



## Effect of Project-Based Learning Strategy on Attitude of Biology Students towards Ecology in Misau Local Government Area, Bauchi State

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### Abstract

The purpose of this study was to examine the impact of Project-Based Learning (PBL) on the attitudes of SSII students in the subject of Ecology. The research focused on one research question and formulated a null hypothesis. A pretest-posttest Quasi-experimental research design was employed for the study. The target population consisted of all Senior Science Secondary School II students taking biology in the Misau Local Government Area of Bauchi State, with a total of 2,698 students. Two schools were randomly selected from the eleven Senior Secondary Schools in Misau. From each sampled school, one intact class was chosen using the Simple Random Sampling Technique, resulting in a total sample size of 88 students. Data collection involved the use of a self-developed questionnaire called the Ecology Attitude Questionnaire (EAQ), which included Likert Scale items ranging from Strongly Agree to Strongly Disagree. The questionnaire underwent validation by experts, and its reliability was assessed using the split-half method, resulting in a reliability coefficient of  $r=0.62$  as determined by Cronbach's alpha statistic. The experimental group received instruction in Ecology using Project-Based Learning, while the control group was taught using the Lecture Method. Data analysis employed Mean and Standard Deviation to address the research question, and the Wilcoxon Ranked Sign test statistic was utilized to test the null hypothesis at a significance level of  $p \leq 0.05$ . The findings indicated that students exposed to Project-Based Learning exhibited improved attitudes towards learning Ecology, whereas those taught using the Lecture Method did not show significant differences in their attitudes before and after instruction. Based on the results, it is recommended that biology teachers at the secondary school level incorporate Project-Based teaching and learning strategies when teaching Ecology.

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### INTRODUCTION

Learning of science in every part of the world have contributed a lot to the development of mankind. The teaching and learning of science makes students to think rationally. According to Jibrin (2014); Ngwu, Barnabas and Emmadiole (2019) this requires teachers' commitments to effectively teach the scientific concepts the students are expected to learn right from

secondary schools to prepare them to think and solve problems in life. One of science subjects taught at the Senior Secondary Schools includes Biology. The study of Biology would enable the learners to study some professional courses such as Medicine, engineering, agricultural technology, pharmacy, biotechnology and some other related areas of human endeavour.

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The study of biology in real life context would assist an individual to gain some experience that will be useful in solving daily life problems (Jibrin, 2014). Therefore, the teachers' choice and use of relevant teaching and learning strategies would provide basis for learning of sound biological concepts among the students (Jibrin, Mohammed & Zayum, 2020). The achievement of this would hopefully be fulfilled if teachers employed appropriate teaching and learning strategies that are activity orientated based such as cooperative teaching strategy, problem-solving, peer tutoring, practical teaching strategy, project based teaching strategy among others (FME, 2013; Jibrin, 2014; Jibrin, Abba & Mohammed, 2021).

Despite the relevance of biology to humanity, the learning of the subject at the Senior Secondary School is not appealing and hence affect their performance at the final year school examinations certificate (Bature, Bill & David, 2016; WAEC, 2019 & 2021). This is because most Biology teachers used strategy that are teacher-centred that hardly give room for meaningful learning among students (Hussaini, Mohammed and Jibrin, 2021). Consequently, this affect other learning constructs like attitude towards learning of science subjects, Biology inclusive (Jibrin, Ibrahim & Zayum, 2016; Bash, Kebang, Dawal & Josiah (2019); Ngwu, Barnabas and Emmadiole (2019). This according to some researchers like Markula and Aksela (2022) if students are not doing well in their learning process, they may likely develop a certain disposition towards that particular subject or concept, including ecology. According to Akcay, Yager, Iskander and Turgut (2010) students' attitude to learning science is simply refer to as feeling, beliefs and values students have towards school science, how science is being taught and its relevance to the society. That is why, the National Policy on Education (FME, 2013); Babayemi and Kareem, (2018) expressed that the use of any other method other than the child-centred approach would deprived the learners to be involved in hands-on activities, and may likely affect learning construct such as attitude in learning Biology concepts, ecology inclusive.

Ecology is among the topics in the senior secondary school biology curriculum that would give the opportunity to students to understand their environment, and how living and non-living components of the environment interaction (Hussaini, Mohammed and Jibrin, 2021). Despite this, students usually found questions asked in the area of ecology difficult as indicated in their inability to answer correctly or failed to attempt, and hence affect the overall performance in Biology (Aniekwa & Okoli, 2019; WAEC, 2019 & 2020). In the light of this, Jibrin, Mohammed & Zayum, (2020) opined that, if Biology teachers employ teaching strategies that involves hands-on activities it may enhance students' attitude toward learning of Biology, and equally, it may make learning of concept like ecology enjoyable and easy to comprehend (Essien & Aniefiok, 2019). In fact, Mahmoud, Mohammed and Jibrin (2020) reported that if teachers use strategy that would makes students to enjoy learning, they tend to develop positive attitude towards learning of Biology in general.

Therefore, Wekesa and Ongunya (2016) mentioned one of these hands-on activities include Project- Based Learning. Project-Based Learning (PBL) is a strategy by which instructions is shifted from teacher-centred approach to students-centred where the learners are provided with some learning materials and tasks whose output is usually a concrete product (Ayan, 2012). The PBL is grounded in constructivists learning theory where active learning is emphasized to make learning meaningful (Jibrin, 2014; Okoro, 2019). In the light of this, Wekesa and Ongunya (2016) reported that students exposed to PBL achieved higher as well as makes students to have positive attitude towards learning of Biology (Naji, Ahmad, Avi & Muhamad, 2018). However, a study earlier conducted by Karacalli and Korur, (2012) reported that academic performance in science is improved when taught with PBL, but their attitude towards learning science is not favourable. A lot of studies has been done using different innovative teaching strategies such as Project-Based Learning Strategy, but relatively few have been done in Misau Local Government Area, Bauchi State. Based on this, the present

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study investigated the effect of Project- Based Learning Strategy on SSII biology students' attitude in ecology within Misau Local Government Area, Bauchi State.

### **Objectives of the Study**

This study investigated the effect of Project-Based Learning Strategy (PBL) on SSII biology students' attitude towards ecology. Specifically, the study

- i. find out the attitude of SSII biology students towards leaning of ecology before and after exposure to Problem-Based Learning

### **Research Question**

One research question guided the study.

1. What is the mean attitude scores of SSII biology students before and after exposure to PBL and those taught using lecture method?

### **Research Hypothesis**

One null hypothesis was formulated and tested at  $P \leq 0.05$  level of significance.

$H_{01}$ . There is no significant difference in mean attitude scores of SSII biology students before and after exposure to PBL and those taught using lecture method

### **RESEARCH METHODOLOGY**

In this study, the pretest -posttest control group quasi-experimental research design was used. The pretest was used to establish SSII Biology students' attitude before the commencement of the treatment, while the posttest was given to ascertain their attitude after the treatment. The population consist of all the 2,698 Senior Secondary School II Biology students in all the eleven Senior Secondary Schools in Misau Local Government Area of Bauchi state. From these schools, two schools were randomly selected and subsequently, one intact class from each of the sampled schools were randomly selected using balloting sampling technique. The selected classes have a total size of 43 and 45 respectively. Therefore, a sample

size of 88 subjects were used for the study. Hence, the two schools were also randomly assigned to experimental and control group.

The instrument for data collection was a questionnaire called Ecology Attitude Questionnaire (EAQ) developed by the researchers on a four Likert-Scales for measuring students' attitude towards learning ecology. The Ecology Attitude Questionnaire consisted of 15 items with four options which ranges from Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was subjected to content and face validation by Experts with PhD as their qualification in Science Education Department and Educational Foundation, Abubakar Tafawa Balewa University Bauchi. The observations, corrections, and suggestions of the experts were used to modify the instruments. The reliability of the attitude questionnaire was measured using split half method on thirty students in a school that was not in the study area. The data obtained was analyzed using Cronbach alpha statistic and a reliability coefficient of  $r=0.62$  was established.

Before the treatment, the researcher trained the regular Biology teachers of the sample schools to serve as research assistants. These Biology teachers were trained for the period of two weeks to guide them on how to carry out the process of the teaching and as well as how to administered the instrument both as pre and posttests. After the training, copies of the teaching packages/ lesson plans for both the PBL and lecture method were given to the research assistants. In the first week, students in the experimental and control groups were given pretest using the attitude questionnaire to measure their attitude before the treatment.

In the treatment, the experimental group was taught using PBL strategy where activities were performed within and outside the classroom on the concepts of producers, consumers, decomposers, energy flow in the system, construct a functional ecosystem (food chains, food web, energy flow- energy pyramid).and impact of some different factors on an ecosystem. At end of every activities, questions were asked to ensure that the concepts were learned. While for

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the control group, the same ecological concepts were taught to the students by the teacher via lecture method, as students were not given the opportunity to learn with any instructional materials or performed any activities. The teaching procedure for both the experimental and control groups was carried out simultaneously and lasted for six weeks including the administration of the Post attitude test to the groups. The items of the Post attitude test were the same as previously used during the pretest but were reshuffled. In the questionnaire, the students were requested to express their opinion freely on each of the statement that appeal to them ranging from Strongly Agree (SA), Agree (A) Disagree (D) to Strongly Disagree (SD) by ticking appropriately. The responses of the students were coded to obtain numerical data and presented for statistical analysis.

The data obtained was analyzed using Mean and Standard Deviation to answer the research question, while the research hypothesis was tested using Wilcoxon ranked sign test statistics at  $P \leq 0.05$  level of significance because the data was obtained from before and after measurement from matched groups (Mohammed, 2012).

### RESULTS PRESENTATION

The data analyzed revealed the following results according to the research question raised and the null hypothesis formulated.

**Research Question one:** What is the mean attitude scores of SSII Biology students before and after exposed to PBL and those taught using lecture method?

**Table 1a:** Pre and Post Attitude Mean Scores of Students Exposed to Project-Based Learning.

Variable	N	Mean	SD	Mean difference
Before	43	13.60	2.33	
After	43	17.70	2.23	4.10

**Table 1b:** Pre and Post Attitude Mean Scores of Students Taught using lecture method.

Variable	N	Mean	SD	Mean difference
Before	45	12.40	1.66	
After	45	12.42	2.09	0.02

Results presented in Table 1a indicates the attitude mean scores of students before and after exposure to Project-Based Learning strategy to be 13.60 with standard deviation of 2.33 and 17.70 with standard deviation of 2.23 respectively. The difference in the mean scores before and after was 4.10, this indicates an increase in attitude of students when exposed to Project-Based Learning strategy and was subsequently tested in the hypothesis testing to determine the level of significance difference between the mean scores before and after exposed to Project-Based Learning of ecology.

Similarly, results in Table 1b show a mean score of 12.40 and standard deviation of

1.66 before taught via conventional lecture method and the mean score after was 12.42 and standard deviation of 2.09. From the two mean scores, 0.02 was found to be the mean difference and was tested statistically in hypothesis testing.

### Hypothesis Testing

The results of hypothesis are presented as follow;

**Hypothesis One:** There is no significant difference in mean attitude scores of SSII Biology students before and after exposed to PBL and those taught using lecture method.

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**Table 2a:** Wilcoxon Test Statistic of Mean Attitude Scores of Students Exposed to Project Based Learning.

Variable	N	Mean	SD	DF	Z. val	P.val	Remark.
Before	43	13.60	2.33	85	-5.43	0.00	Sig.
After	43	17.70	2.23				

Sig.at  $p \leq 0.05$

**Table 2b:** Wilcoxon Test Statistics of Mean Attitude Scores of Students Taught using lecture method.

Variable	N	Mean	SD	DF	Z. val	P.val	Remark
Before	45	12.40	1.66	89	-.255	0.78	Not Sig.
After	45	12.42	2.09				

Not Sig. at  $P \leq 0.05$

The results in Table 2a revealed the attitude mean scores of 13.60 students before exposed to Project Based Learning and 17.70 after exposure to Project Based Learning respectively with P.value calculated to be 0.00 at the DF of 85. Since 0.00 is less than 0.05 level of significance, it means that, there is a significant difference in the attitude mean scores of students before and after exposed to Project Based Learning. Hence, the null hypothesis is rejected.

Similarly, results in table 2b shows P-value calculated of 0.78 at the DF of 89. Since 0.78 is greater than 0.05 level of significance, is a clear indication that attitude of students in the control group does not change before and after taught ecosystem using the traditional lecture method. Therefore, the hypothesis which states that there is no significant difference between the attitude mean scores of SSII biology students before and after taught ecosystem using PBL is accepted.

### DISCUSSION OF FINDINGS

From the findings of the study of the impact of Project-Based Learning on Biology students' attitude towards ecology, it revealed that Biology students exposed to Project-Based Learning has shown an impact on the attitude of students in learning ecological concepts. This study is in agreement with that of Yilmaz and Nihal (2013) who equally reported that Project-Based Learning if properly utilized improve attitude among learners. This according to Ayan, (2012) ; Gulbabar and Tinmaz (2006); activity-based learning lead to good learning experiences and

enhance their problem-solving abilities and attitude towards learning science in general. However, a contrary study by Karacalli and Korur (2012) reported no significant in students' attitude when exposed to project-based learning. Again, in a study conducted by Halil (2018) on the effects of activity-based learning on grade 6<sup>th</sup> mathematics learners' attitude does not improved as those in the control group, but the experimental group performed better in term of the academic achievement. This may be because their teachers are not familiar in the use of this activity-based instructional strategy as employed in this study (Nazif, Shehu & Musa, 2019).

### RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made;

1. The biology teachers should use activity-based teaching and learning strategies while teaching biology at secondary school level to improve students' attitude in learning biological concepts.
2. The biology teachers should encourage their students to always be ready to do some project work on their own, as this may widen their scope of thinking.
3. The school authorities should encourage and sponsor biology and other science teachers to attend conferences and workshops on activity-based instructional strategies organized by professional bodies such as Science Teachers Association of Nigeria and their like.

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## CONCLUSION

From the findings of this study, it can be concluded that students' attitude in learning ecology depends on learning experience gained during the teaching and learning process. This is evident from the fact that if students are involved in child-centred approach that engage students in hands-on activities, like project-based learning it could enhance their attitude towards learning of Biology in general.

## REFERENCES

- Aksela, M., & Haatainen, O. (2019). Project-based learning (PBL) in practice: Active Teachers' Views of Its Advantages and Challenges. In *Integrated Education for the Real World: 5th International STEM in Education Conference Post-Conference Proceedings* (pp. 9–16). Queensland University of Technology.
- Akcay, H; Yager, R. E.; Iskander, S. M., & Turgut, H. (2010). Change in student beliefs about attitudes toward science in grades 6-9. *Asia-Pacific Forum on Science Learning and Teaching*, 11 (1), Article 1 (Jun., 2010)
- Aniekwu, C. C. & Okoli, J.N. (2019).Effect of Constructivist Instructional Approach on Senior Secondary School Students' Achievement in Ecological Concepts. In A.S. Ifamuyiwa (Ed) .*60th Science Teachers Association of Nigeria Annual Conference. Proceedings*, PP305-314. The STAN Place Ltd, Kwali, FCT, Abuja
- Ayan, M. (2012). Proje Tabanh Ogrenme Yaklasiminin Ilkogretim Ogrencilerinin Fen Bilgisi Dersi Akademik Basari Duzeyine Etkisi. *Turk Egitim Bilimleri Dergisi*, 10(1), 167-183.
- Babayemi, J. O. & Kareem, A. A. (2019). Services In Secondary Schools Science Laboratory As Centre For Innovation in Basic Science And Technology in Akwa Ibom State. In A.S. Ifamuyiwa (Ed) *60th Science Teachers Association of Nigeria Annual Conference. Proceedings*, PP254-262. The STAN Place Ltd, Kwali, FCT Abuja
- Bash, A. E, Kabang, B. A, Dawal, B.S & Josiah, M.M. (2019). Target Task Approach as an Innovation for Improving Achievement and Interest in Basic Science and Technology. In A.S. Ifamuyiwa (Ed) *60th Science Teachers Association of Nigeria Annual Conference. Proceedings*, PP 263-271. The STAN Place Ltd, Kwali, FCT Abuja
- Denis, C. H. & Balim, A. G. (2012).Effects of project-based learning of the solar system and beyond: Space Puzzle Unit on students' achievement. *Journal of Theoretical Educational Science*, 5(3), 254-277.
- Essien, E. U. & Aniefiok, O. E (2019). Innovation in Basic Science and Technology Education through Effective Pedagogical Principles. In A.S. Ifamuyiwa (Ed) *60th Science Teachers Association of Nigeria Conference. Proceedings*, PP 273-279 .The STAN Place Ltd, Kwali, FCT Abuja
- Federal Ministry of Education (FME, 2013). *National Policy on Education*. Yaba: NERDC Press.
- Gulbahar, Y. & Tinmaz H. (2006). Implementing Project Based Learning and E-Portfolio Assessment in An Undergraduate Course. *Journal of Research on Technology in Education* 38(3), 309-327
- Halil, C. C. (2018). The effects of Activity-based Learning on grade 6th Students' Achievement and Attitude towards Mathematics. *Eurasia Journal of Mathematics, Science, Technology Education*, 14 (5), 1963-1977
- Jibrin, A. G. Abba, H. A. & Mohammed, I. (2021). Effects of Cooperative Learning Instructional Strategy on the Academic Performance of Biology Students in Senior Secondary Schools in Azare Metropolis. *International Journal of Educational Research and Policy (IJERPM)*, 4(1), 683-691.
- Jibrin, A. G, I. Mohammed & Zayum (2020). Effect of Cooperative Learning Instructional Strategy on the Academic Performance of Male and Female Senior Secondary School Biology Students in Bauchi Metropolis. *Annals of Technology Education Practitioners of Nigeria, ATEPAN*, 3(1), 14-19

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- Jibrin, A. G. (2014). Effects of Problem-Solving Instructional Strategy on Self-Efficacy, Creativity and Academic Achievement in Genetics among NCE Students in North-West Geo- Political Zone. Unpub. PhD Thesis, Ahmadu Bello University, Zaria.
- Jibrin, A. G, Ibrahim, M & Zayum (2016). Effect of Peer-Tutoring on the Academic Achievement of Upper Basic Students in Basic Science in Dengi Metropolis of Plateau State. *Journal of Nigerian Association of Teachers of Technology*, 11 (3), 44-46.
- Karacalli, S. & Korur, F. (2012). Yasammizdaki Elektrik Unitesinde Ogrenilirin Akademik Basarisina Ve Kaliciligina proje Tabanlı Ogrenme Yonteminin etkisi. *X Ulusal Fen Bilimleri Ve Matematik Egitini Kongresi 25-27 Haziran, Nigde Universitesi, Nigde*.
- Mahmoud, J. B, Mohammed, I. & Jibrin, A. G. (2020). Attitude of Biology Teachers towards Teaching of Socio- Scientific Issues in Senior Secondary Schools of Bauchi State. *Journal of Science Technology and Education*, (8) 1, 235-240.
- Markula, A. & Aksela, M. (2022). The Key Characteristics of Project-Based Learning: How Teachers Implement Projects in K-12 Science Education. *Disciplinary and Interdisciplinary Science Education research*, 4 (2), 1-17
- Mohammed, I. (2012). Effects of Improvised and Conventional Instructional Materials on the Achievement and Attitude of Primary School Pupils in Wase L G A, Plateau State. Unpublished M.Ed Science Education Thesis, Ahmadu Bello University, Zaria
- Nazif, W. S, Shehu, S.B, and Musa, G. (2019). Effect of Collaborative Learning Strategy on Secondary School Students' Academic Performance in Biology. In A.S. Ifamuyiwa (Ed) 60<sup>th</sup> Science Teachers Association of Nigeria Conference. *Proceedings*, PP349-356. The STAN Place Ltd, Kwali, FCT Abuja
- Ngwa, A. N, Barnabas, O. E. & Emmadiolo, B. N. (2019). Teachers' Perceived Strategies for Improving Human Capital Development in Biology Education for the Enhancement of Stem Education. In A.S. Ifamuyiwa (Ed) 60<sup>th</sup> Science Teachers Association of Nigeria Annual Conference. *Proceedings*, 323-332. The STAN Place Ltd, Kwali, FCT Abuja
- Okoro, C. U. (2019). Activity-based learning strategies and Academic Achievement of Social Studies in Obio/Akpor LGA. *International Journal of Education and Evaluation* (5), 19-24
- WAEC (2019). West African Examinations Council Chief Examiners' Reports Senior School Certificate Examinations. Biology O-Level Paper, Lagos: WAEC Press
- WAEC (2020). West African Examinations Council Chief Examiners' Reports Senior School Certificate Examinations. Biology O-Level Paper, Lagos: WAEC Press
- Wekesa, N. W. & Ongunya, R. O. (2016). Project Based Learning on Students' Performance in the Concept of Classification of Organisms Among Secondary Schools in Kenya. *Journal Of Education And Practice*, 7(16), 25-31
- Yilmaz, C. and Nihal, T. (2013). An Investigation of The Effect of Project- Based Learning Approach on Children's Achievement and Attitude in Science. *Online Journal of Science and Technology*, 3(2), 9-17

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