT THE AUTHORS

Mrs. Y.M. Adekoya, holds a Masters Degree in Educational Evaluation from Olabisi Onabanjo University, Ago-Iwoye, Nigeria. She is interested in innovative teaching methods that can enhance dissemination of instructions in the science classroom. She has published quite a number of articles in science education

Dr. R.A. Olatoye, is a Senior Lecturer at the Department of Science, Technology and Mathematics Education, College of Education, Osun State University, Ipetu-Ijesa Campus, Osogbo, Osun State, Nigeria. He holds a Ph.D. degree in Educational Evaluation and his areas of interest are science education, educational evaluation, and educational statistics. He is also an expert in quantitative measurement and data processing. He has published many scholarly papers in reputable journals and has attended many conferences within and outside his country, Nigeria.

SUGGESTED CITATION

Adekoya, Y.M. and R.A. Olatoye. 2011. "Effect of Demonstration, Peer-Tutoring, and Lecture Teaching Strategies on Senior Secondary School Students' Achievement in an Aspect of Agricultural Science". *Pacific Journal of Science and Technology*. 12(1):320-332.

 [Pacific Journal of Science and Technology](http://www.pacificjournalofscienceandtechnology.com)