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STUDENTS' ACHIEVEMENT AND RETENTION IN PROBLEM-BASED GEOGRAPHY TOPICS: EFFECTS OF EXPERIENTIAL SPATIAL PROBLEM-BASED LEARNING (ESPBL) INSTRUCTIONAL MODEL IN PLATEAU STATE, NORTH-CENTRAL NIGERIA

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ABSTRACT
A study in Plateau State, North-Central Nigeria on the effects of the Experiential Spatial Problem-based Learning (ESPBL) Model on the achievement and retention of knowledge in Geography problem-based topics. Driven by four research questions and hypotheses, the study employed a quasi-experimental design for non-equivalent samples and a randomly selected sample of 47 Geography students spread into an experimental group (27 students) and a control group (20 students). Data was collected using the Spatial Problem-based Achievement Test (SPBAT) with a reliability coefficient of .96 tested using the Pearson Product Moment technique. The study's data was analysed using mean and standard deviation to answer the research questions and analysis of covariance (ANCOVA) and Linear Regression Model (LRM) to test the formulated hypotheses. Findings revealed that the ESPBL model significantly increased the achievement and knowledge retention of students in the experimental group compared to the control group. The Treatment was responsible for the students' ability to maintain statistically equal scores in the posttest achievement and the retention test. The study also realized that students' retention of knowledge was predicted by achievement. Thus, students who achieved high scores on the achievement posttest also achieved high scores on the retention test. It was concluded that the ESPBL model is effective in improving students' achievement and retention in Geography problem-based topics. The study recommended that the strategy should be employed at all levels for implementing the Geography curriculum and other science and social science disciplines, especially where the objective of teaching is to solve a known problem.

KEYWORDS: *ESPBL Model, Academic Achievement, Retention, Geography Problem-Based Topics.*

INTRODUCTION
In the quest for human knowledge and understanding, several subjects have emerged concerning humans and their environment. One of the areas of human investigation on the Earth, where humans live, is the network of relationships and interactions that occur among the Earth's natural and anthropogenic elements. This field of study, which came to be labeled as Geography, has never lost relevance in discussions among common people, renowned scientists, and research institutions, or in decision-making committees of top global coalitions such as the United Nations (UN). Central to the study of Geography is the systematic effort to understand the various attributes of man's environment and the relationship between man and the environment (Singh & Kalamdhad, 2011) with particular emphasis on space and time. Thus, Geography has been defined by Waugh (2009) as spatial interaction.

The spatial interaction of man has resulted in pleasant and in some cases, degrading deliverables. Today, the world gropes in search of solutions to environmental and societal problems, and in some cases, environmental crises. These problems range from flooding to climate change to erosion, deforestation, pollution, wildfires, and several others. Several of these environmental problems, especially the climate crisis, have been attributed largely to human activities in the environment (UN, 2024). The thorough study and understanding of these spatial problems and several others have been achieved only in Geography and disciplines strongly related disciplines. Though enormous research effort is recorded on the various subjects of environmental problems, chiefly to curtail their immediate and future consequences, there is a need for deploying learning approaches that emphasise pragmatic engagements in dealing with these environmental problems. This is true because rote memorization of content on environmental problems does not address them in real-life settings. Thus, the Experiential Spatial Problem-based Learning (ESPBL) model proposed by Dakur (2023) may be effective in addressing environmental problems experientially, proffering possible solutions to such problems.

The ESPBL model combines the elements of experiential, spatial, and problem-based learning, giving a composite learning strategy that, if well executed, promotes maximum benefit from the instructional process. As opposed to teacher-centered learning approaches, the ESPBL model allocates the most significant responsibilities of learning to the learner. Dakur (2023) gives a detailed exposition of the execution of the ESPBL model as seen in Figure 1. This could be used for teaching any environmental problem, for instance, 'soil erosion'.

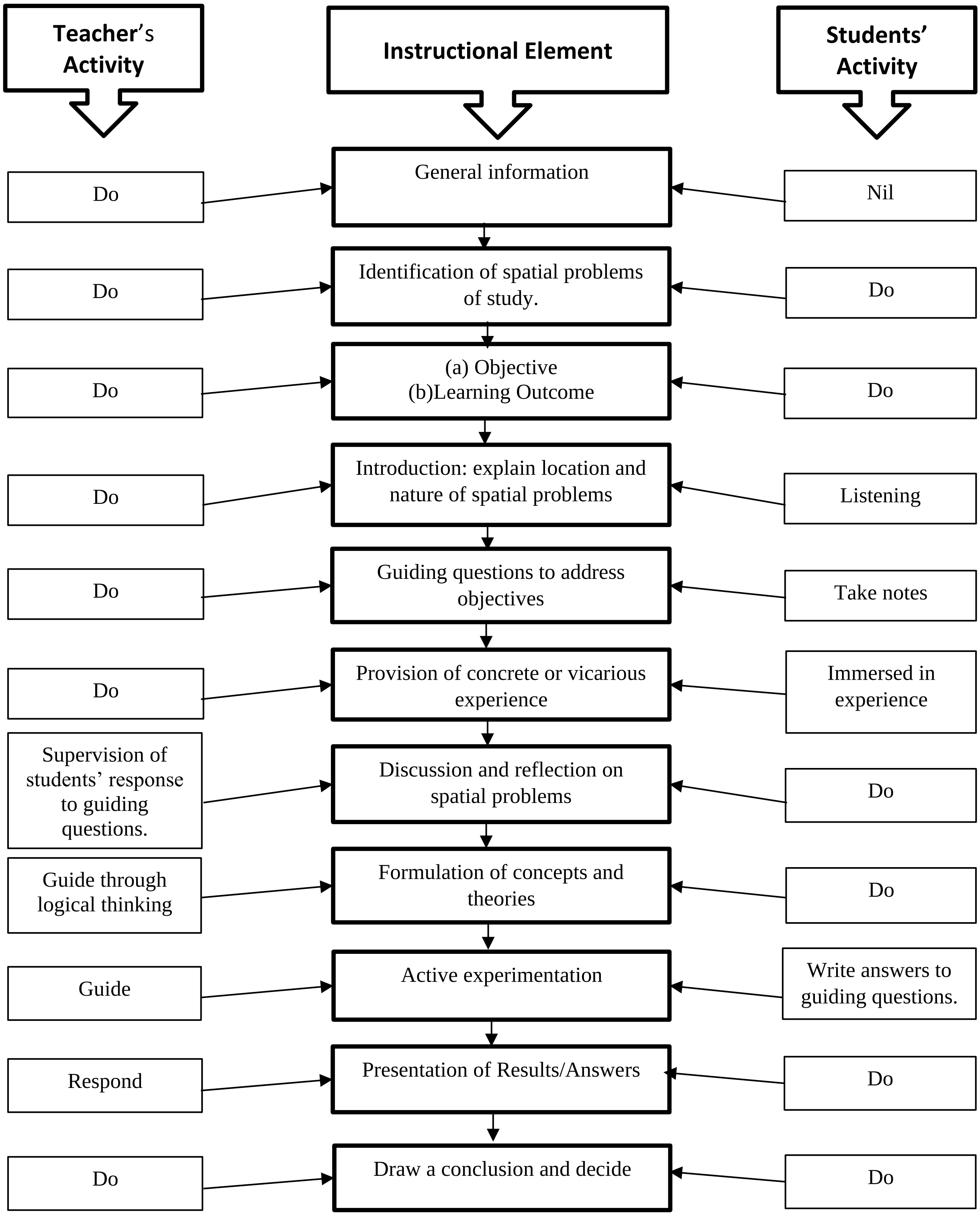

Figure 1: Instructional Guide for Experiential Spatial Problem Based Learning (ESPBL)

Essentially, a spatial problem such as soil erosion is identified and the teacher and students play their roles through discussions, explanations, questioning, hands-on-experience, experiments, proffering solutions, presentations, and conclusion. A step-by step instructional plan on the topic 'soil Erosion' (An environmental problem) is presented below.

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Topic: Environmental Problems - Erosion
Teaching Method: Experiential Spatial Problem-based Learning (ESPBL)
Resources: Textbooks, charts, video clips, fieldwork.
Entry Knowledge: Awareness of the problem of soil erosion.

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

a. Explain the meaning of soil erosion and mention the agents.
b. Mention and explain the types of soil erosion
c. Explain the effects of soil erosion.
d. State and explain methods of controlling soil erosion

Introduction

1. The teacher briefly explains the following while students listen:
   a. The location of the spatial problem (soil erosion).
   b. Concept of soil erosion.
   c. Nature of soil erosion.
      - Causes of soil erosion.
      - Types of soil erosion.
      - Effects of soil erosion.
      - Methods of controlling soil erosion.
2. The teacher raises provoking questions in respect to (a)-(c) in (1) above.
   a. What is soil erosion?
   b. What are the causes of soil erosion?
   c. State the types of soil erosion.
   d. What are the effects of soil erosion (dangers of soil erosion)?
   e. How can you control soil erosion?

Presentation

Step	Teacher's Activity	Students' Activity
1	The teacher raises the following provoking questions: a. What is soil erosion? b. What are the causes of soil erosion? c. State the types of soil erosion. d. What are the effects of soil erosion (dangers of soil erosion)? e. How can you control soil erosion?	a. Students read materials on soil erosion in groups b. They also take notes from the reading materials. c. Students discuss, ask questions and answer questions from the teacher as they read materials.
2	a. Teacher projects video clips and explain: - Causes of soil erosion. - Types of soil erosion. - Effects of soil erosion. - Methods of controlling soil erosion. b. Where possible, teacher takes the students out to observe: - Causes of soil erosion. - Types of soil erosion. - Effects of soil erosion. - Methods of controlling soil erosion.	a. Students observe both concrete and vicarious materials: - Causes of soil erosion. - Types of soil erosion. - Effects of soil erosion. - Methods of controlling soil erosion. b. Students ask questions c. Students discuss in groups.
3	a. The teacher responds to students' questions. b. Helps students in their discussions on soil erosion. c. Guides students to reflect on their discussions.	a. Students reflect on soil erosion b. Students discuss c. Students ask and answer questions
4	Guide the students to form their own different concepts of soil erosion.	Form individual notes on soil erosion. For example, "erosion is faster on sloping surfaces than on less sloping ones."

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5	a. Direct students in their groups to some sites that are being eroded either by water, wind, or glacier in their immediate environment to identify: i. The type of erosion ii. The cause of erosion iii. Why is it dangerous, and iv. Discuss and carry out possible practical actions to stop or slow the rate of erosion. b. Supervise the activities of students to ensure they are executed. c. Gather students after the expiration of the time for outdoor activities. **Note:** The sites could be near splashes by rainfall, sheets, rills, or gullies. Make use of relevant videos if erosion sites cannot be found nearby. Precautionary measures must be taken when students are visiting deep gullies.	a. The students should go as directed by the teacher to erosion sites and carry out (i) – (iv). b. Make observations of the erosion sites. c. Possibly take some action against erosion or recommend mitigation strategies. d. Each group makes notes on activities carried out.
6	a. Set up students to make a presentation of the reports of their activities group-by-group to the entire class. b. The teacher discusses the report together with the class in turns	a. Students make presentations of reports in groups. b. Effect corrections as made by the teacher
7.	a. Conclude with the students on soil erosion as a spatial problem.	a. Students take note of the conclusions drawn by the teacher, together with the class, on soil erosion.

Instructional strategies have remained central to discussions and research efforts among educators and education stakeholders. This is possible because of the power of this variable to direct students' learning outcomes, usually measured in terms of academic achievement. Academic achievement is widely measured by scores or grades students make on tests or examinations that are taken after an instructional period. Rony, Ariesya, and Nonie (2019) submit that students' academic achievement can be appraised by the amount of their grade point average (GPA) achieved and the social activities they carry out through the intensity of their involvement in a study program. This suggests further that apart from scores, what students can do or changes that occur in behavior could also constitute academic achievement. This conforms to the tenets of the ESPBL model, being experimented with in this study.

Several factors have been reported to influence academic achievement. For instance, physical and psychological stability as well as family conditions in terms of quality and quantity are determinants of students' academic achievement (Suhaily & Soelasih, 2015). The support students get through mentorship has also been found to advance success in academics (Demtir et al., 2014). Tran (2014) and Nkok (2021) have also reported that instructional strategies can significantly affect students' academic achievement. This implies that the methods teachers decide to employ during the instructional process contribute significantly to determining students' achievement. In the studies, the use of cooperative and computer simulations positively impacted the academic achievement of students. The current study seeks to investigate the effects of the ESPBL model on students' achievement in Geography problem-based topics.

As compelling as students' achievement is in measuring the success of an educational programmme in an instant, learners must remember what they learn in the future, either in examination conditions or when faced with real-life problems that need to be solved. Hence, retention of learning is equally important. Retention of learning entails the ability of a student to recall learned materials or content after a certain period of instruction. Retention depends on the quality of learning, which also depends strongly on the methods used in teaching. In the submission of Iji (2012), teaching methods that encourage rote memorization do not promote retention of learning. Thus, more interactive methods achieved higher retention rates. The researchers believe that ESPBL could have positive effects on students' achievement in Geography problem-based topics and retention of learning, as well as practical skills acquired while learning.

Given the role of effective methods of teaching in improving students' achievement, retention, and ability to solve environmental problems, this study sets out to explore the effects of ESPBL on these variables. The study sought to find out whether a treatment using ESPBL would generate a significant improvement in students' achievement and retention in Geography problem-based topics.

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Research Questions
The research questions probe the following underpinning issues:
1. The posttest achievement mean scores of students in the experimental and control groups.
2. The retention mean scores of students in the experimental and control groups.
3. The achievement and retention mean scores of students in the experimental group.
4. The relationship between students' posttest achievement and retention mean scores in the experimental group.

Hypotheses
The study tested the following hypotheses at the 0.05 level of significance:
Ho_1: There is no significant difference between the experimental and control groups on posttest achievement mean scores.
Ho_2: There is no significant difference between the experimental and control groups on retention mean scores.
Ho_3: There is no significant difference between the achievement and retention mean scores of students in the experimental group.
Ho_4: The relationship between students' posttest achievement and retention scores in the experimental group is not significant.

Methodology
A quasi-experimental non-equivalent control group research design was employed for the study, involving two intact classes (one as the experimental group and the other as the control group). The population of the study consisted of senior secondary two (SS 2) Geography students in all senior secondary schools in Jos South Local Government Area of Plateau State, Nigeria, in 92 schools. The sample for the study consisted of 47 students in two randomly selected senior secondary schools in the study area. The experimental group had 27 students while the control group had 20. A Spatial Problem-based Achievement Test (SPBAT) was used to collect data for pretest, posttest, and retention. The instrument was validated by experts in the field of Geography education. The reliability of the SPBAT was tested using the Pearson Product-Moment method to be 0.96 based on a test-retest approach. The research questions were answered using mean, standard deviation, and linear regression. The hypotheses were tested using Analysis of Covariance (ANCOVA), independent sample t-test, and Linear Regression Model (LRM) on the Statistical Package for Social Sciences (SPSS, Version 26) at 0.05 level of significance.

RESULTS
The results of data analysis based on the four research questions and hypotheses are presented as follows:
Research Question One: The posttest achievement mean scores of students in the experimental and control groups.

Table 1: Summary of Posttest Achievement Mean Scores of the Experimental and Control Groups

Group	n	Mean ($\bar{x}$)	Standard Deviation (Sd)	Mean Difference
Experimental	27	56.56	23.30	28.46
Control	20	28.10	9.00	

The posttest achievement mean scores and standard deviations of the experimental and control groups are presented in Table 1. The experimental group had a mean = 56.56 with a standard deviation = 23.30, while the control group's mean = 28.10 with a standard deviation = 9.00. The experimental group achieved a higher score than the control group with a mean difference = 28.46. This indicates that the use of the Experiential Spatial Problem-based Learning (ESPBL) model increased students' achievement in Geography problem-based topics.

Research Question Two: The retention mean scores of students in the experimental and control groups.

Table 2: Summary of Retention Mean Scores of students in the Experimental and Control Groups

Group	n	Mean ($\bar{x}$)	Standard Deviation (sd)	Mean Difference
Experimental	27	55.07	22.13	32.82
Control	20	22.25	7.04	

The data in Table 2 shows that the experimental group had a retention mean score of 55.07 and a standard deviation of 22.13, while the control group received a retention mean score of 22.25 and a standard deviation of 7.04. The mean difference was 32.82 in favour of the experimental group. This implies that the use of the ESPBL model resulted in higher retention of learning in the experimental group compared to the control group.

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Research Question Three: The achievement and retention mean scores of students in the experimental group.

Table 3: Summary of Posttest Achievement and Retention Mean Scores of Students in the Experimental Group.

Test	n	Mean ($\bar{x}$)	Standard Deviation (sd)	Mean Difference
Achievement	27	56.56	22.13	1.49
Retention	27	55.07	23.30	

The results in Table 3 reveal the experimental group's posttest achievement and retention mean scores and standard deviation. The posttest achievement mean score was 56.56 (Std. =22.13), while the retention mean score was 55.07 (Std. = 23.30). The mean difference was 1.49, indicating that the retention mean score of students in the treatment group only differed slightly from the posttest achievement mean score.

Research Question Four: The relationship between students' posttest achievement and retention mean scores in the experimental group.

Table 4: Summary of the relationship between Posttest Achievement and Retention Scores of Students in the Experimental Group.

Model 1	Coefficient (β)	Standard Error (SE)
Constant		1.972
Experimental Group Achievement	.985	.032

The Linear Regression Model (LRM) was used to determine the relationship between the achievement and retention scores of students in the treatment group, and the result is contained in Table 4. The relationship is positive and strong (beta = .985). This means that as the posttest achievement of the students in Geography problem-based topics increased, their retention scores also increased.

Test of Hypotheses

The results of the test of the study's hypotheses are presented as follows:

Hypothesis One: There is no significant difference between the experimental and control groups on posttest achievement mean scores.

Table 5:Analysis of Covariance (ANCOVA) Test of Significant Difference of Posttest achievement Mean Scores between the Experimental and Control Groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig. of F (ρ-value)	Decision
Corrected Model	9538.101[a]	2	4769.051	13.610	.000	Reject H_o
Intercept	3522.588	1	3522.588	10.053	.003	
Achievement Pretest	234.951	1	234.951	.671	.417	
Group	9270.854	1	9270.854	26.458	.000	
Error	15417.516	44	350.398			
Total	117805.000	47				
Corrected Total	24955.617	46				

a. R Squared = .382 (Adjusted R Squared = .354)

The significant differences between the experimental and control groups were tested using ANCOVA, and the result is presented in Table 5. The result shows that $F (1, 44) = 26.46$ and ρ-value ($\rho = .000$). Since $\rho = .000 < 0.05$, the null hypothesis was rejected. This suggests that the difference between the experimental and control groups on posttest achievement was statistically significant. This means that the experimental group's achievement was significantly higher than that of the control group. The conclusion is that the ESPBL increased students' achievement in spatial problems.

Hypothesis Two: There is no significant difference between the experimental and control groups on retention mean scores.

Table 6:Analysis of Covariance (ANCOVA) Test of Significant Difference of Retention Mean Scores between the Experimental and Control Groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig. of F (ρ-value)	Decision
Corrected Model	24477.651[a]	2	12238.825	342.385	.000	Reject H_o
Intercept	15.395	1	15.395	.431	.515	
Achievement Posttest	12098.785	1	12098.785	338.467	.000	
Group	439.152	1	439.152	12.285	.001	

Error	1572.817	44	35.746
Total	105468.000	47	
Corrected Total	26050.468	46	

a. R Squared = .940 (Adjusted R Squared = .937)

The significant differences between the experimental and control groups' retention were tested using ANCOVA and the result is presented in Table 6. The result shows that F (1, 44) = 12.285 and ρ-value (ρ = .001). Since ρ = .001 < 0.05, the null hypothesis was rejected. This suggests that the difference between the experimental and control groups on retention scores was statistically significant. This means the experimental group's achievement was significantly higher than the control group. The conclusion is that the ESPBL increased students' retention in Geography problem-based topics.

Hypothesis Three: There is no significant difference between the achievement and retention mean scores of students in the experimental group.

Table 7: Results of t-test Analysis of Significant Difference between the Achievement and Retention Mean Scores of the Experimental Group

Group	n	Mean ($\bar{x}$)	Mean Difference	df	α	t	ρ-value	Decision
Achievement	27	56.56	1.49	52	.05	.240	.812	Accept H_o
Retention	27	55.07						

Table 7 contains the results of an independent samples t-test of the significant difference between the achievement and retention mean scores in the experimental group. The results show that the calculated value is .240, the degree of freedom is 52, and the ρ-value = .812. With this statistical evidence, the null hypothesis was accepted and concluded that there was no significant difference between the posttest achievement and retention mean scores of students in the experimental group. It thus implies that the use of the ESPBL model guarantees deep learning that enables students to recall what was learned from future data. This is supported by the statistical consistency in the students' posttest achievement and retention mean scores.

Hypothesis Four: The relationship between students' posttest achievement and retention scores in the experimental group is not significant.

Table 8: Test of Significant Relationship between Posttest Achievement and Retention Scores in the Experimental Group.

Model 1	Coefficient (β)	Standard Error (SE)	Sig (ρ-value)	Decision
Constant		1.972	.000	Reject H_o
Experimental Group Achievement	.985	.032		

R = .985[a]; R Square = .971

In Table 7, the results of the analysis of the significant predictive relationship between students' achievement and retention scores tested using the Linear Regression Model (LRM) are presented. The results show that the relationship is positive and near perfect (beta = .985), and statistically significant (ρ = .000 < .05). The statistical evidence supports the rejection of the null hypothesis, implying that as the achievement of the students in Geography problems-based topics rose, retention scores also rose in the same direction. The results also suggest that the achievement of students was responsible for their retention of learning. An R Square value (.971) confirms that up to 97% of the students' retention scores are caused by their posttest achievement. To guarantee confidence in the result, the SE value (.032) assures that only about 3% of error was allowed in the model. Therefore, students' achievement when taught using ESPBL is a strong predictor of their retention of learning.

DISCUSSION

This study revealed that students who received the treatment with the ESPBL model achieved significantly higher scores than those who did not receive the treatment. This affirms that the treatment was potent enough to enhance students' academic achievement in Geography problem-based topics. Harmonizing findings with this study, Adonu et al. (2021) report that teaching strategies are capable of improving students' academic achievement. This is also similar to Badar, Bala, and Bello (2024), and Salami and Popoola (2016) unanimously propagate the position for the use of effective teaching strategies by teachers. The authors attributed students' failure in mathematics to ineffective teaching methodologies. The ESPBL model could be instrumental in dealing with difficult learning content and problems in a completely immersive fashion for deep learning and improved achievement of learners.

The findings of the study also revealed that the treatment achieved a better retention of knowledge in the experimental group, as revealed by the retention scores of both research groups. It therefore follows that students treated using the ESPBL model recalled more of their learning than those taught using the conventional method, as reflected in the knowledge retention test scores.

Conforming to the argument that teaching method affects the retention of knowledge, Adonu et al. (2021) also submit that a combination of flipped classroom and PowerPoint instructional approaches not only enhances achievement but also helps the students retain their learning. The text of this finding has also been advocated by Makinde and Yusuf (2018), who found that the degree to which students retain what they are taught significantly depends on the instructional strategies employed. Hence, innovative teaching methods such as ESPBL stand out due to the ability to provoke deep learning, critical thinking, and problem-solving skills, making the recall of learning in the future easier.

The study also proved that students taught using the ESPBL model did not show significant discrepancies in their posttest achievement and retention mean scores. By implication, students who partook in the experiment were able to maintain nearly the same scores in the knowledge retention test as in the posttest, confirming that the method engenders deep learning such that students could recall on a later date. Again, this corroborates Cecilio-Fernandes et al. (2019) reported that an additional simulation training strategy resulted in improved students' retention of learning. Williams and Otoyo (2021) also found that engagement of students in the learning process, such as the construction of instructional materials, could improve retention. This emphasizes the dimension of the ESPBL model that ensures learners create their best learning scenarios through experimentation and hands-on engagements to proffer a solution to a problem of interest. Such activities culminate in learning experiences that facilitate the recall of learning in the future.

The study further found, with strong evidence, that students' achievement and retention of knowledge were significantly related. It confirms researchers' speculation that students' retention of learning was dependent on academic achievement. Hence, academic achievement is a predictor of knowledge retention when students are exposed to the ESPBL model. This is in line with Iji (2010), who argues for a strong link between academic achievement and retention of knowledge. However, Iji opined that students only achieve well academically if they can retain what they have been taught. This advances a position directly opposite to this finding. The current study collected sufficient evidence that revealed the predictability of retention of learning from academic achievement. Since the ESPBL model has proven to be effective in enhancing learning and achievement, it is safe to conclude that the method also guarantees a substantial retention of knowledge.

CONCLUSION

The experiential Spatial Problem-based Learning (ESPBL) model proves to be significant in its effects toward earning improved academic achievement and retention of knowledge. The right application of this strategy yields positively predictable achievement and retention, ensuring that students not only pass a test in an instant but are also able to apply the experiences and skills in the future to relevant real-life problems.

RECOMMENDATION

1. The researchers recommend the ESPBL strategy for the implementation of the Geography curriculum at all levels to give students impactful learning experiences.
2. Teachers should incorporate the strategy in teaching, especially in science and social science disciplines.
3. Where teaching aims to solve a particular problem, the ESPBL model is highly recommended.

REFERENCES

1. *Adonu, C. J., Nwagbo, C. R., Ugwuanyi, C. S. & Okeke, I. O. (2021). Improving Students' Achievement and Retention in Biology using Flipped Classroom and Powerpoint Instructional Approaches: Implication for Physics Teaching. International Journal of Psychosocial Rehabilitation, 25(2), 234-247.*
2. *Badar, Y., Bala, S. S. & Bello, A. (2024). Leveraging Think Pair Share in Improving Students' Academic Achievement and Retention in Algebraic Expression in Secondary Schools in Kano State. African Journal of Science, Technology and Mathematics Education (AJSTME)10(5), 814-822.*
3. *Cecilio-Fernandes D, Brandao, C. F. S., Catanio de Oliveira, D. L., Rosário Fernandes, G. C. V. & Tio, R. A. (2019). Additional simulation training: does it affect students' knowledge acquisition and retention? BMJ Stel, 5, 140–143. DOI: 10.1136/bmjstel-2018-000312*
4. *Dakur, D. S. (2023). Guide to Teaching Geography for Achieving Analytical Thinking Skills Among Secondary School Students. British Journal of Education, Learning and Development Psychology 6(3), 110-119. DOI: 10.52589/BJELDP-CDKAPC1W*
5. *Demir, S., Demir, S.G., Bulut, H. and Hilsar, F. (2014). Effect of mentoring program on ways of Coping with stress and locus of control for nursing students. Asian Nursing Research, 8, 254-260.*
6. *Iji, C. O. (2010). Actualizing Mathematics Achievement and Retention Among Primary School Pupils using Interactive Logo Programming Package. ABACUS. The Journal of the Mathematical Association of Nigeria (MAN,) 35(1), 80-90.*
7. *Iji, C.O. (2012). Effects of logo and basic programmes on achievement and retention in geometry of Junior secondary school students. Unpublished Ph.D Thesis, University of Nigeria, Nsukka.*
8. *Makinde, S. O. & Yusef, M. O. (2018). The flipped classroom. Its effects on students' performance and retention in secondary school mathematics classroom. International journal for innovative technology integration in Education (SI), 1(1), 117 – 126.*

9. *Nkok, E. M. (2021). Effect of Computer Simulation on Students' Achievement and Retention in Sexual Reproduction in Plants in Niger State, Nigeria. International Journal of Innovative Social & Science Education Research, 9(3), 10-18.*
10. *Rony, S., Ariesya, A. & Nonie, M. (2019). Analysis of antecedent factors in academic achievement and student retention. AAOU Journa, 15(1), 38-47.*
11. *Salami, O. O. & Popoola, A. A. (2016). Effect of collaborative learning method on senior secondary school students learning outcomes in mathematics. The Proceedings of 53rd Annual National Conference, Mathematical Association of Nigeria (MAN), 229–241.*
12. *Singh, J. & Kalamdhad, A. S. (2011) Effects of Heavy Metals on Soil, Plants, Human Health and Aquatic Life. International Journal of Research in Chemistry and Environment, 1, 15-21.*
13. *Suhaily, L. and Soelasih, Y. (2015). Factors affecting student achievement in faculty of economics 'X' university. Journal of the Winners, 16(1), 25-35.*
14. *Tran, V. D. (2014). The effects of cooperative learning on the academic achievement and knowledge retention. International Journal of Higher Education, 3(2), 131-140. DOI: http://dx.doi.org/10.5430/ijhe.v3n2p131*
15. *United Nations (2024, August 15). Climate Action. https://www.un.org/en/climatechange#*
16. *Waugh, D. (2009). Geography An Integrated Approach. United Kingdom: Thomas Nelson and Sons Ltd.*
17. *Williams, P. S. & Otoyo, M. E. (2021). Effect of students' constructed instructional materials on their academic achievement and retention in basic science in Oron local government area. KING-UK. International Journal of Academic Anthology, 6(2), 30-44.*