



Using Artificial Intelligence in the Think-Pair-Share Instructional Strategy for Enhancing Biology Students' Interest and Performance in Rivers State, Nigeria

***Geo-Wosu, C., & Weli, B.**

Department of Educational Technology, Faculty of Education, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Rivers State

***Corresponding author email:** charity.geo-wosu@iaue.edu.ng

Abstract

The paper studied the effect of Artificial Intelligence (AI) in cooperative learning on Biology students' Interest and performance in Port Harcourt Local Government Area, River State. The paper made use of a quasi-experimental design, adopting two objectives, two research questions cum two hypotheses. Ninety-two Biology students in two mixed public secondary schools were purposively selected and involved in the study. AI in cooperative learning was adopted in the treatment group, while Biology Performance Test (BPT) and Biology Interest Questionnaire (BIQ) were used to gather data. Research questions and hypotheses were addressed using the mean, Standard deviation, and analysis of covariance, respectively. The findings of the study proved that Artificial Intelligence (AI) in cooperative learning improved students' academic performance more than the lecture method in Biology. It was further established that the use of Artificial Intelligence (AI) in cooperative learning also improves students' interest level in Biology. In light of these findings, it was therefore recommended that the Government should encourage teachers to adopt the use of artificial intelligence (AI) in the classroom instructional delivery for the sake of students' interest and academic performance in Biology.

Keywords: AI, Think-Pair-Share, Cooperative Learning, Instructional Strategy, Interest

Introduction

Biology Education prepares students for further studies in the field of science-related courses, especially at a higher institution. The knowledge of Biology is necessary for national growth and development. Nevertheless, the adoption of the wrong method by Biology teachers during the classroom process has led to the poor performance of students in external examinations. Therefore, in helping students to have a good understanding of the subject, Artificial Intelligence (AI) in cooperative learning was employed in the study. Learning in the era of emerging technology has changed the way students learn. According to Kelvin (2020), learning requires an active process that includes students' participation, engagement, and involvement. The teaching-learning environment has changed from teacher-centered to learner-centered, using digital tools to enhance effective learning. One of such tools is Artificial Intelligence, which has to do with the use of computer machines that can perform tasks that technically require human understanding, especially in teaching and learning. AI has numerous applications in education. It has what it takes to improve education, making teaching and learning easy by improving overall teachers' productivity. The use of artificial intelligence (AI) in the classroom guarantees powerful potential for science and technological education. Millions of students use AI in different plat-forms both on YouTube and WhatsApp. Students access educational materials via online AI platforms from any location in the world.

In recent developments, various AI learning tools have been used in conducting academic research. According to Finik (2022), artificial intelligence instruction with various illustrations can be used to present content in ways that are not possible within the confines of the traditional method. Therefore, this study used AI to support cooperative learning in the experimental group, while an AI instructional package was not used in the control group, where the lecture method was used. It is on this note that the aim of Science Education can be achieved, especially at the secondary school level. The teaching of Biology at the secondary school will call for a rapt attention with special emphasis on cooperative learning, which encourages participation of students in the teaching and learning environment. Cooperative learning involves learning in groups. It encourages positive interaction among members of a group in terms of thinking and sharing of possible answers to a question posed by a teacher. It also emphasizes working together to maximize each other's shared knowledge. According to Don (2020), students in a cooperative learning setting improve in knowledge. Based on this, the paper studied the effect of artificial intelligence in cooperative learning on Biology students' interest and performance in Rivers State.

Poor performance of Biology students in examinations in Rivers State and in the Port Harcourt Local Government Area in particular has remained worrisome to parents and educators. The use of inappropriate instructional strategies by Biology teachers has been widely reported as one of the major factors contributing to the poor performance of students (Esogwa, 2021). These inappropriate instructional strategies do not encourage interest in learning Biology concepts; students struggle to memorize concepts only to forget them shortly afterwards. Preliminary findings show that being unable to expose students to practical exercises has been one of the factors that lead to poor performance in the subject (Ehirim, 2020). The problem of poor performance in Biology in the West African Examinations Council (WAEC) may not be far from the method of presenting the content. This ugly situation prompted Okebukola (2014) to frown at the quality of science education in Nigeria, describing it as way below the mark. Sequel to this, this paper investigated the effect of artificial intelligence in cooperative learning on Biology students' interest and performance in Rivers State.

The aim of the study was to determine the effect of artificial intelligence in cooperative learning on Biology students' interest and performance in Rivers State. Specifically, the objectives of the study were to:

1. Ascertain the interest level of students taught Biology using AI-based cooperative learning
2. Ascertain the academic performance of students taught Biology using AI-based cooperative learning

Research Questions

1. What is the interest level of students taught Biology using AI-based cooperative learning and lecture method?
2. What is the academic performance of students taught Biology using AI-based cooperative learning and lecture method?

Hypotheses

H₀₁: There is no significant difference between the interest level of students taught Biology using AI-based cooperative learning and the lecture method.

H₀₂: There is no significant difference in the academic performance of students taught Biology using AI-based cooperative learning and the lecture method.

Methodology

The study made use of quasi-experimental design. Two groups (experimental and control) from two co-educational schools were used. Ninety-two (92) Biology students from two co-educational secondary schools purposively selected participated in the study. AI in think-pair-share instructional strategy was used as the treatment while Biology Performance Test (BPT) and Biology Interest Rating Scale (BIRS) were used to gather data after thorough validation with a reliability index of 0.76 and 0.86 respectively using Kuder-Richardson 20 statistic (K-R 20) for Biology Interest Rating Scale and Pearson's Product Moment correlation statistic for Biology Performance Test by two experts in Department of Educational Technology, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Rivers State. The experimental group was taught using AI in cooperative learning while the control group was taught using lecture method. Data obtained were analyzed using mean, standard deviation and analysis covariance.

Results

Research Question One: What is the interest level of students taught Biology using AI in cooperative learning and the lecture method?

Table 1: Mean and Standard deviation of pre-interest and post-interest of students using AI in cooperative learning and lecture method.

Group	n	Pre-Interest	SD	Post-Interest	SD	Mean Gain
AI-TPS	44	40.52	2.49	64.80	5.573	24.28
LM	48	42.30	3.52	56.90	4.60	14.6

In Table one, students taught Biology using AI in cooperative learning had a pre-interest mean of 40.52 and a post-interest mean of 64.80. Students in the control group taught using lecture method had pre-interest mean score of 42.30 and post-interest mean score of 56.90. Looking at the mean gain, the result revealed that the mean gain for students in the experimental group was 24.28, while for the control group was 14.6. This means that AI in cooperative learning significantly improved the interest level of students in Biology compared to the lecture method.

Research Question Two: What is the academic performance of students taught Biology using AI in cooperative learning and the lecture method?

Table 2: Mean and Standard deviation of pre-test and post-test performance of students using AI in Cooperative learning and the lecture method

Group	n	Pretest	SD	Posttest	SD	Mean Difference
AI-TPS	44	69.80	3.57	75.50	7.20	5.7
LM	48	64.60	4.52	67.80	5.60	3.2

In Table two, students taught Biology using AI in cooperative learning had a pre-test mean of 69.80 and a post-test mean of 75.50. Students in the control group taught using lecture method, had a pre-test mean score of 64.60 and a post-test mean score of 56.90. Looking at the mean gain, the result revealed that the mean gain for students in the experimental group was 5.7, while for the control group was 3.2. This means that AI in cooperative learning significantly improved the academic performance of students in Biology compared to the lecture method.

H₀₁: There is no significant difference between the interest level of students taught Biology using the AI-Think-Pair-Share Instructional Strategy and the lecture method

Table 3 Analysis of Covariance of interest level of students taught Biology using AI-Cooperative learning and lecture method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	1195.355 ^a	2	597.678	20.428	.000	.257	
Intercept	4170.920	1	4170.920	142.560	.000	.547	
Pre_Interest	51.389	1	51.389	1.756	.188	.015	
Group	1194.710	1	1194.710	40.835	.000	.257	
Error	3452.364	90	29.257				
Total	214495.000	92					
Corrected Total	4647.719	91					

a. R Squared = .257 (Adjusted R Squared = .245)

The result in Table 3 revealed a $F_{1,118} = 40.835$, partial eta squared = 0.257 ($p < 0.05$) for the instructional strategy on students' mean interest in Biology. The hypothesis is therefore rejected. This indicated that the use AI-cooperative

learning had a significant effect on the mean interest score of students in Biology, with a partial eta squared value showing a large effect on students' interest in Biology.

H02: There is no significant difference between the mean academic performance of students taught Biology using AI-Cooperative learning

Table 4 Analysis of Covariance of mean academic Performance of students taught Biology using AI-Cooperative learning.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	2489.658 ^a	2	1244.829	7.148	.001	.108	
Intercept	5700.520	1	5700.520	32.732	.000	.217	
Pre_test	176.873	1	176.873	1.016	.316	.009	
Group	2007.991	1	2007.991	11.530	.001	.089	
Error	20550.789	90	174.159				
Total	523018.000	92					
Corrected Total	23040.446	91					

a. R Squared = .108 (Adjusted R Squared = .093)

The result in Table 4 revealed an $F_{1,118} = 11.530$, partial eta squared = 0.089 ($p < 0.05$) for the instructional strategy on students' performance in Biology. The hypothesis is therefore rejected. This indicated that there is a significant effect of AI-cooperative learning on the mean performance score of students in Biology, with a partial eta squared value showing that the strategy has a large effect on students' performance in Biology.

Discussion

In Table 1, results showed that AI in cooperative learning has a greater effect on students' interest level in Biology than the lecture method. The result in Table 3 revealed that the use of AI-cooperative learning had a significant effect on the mean interest score of students in Biology, with a partial eta squared value showing a large effect on students' interest in Biology. This result is in agreement with the findings of Ehirim (2020), who showed that senior students taught using an AI-enabled think-pair-share instructional strategy had high interest level in the mean scores than those taught using the demonstration method. AI-enabled Think-Pair-Share instructional strategy gave students the opportunity to learn by constructing their own knowledge. Also, findings of Egwim (2020) stated that students had high interest when taught with an AI-enabled cooperative learning method than the lecture method.

In Table 2, it was observed that AI in cooperative learning had a significant effect on the performance of students in Biology. Table 4 showed that there was a significant difference between the mean performances of students taught Biology using AI in cooperative learning. This finding is in agreement with the study of Don (2020), who found that AI-enabled cooperative learning affected students' academic performance more than the lecture method. However, the present finding agreed with the earlier findings of Bello (2022) who found out that AI in cooperative learning has significant effect on students' academic performance compared to the conventional method

Conclusion

The study focused on the effect of Artificial Intelligence (AI) in cooperative learning on Biology Students' Interest and Performance in River State. The study is an extension in the use of emerging technologies which emphasis on learner centered classroom that encourages active participation, higher-level thinking skills of students, and engagement. The study showed that AI-enabled cooperative learning proved to be more effective than the lecture method (LM) in understanding the Biological concept. It was therefore concluded that the use of AI in cooperative learning has a significant effect on the students' interest and academic performance.

Recommendations

The study recommended that:

1. The government should encourage teachers to adopt the use of artificial intelligence (AI) in cooperative learning settings to improve students' interest and academic performance in Biology
2. The government should organize seminars for Biology teachers on the use of artificial intelligence (AI) in cooperative learning during teaching.

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