جامعة الحكمة، إلورن - نيجيريا
AL-HIKMAH UNIVERSITY
ILORIN - NIGERIA
...learning for wisdom and morality
The 1st Islamic Faith-Based University in Nigeria

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Effect of Problem Based Learning Strategy on Secondary School Students' Academic Achievement and Attitude in Agricultural Science in Gaya Education Zone, Kano State, Nigeria

Idi Garba, PhD
Department of Science and Technology Education, Faculty of Education,
Bayero University, Kano
idigarba926@yahoo.com 08065991335

Abstract
The study investigated the effect of Problem Based Learning on academic achievement and attitude among Agricultural Science students in Secondary Schools in Gaya Education Zone, Kano State. Four research questions and four null hypotheses were formulated and tested at 0.05 level of significance. Quasi-experimental design was adopted. The population of the study was made up of 3,823 SS II Agricultural Science students, consisting of 2,106 males and 1,717 females. Stratified Simple Random Sampling was used to select four schools while Simple Random Sampling was used in selecting four intact classes, two as experiment and two as control groups comprising of 99 and 94 students respectively. Two instruments used for data collection titled Agricultural Science Achievement Test and Agricultural Science Students Attitude Questionnaire, reliability coefficients of 0.72 and 0.68 were obtained respectively. Mean and Standard Deviation were used for answering the research questions while z-test was used in testing the null hypotheses at 0.05 level of significance. The findings of study among others indicated that students taught Agricultural Science using Problem Based Learning had higher academic achievement mean and attitude ratings means scores than those taught using Lecture Method.

Keywords: Secondary School, Agricultural Science**,** Problem Based Learning, Academic Achievement

Introduction
Agricultural Science means the application of scientific principles for the growing of crops and rearing of animals for man's use and industrial purposes. It is a broad multidisciplinary field that deals with the selection, breeding and management of crops and livestock for the purpose of providing food, raw materials and shelter (Ogunjobi & Owoseni, 2025). It also involves the science of processing, preservation, storage, marketing and distribution of the agricultural products. Agricultural science is one of the vocational subjects taught in senior secondary schools (Federal Republic of Nigeria [FRN], 2013),

Secondary Education is the education children receive after Primary Education and before the tertiary stage. As stipulated in the National Policy on Education (FRN, 2013), Secondary Education shall be of six years duration given in two stages - a Junior Secondary Education and a Senior Secondary Education; each shall be of three years duration. The Junior Secondary Education to be provided by government shall be compulsory, free, universal and qualitative. It provides the child with diverse basic knowledge and skills for entrepreneurship and educational advancement. The Senior

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Secondary Education shall be comprehensive with a core-curriculum designed to provide entrepreneurial, technical and vocational job- specific skills for self-reliance. Unfortunately, something seems to have gone wrong with these functions because secondary school graduates seem to be jobless. The reason might be attributed to the type of teaching methods used by Agricultural Science teachers. The method of teaching employed by most of Agricultural Science teachers in secondary schools is Lecture Method. Lecture Method is a type of teaching that is characterized by one-way communication from teacher to students. Effective teaching and learning take place when learners are given opportunity to take part in the teaching process. Students are usually passive listeners in lecture teaching method (Michael et al. 2024). Federal Ministry of Education in its National policy on Education (FRN, 2013) has discouraged the use of Lecture Method and recommended students-centered method such as Problem Based Learning.

According to Behiye and Ibrahim (2024), Problem Based Learning is a widely recognized pedagogical approach that has gained substantial attention in education worldwide. The strategy was originated from medical education in the late 1960s. It has since evolved and being implemented across various educational levels. The method has attained significant recognition and relevance in science education due to its effectiveness in promoting a deeper understanding of scientific concepts, enhancing students' problem-solving abilities, and fostering students' critical thinking skills as they analyze, evaluate, and synthesize information to solve problems. Additionally, the method helps to prepare students for future careers in science and science-related fields by equipping them with skills, such as critical thinking, problem solving, teamwork, and adaptability which are highly valued by employers. It is characterized by its student-centered, inquiry-driven, and collaborative nature. Students engage in a dynamic and collaborative inquiry process to explore and solve complex authentic problems (Behiye & Ibrahim, 2024).

The first task for the teacher in Problem Based Learning is to guide the students to identify the problems and helps them to link the problem with previous knowledge. The students discuss the problem cooperatively among themselves in a small group, explain what they know, develop research questions, generate hypotheses, initial plans and organize their knowledge, attempt to solve the problems with several modifications, derive learning goals and organize further work. Finally, the small group of students present the result to larger groups through the guidance of the teacher and the students are allowed to reflect on the learning that has taken place (Ogunjobi & Owoseni, 2025). Therefore, Problem Based Learning strategy enhances students' academic achievement. Students' academic achievement is the level of success or accomplishment in a given area as measured by a test score. It is a measure of knowledge that students gained through formal education typically indicated by test scores, grade point average, and degree (Kaur, 2023).

Statemen of the Problem

Students' academic achievement in Agricultural education has been observed to be hindered by many factors such as teachers' insensitivity when planning instructional activities in the classroom, inadequate instructional materials and ineffective teaching method (Zhirin, 2024) like Lecture Method. Tofi et al. (2023) observed that the method of instruction employed by most science teachers is the Lecture Method. Lecture

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Method which is a teacher-centered is not efficient for improving students' academic performance as it does not give enough room for active participation of students which leads to their poor academic performance. Federal Ministry of Education in its National Policy on Education (2013) has discouraged the use of Lecture Method and recommended student-centered method. Problem Based Learning is characterized as a student-centered method in which students engage in a dynamic and collaborative inquiry process to explore and solve complex, authentic problems, enhancing students' problem-solving abilities, and fostering students' critical thinking skills (Behiye & Ibrahim, 2024). Hence, the use of Problem Based Learning strategy could be an option for teachers seeking to enhance students' academic achievement in agricultural science. However, despite the relevance of the method highlighted from the literature reviewed, no any empirical study was found conducted in agricultural science specifically in secondary schools in Gaya Education Zone. It is based on this background that research was conducted to find out effect of Problem Based Learning and its influence on gender on academic achievement and interest among Agricultural Science students in secondary schools in Gaya Education Zone, Kano State.

Purpose of the Study

This study aims to investigate the effect of Problem Based Learning strategy on secondary school students' academic achievement and attitude in Agricultural Science. Specifically, the study sought to:

i. find out the difference in academic achievement mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.
ii. determine the difference in academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning.
iii. find out the difference in attitude ratings mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.
iv. Find out the difference in attitude rating mean scores of male and female students taught Agricultural Science using Problem Based Learning.

Research Questions

The following research questions guided the study:

i. What is the difference between the academic achievement mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method?
ii. What is the difference between the academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning?
iii. What is the difference between the attitude ratings mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.
iv. What is the difference between the attitude rating mean scores of male and female students taught Agricultural Science using Problem Based Learning.

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

$H0_1$: There is no significant difference in academic achievement mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.

$H0_2$: There is no significant difference in academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning.

HO_3: There is no significant difference in attitude ratings mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.

$H0_4$: There is no significant difference in attitude ratings mean scores of male and female students taught Agricultural Science using Problem Based Learning.

Methodology

Quasi-experimental design specifically pretest, posttest non-equivalent control group design was adopted for the study. Four research questions and four correspondence null hypotheses were formulated for the study which were tested at 0.05 level of significance. The population for the study was 3,823 Agricultural Science SS II students, consisting of 2,106 males and 1,717 females. Stratified Simple Random Sampling was adopted to select four experimental schools while Simple Random Sampling was used in assigning two intact classes as experiment and control groups that comprised of 99 and 94 students respectively. Two instruments titled Agricultural Science Achievement Test (ASAT) containing 30 items adapted from past question papers of NECO and WAEC from 2020 to 2023 and Agricultural Science Students Attitude Questionnaire (ASSAQ) containing 20 items developed by the researcher on four- points rating scale of Strongly Agree (SA), Agreed (A), Disagree (D) and Strongly Disagreed (SD), coded and weighted as 4,3,2, and 1 beginning from the highest to the lowest respectively, validated by three experts were used for data collection.

Test-retest and split half methods were used to ascertain the reliability coefficient ASAT and ASSAQ which yielded 0.72 and 0.68 using Pearson Product Moment Correlation Coefficient (PPMC) and Spearman Rank Order Correlation Coefficient respectively. The period for data collection lasted for six weeks. The data collected were analyzed using descriptive statistics of Mean and Standard Deviation for answering the research questions while inferential statistics of z-test was used in testing the null hypotheses at 0.05 level of significance.

Results

The analysis of the data collected, the findings and discussion of the findings were presented as follow;

Research Question One: What is the different between the academic achievement mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method?

Descriptive statistics of mean and standard deviation were used to answer this research question and summary of the result is presented in Table 1.

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Table 1
Mean and Standard Deviation of Students' Academic Achievement Scores in Experimental and Control Groups.

Groups	N	Mean	S. D	Mean Difference	Std. Error Mean
Control Group	94	14.93	2.75	1.79	.29
Experimental Group	99	16.72	2.46		.32

Table 1 indicated that students taught Agricultural Science using Lecture Method have the mean academic achievement score of 14.93 and the standard deviation of 2.75 while those taught using Problem Based Learning have the mean score of 16.72 and standard deviation of 2. 46. The mean difference between the groups is 1.79. This clearly reveals that the students taught Agricultural Science using Problem Based Learning have high achievement mean scores than those taught using Lecture Method. The standard deviation of both control and experimental groups show that students responses on the test were closely related.

Null Hypothesis One: There is no significant different between the academic achievement mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.
The independent t-test was used to test this hypothesis using post test scores. The summary of the result is presented in Table 2.

Table 2
Analysis of Independent z-test on Students' Academic Achievement Mean Scores in Experimental and Control Groups

Groups	N	Mean	SD	Df	Z-value	P-value	Decision
Experimental Group	94	22.28	3. 22	191	10.61	0.000	Rejected
Control Group	99	14.25	3. 49				

Table 2 showed that observed p-value is 0.000 which is less than the significant level of 0.05. Based on this evidence, the null hypothesis was rejected ($P=0.000 < 0.05$). This reveals that there is significant different between the academic achievement mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.

Research Question Two: What is the different between the academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning?

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Descriptive statistics of mean and standard deviation were used to answer this research question and summary of the result is presented in Table 3.

Table 3

Mean and Standard Deviation of Male and Female Students' Academic Achievement Scores in Experimental Group.

Groups	N	Mean	S. D	Mean Difference	Std. Error Mean
Male Students	52	15.28	2.35	0.15	.43
Female Students	47	15. 43	3.89		.52

Table 3 indicated that the academic achievement mean scores of male and female Agricultural Science students taught using Problem Based Learning. The result indicated that male students have academic achievement mean score of 15.28 with a standard deviation of 2.35 while female students have academic achievement mean scores of 15.73 with a standard deviation of 3.89. The mean difference is 0.15. This shows that there is difference between the academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning in favour of female students. The standard deviation for the female students showed that the female students' responses were not closely related to each other as those for male students.

Null Hypothesis Two: There is no significant different between the academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning.

The independent z-test was used to test this hypothesis using post test scores. The summary of the result is presented in Table 4.

Table 4

Analysis of Independent z-test of Male and Female Students' Academic Achievement Mean Scores in Experimental Group

Groups	N	Mean	SD	Df	z-value	P-value	Decision
Male Students	52	22.98	3.38	292	1.39	0.24	Accepted
Female Students	47	23.12	3.67				

Table 4 revealed that observed p-value of 0.24 is greater than significant level of 0.05 (p=0.24> 0.05). Based on this evidence, the null hypothesis was accepted. This showed that there is no significant different between the academic achievement mean scores of male and female students taught Agricultural Science using Problem Based Learning.

Research Question Three: What is the different between the attitude rating mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method?

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Descriptive statistics of mean and standard deviation were used to answer this research question and summary of the result is presented in Table 5.

Table 5
Mean and Standard Deviation of Students' Attitude Rating Mean Scores in Experimental and Control Groups.

Groups	N	Mean	S. D	Mean Difference	Std. Error Mean
Control Group	94	19.67	4.23	3.78	.78
Experimental Group	99	23.45	2.98		.59

Table 5 indicates that students taught Agricultural Science using Lecture Method have the attitude ratings mean score of 19.67 and the standard deviation of 4.23 while those taught using Problem Based Learning have the attitude ratings mean score of 23.45 and standard deviation of 2.98. The mean difference between the groups is 3.78 in favor of experimental group. This clearly revealed that the students taught Agricultural Science using Problem Based Learning have high attitude rating mean scores than those taught using Lecture Method. The standard deviation of control group of 4.23 indicated that students' responses on the test were not closely related as those in the experimental groups whose standard deviation was 2.98.

Null Hypothesis Three: There is no significant different between the attitude ratings mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method.
The independent z-test was used to test this hypothesis using post test scores. The summary of the result is presented in Table 6.

Table 6
Analysis of Independent z-Test on Students' Attitude Ratings Mean Scores in Experimental and Control Groups

Groups	N	Mean	SD	Df	Z-value	P-value	Decision
Experimental Group	151	20.46	3.72	292	14.44	0.000	Rejected
Control Group	143	10.47	3.38				

Table 6 revealed that z-value is 14.44 and p-value is 0.00. Therefore, p-value of 0.000 is less than significant level of 0.05. Based on this evidence, the null hypothesis was rejected. This shows that there is significant different between the attitude ratings mean scores of students taught Agricultural Science using Problem Based Learning and those taught using Lecture Method in favour of the experimental group.

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Research Question Four: What is the different between the attitude rating mean scores of male and female students taught Agricultural Science using Problem Based Learning.

Descriptive statistics of mean and standard deviation were used to answer this research question and summary of the result is presented in Table 7.

Table 7

Mean and Standard Deviation of Male and Female Students' Attitude Scores in Experimental Group.

Groups	N	Mean	S. D	Mean Difference	Std. Error Mean
Male Students	52	29.88	3.87	0.31	.43
Female Students	47	29.57	3.45		.52

Table 7 showed the mean scores of male and female Agricultural Science students taught using Problem Based Learning. The result indices that male students have attitude ratings mean scores of 29.88 with a standard deviation of 3.87 while female students have attitude ratings mean scores of 29.57 with a standard deviation of 3.45. The mean difference is 0.31. This revealed that there is no significant difference between the mean attitude ratings scores of male and female students taught Agricultural Science using Problem Based Learning.

Null Hypothesis Four: There is no significant different between the attitude ratings mean scores of male and female students taught Agricultural Science using Problem Based Learning.

The independent z-test was used to test this hypothesis using post test scores. The summary of the result is presented in Table 8.

Table 8

Analysis of Independent z-test of Male and Female Students' Attitude Ratings Mean Scores in Experimental Group

Groups	N	Mean	SD	Df	Z-value	P-value	Decision
Male Students	52	22.34	3.39	292	0.56	0.68	Accepted
Female Students	47	22.71	3.53				

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Table 8 revealed that the observed p-value of 0.68 is greater than significant level of 0.05 (p=0.68 > 0.05). Based on this evidence, the null hypothesis was accepted. This shows that there no significant different between the attitude mean scores of male and female students taught Agricultural Science using Problem Based Learning.

Discussion of Findings

The finding of the study revealed that Agricultural Science students taught with the Problem Based Learning have high achievement mean scores (mean = 16.72) than those taught with the Lecture Method (mean = 14.93). The difference was statistically significant (P=0.000 < 0.05). This finding supports earlier studies conducted by David et al. 2021; Ogweno et al. 2021; Gunay et al. 2022; Kaur and Singh, 2023 and Oluwadayo, 2024; who reported that students exposed to Problem Based Learning attained higher academic achievement mean scores than their counterparts exposed to Lecture Methods.

The finding of the study indicated that Problem Based Learning had no significant effect on gender academic achievement in Agricultural Science. The academic achievement mean scores of male students was 15.28 and that of female students was 15.73 while p-value = 0.24. The difference was statistically insignificant (p=0.41> 0.05). This finding is in line with David et al. (2021) who revealed that Problem Based Learning is gender friendly but the finding was contrary with that of Yidana (2018) who reported that male students performed relatively better than their female counterparts.

The finding of the study showed that the students taught Agricultural Science using Problem Based Learning have high attitude rating mean scores than those taught using Lecture Method. The attitude ratings mean score of experimental groups was 23.45 and that of control group was 19. 67 while p-value = 0.000. Hence, it was concluded that a significant difference existed between the two groups (P=0.000 < 0.05) in favor of the experimental group. This finding supported the findings of Ural and Dadli (2020) and Gunay et al. (2022) who revealed that there was a statistically significant difference between the students' attitudes, the experimental group thought using Problem Based Learning gained higher attitude ratings mean scores than the control group taught using Lecture Methods.

The finding of the study shows that there was no significant different between the attitude ratings mean scores of male and female students taught Agricultural Science using Problem Based Learning. The mean score of male students was 29.88 and that of female students was 29.57 while p-value = 0.68. The difference was statistically insignificant (p=0.68> 0.05). This finding is in line with David et al. (2021) who revealed that Problem Based Learning is gender friendly instructional strategy.

Conclusions

Based on the findings of the study, it was concluded that Problem Based Learning is an effective instructional method that enhances Agricultural Science students' academic achievement and attitude and improve their problem-solving skills.

Recommendations

Based on the findings of the study, the following recommendations were offered;

1. Kano State Ministry of Education should organize regular workshops on Problem Based Learning for secondary school teachers so as to motivate them to adopt the

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

strategy in their teaching processes as the strategy enhances students' academic achievement.

2. Curriculum developers for secondary schools Agricultural Science should make provision for and emphasize the use of Problem Based Learning in teaching both male and female secondary schools' students as the strategy was found effective and gender friendly in enhancing students' academic achievement.
3. The authors of Agricultural Science textbooks should include activities that involve the use of Problem-Based Learning strategy by both teachers and pupils in teaching and learning processes as the method stimulates students' attitude in Agriculture.
4. Kano State Senior Secondary Schools Management Board should equipe both male and female secondary schools with facilities to encourage the use of Problem-Based Learning in teaching and learning processes as the strategy was found positive in enhancing both male and female students' attitude in Agriculture.

References

Behiye, A. & Ibrahim, B. (2024). Problem-based learning in Turkiye: a systematic literature review of research in science education. *Open Access Journal of Education Sciences,14* (30), 1-26.

David, N.L., Anyagh, P.I., & Adeniran, S.A. (2021). Effect of problem-based learning strategy on upper basic education students' interest, achievement and cognitive load in basic science in Katsina-ala local government area. *International Journal of Multidisciplinary Research and Growth Evaluation, 2* (6), 01-11.

Federal Republic of Nigeria (2013). *National Policy on Education*. Nigerian Educational Research and Development Council (NERDC).

Gunay, S., Akar, C., & Balbağ, N. L. (2022). The effect of problem-based learning methods on the academic success of the social studies course and student attitudes. *Osmangazi Journal of Educational Research, 9* (2), 165-177.

Kaur, G. & Singh, G. (2023). Effect of problem-based learning approach on achievement in science among ix graders. *International Journal for Multidisciplinary Research (IJFMR), 5* (2), 1-8.

Michael M. A., Ajuzie, N. E. & Ukegbu. M. N. (2024). The effects of teaching secondary school students agricultural science with flipped classroom and Lecture Method in public secondary schools in Owerri education zone 11. *Emerald International Journal of Scientific and Contemporary Studies, 6* (1), 1-17.

Ogunjobi, O. P. & Owoseni, K. P. (2025). Effects of technology-enhanced instruction on Agricultural Science students' learning outcome in senior secondary schools in Ekiti State, Nigeria. *International Journal of Research and Scientific Innovation (IJRSI), 12* (I), 321-705.

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Ogweno, P. O., Nephat, J. K. & Nkurumwa, O. A. (2021). Effects of problem-based learning method and demonstration teaching method on secondary students' agriculture achievement in Dhewa Sub County, Kenya. *African Journal of Education and Practice, 7* (2) ,1 – 17.

Oluwadayo, A. T. (2024). Effects of problem-based learning strategy on secondary school mathematics students' academic achievement in Ogun State, Nigeria. *African Journal of Science, Technology and Mathematics Education (AJSTME), 10* (1), 246-251.

Tofi, M., Achor, E. E. & Eje, V. I. (2023) Effect of guided discovery method on secondary school students' academic performance in biology in Makurdi, Benue State, Nigeria. *European Journal of Training and Development Studies, 10* (1), 29-37.

Ural, E. & Dadli, G. (2020). The effect of problem-based learning on 7th-grade students' environmental knowledge, attitudes, and reflective thinking skills in environmental education. *Journal of Education in Science, Environment and Health (JESEH), 6* (3), 177 -192.

Yidana, M. B. (2018). Comparative effects of problem-based and cooperative instructional approaches on students' academic achievement in senior high school economics. *International Journal of Education and Evaluation, 4* (1), 31-53.

Zhirin, A. M. (2024). Relationship between moderating influence of school variables and academic achievement of agricultural education students in Taraba State University, Northern Nigeria. *International Journal of Agricultural and Home Economics Education* (IJAHEE), *11* (1), 30-41.