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Enhancing Students' Interest and Academic Achievement in Ecological Concepts through Think–Pair–Share Strategy: Evidence from Secondary Schools in the Federal Capital Territory, Abuja, Nigeria

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Abstract

This study investigated the effect of the Think–Pair–Share (TPS) instructional strategy on students' interest and academic achievement in Ecological Concepts in Biology among Senior Secondary School I students in the Federal Capital Territory (FCT), Abuja, Nigeria. The study was motivated by persistent low interest and poor achievement in ecology-related topics, often attributed to teacher-centered instructional approaches. A pretest–posttest quasi-experimental control group design was adopted. The population comprised 34,636 SS I students across seventy-six public secondary schools in the FCT, from which a purposive sample of 141 students drawn from three co-educational schools participated in the study. Data were collected using two researcher-developed instruments: the Ecological Concepts Achievement Test (ECAT) and the Ecological Concepts Interest Scale (ECIS). The instruments were validated by experts and pilot-tested, yielding reliability coefficients of 0.78 (KR-20) for ECAT and 0.88 (Cronbach's Alpha) for ECIS, indicating acceptable internal consistency. Descriptive statistics (mean and standard deviation) were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the hypotheses at 0.05 level of significance. Findings revealed that students exposed to TPS recorded higher mean interest scores (4.52) compared to those taught using the conventional method (4.19), with a mean difference of 0.33. Similarly, students in the TPS group achieved a higher mean score (23.10) than their counterparts in the control group (19.73), with a mean difference of 3.37. The ANCOVA results indicated statistically significant differences in both interest ($F = 6.339$, $p = 0.013$) and achievement ($F = 15.294$, $p < 0.05$) in favour of the TPS group, leading to the rejection of the null hypotheses. The study concluded that the Think–Pair–Share instructional strategy significantly enhances both students' interest and academic achievement in Ecological Concepts. It was therefore recommended that Biology teachers adopt TPS as a learner-centered pedagogical approach, curriculum planners integrate cooperative learning strategies into instructional guidelines, and teacher professional development programs emphasize practical training on TPS implementation.

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The study provides strong empirical evidence supporting innovative instructional strategies as catalysts for improving science education outcomes in Nigerian secondary schools.

Keywords: *Academic Achievement, Ecological Concepts, Students' Interest, and Think–Pair–Share Strategy*

Introduction

Biology education plays a central role in developing scientific literacy and environmental awareness among secondary school students, particularly in a rapidly urbanizing and environmentally sensitive region such as the Federal Capital Territory (FCT), Abuja, Nigeria. Ecological concepts including ecosystem dynamics, energy flow, biodiversity, population interactions, and environmental conservation are foundational to understanding contemporary global challenges such as climate change, habitat degradation, and sustainable development. Despite the importance of these concepts, many secondary school students continue to demonstrate low academic achievement and declining interest in ecology-related topics. Reports from classroom observations and internal assessments in Nigerian secondary schools suggest that students often perceive ecology as abstract, theoretical, and disconnected from their lived experiences. This challenge calls for instructional approaches that actively engage learners and promote meaningful conceptual understanding rather than rote memorization.

Conventional teacher-centered instructional methods, which dominate many Nigerian classrooms, tend to limit student participation and collaborative thinking. In such environments, learners are frequently passive recipients of information, with minimal opportunity to question, reflect, or construct knowledge socially. Contemporary educational research increasingly advocates for learner-centered pedagogies that encourage interaction, critical thinking, and shared meaning-making. One such approach is the Think–Pair–Share (TPS) instructional strategy, a structured cooperative learning technique that allows students to think individually about a problem, discuss their ideas with a partner, and subsequently share their insights with the larger class. By integrating reflection, peer discussion, and collective engagement, TPS has the potential to foster deeper understanding and sustain students' interest in complex scientific concepts such as ecology. Within the context of secondary schools in the Federal Capital Territory, Abuja, there is a growing need to empirically examine whether innovative strategies like Think–Pair–Share can significantly enhance both students' academic achievement and their interest in ecological concepts. While collaborative learning approaches have shown promise in various educational settings globally, contextual evidence from Nigerian secondary schools—particularly within the FCT remains limited. Addressing this gap is essential for informing instructional practice, curriculum implementation, and policy decisions aimed at improving science education outcomes. Therefore, this study investigates the effect of the Think–Pair–Share instructional strategy on providing evidence-based insights relevant to educators, curriculum planners, and educational stakeholders in Abuja and beyond.

Literature Review

Recent educational research underscores the important role that learner-centered strategies play in improving both students' cognitive outcomes and affective dispositions in science classrooms. Empirical investigations into the Think–Pair–Share (TPS) instructional strategy

have consistently demonstrated its effectiveness in enhancing students' understanding and achievement across various science subjects. For example, studies conducted in Nigerian contexts reported that TPS significantly improved secondary school students' academic performance in Biology compared with conventional methods, reinforcing its practical value in science teaching (Ogbagaand Osuafor, 2024). Similarly, research focusing on Biology in Lagos State found that students exposed to TPS scored higher on achievement measures than those taught through teacher-centered approaches, indicating that collaborative engagement during instruction facilitates deeper learning (Falilat, 2025). Beyond Biology, TPS has been shown to positively influence students' interest in related science subjects, with studies in Taraba State, Nigeria, and other regions showing that learners exposed to TPS reported higher interest levels in Biology topics than their counterparts in control groups. These findings align with broader educational research suggesting that peer interaction and reflective dialogue promote conceptual understanding and sustain learner motivation in complex subject matter.

In addition to academic achievement and interest, the literature highlights the broader cognitive and social benefits of TPS in science education. For instance, studies across different educational levels and contexts show that TPS can enhance students' retention, attitude, and conceptual clarity when compared to traditional lecture methods. Research on cooperative learning models has found that structured interaction through strategies like TPS reduces misconceptions and improves students' analytical thinking skills in Biology classrooms, contributing to better performance and engagement. Furthermore, a growing body of evidence indicates that TPS is effective not only in pure academic outcomes but also in promoting positive attitudes toward science learning; a study in Plateau State, Nigeria, reported significant improvements in learners' attitudes toward Biology following TPS intervention. International research also supports the effectiveness of TPS in enhancing both student interest and achievement in science disciplines, including chemistry and other difficult conceptual areas, affirming its transferable value across STEM domains (Esiefa and Drummond, 2025). Collectively, these empirical studies provide a strong theoretical and practical foundation for investigating the effect of TPS on students' interest and achievement in ecological concepts within Biology, highlighting its potential to transform science teaching and learning in secondary schools.

Purpose of the Study

i. Think-Pair-Share (TPS) instructional strategy on the interest level of students in Ecological Concepts in biology;
ii. Think-Pair-Share (TPS) instructional strategy on the achievement rank of students in Ecological Concepts in biology;

Research Questions

The following research questions guided the study:

1. What is the difference in the interest level of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and their counterparts taught Ecological Concepts using teacher's conventional method?
2. What is the difference in the achievement rank of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and those taught using teachers' conventional method?

Hypotheses

The following null hypotheses were tested at P ≤0.05 level of significance.

Ho_1: There is no significant difference in the interest level of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and those taught using conventional teaching method.

Ho_2: There is no significant difference in the achievement rank of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and those taught using conventional teaching method.

Methodology

This study employed a pretest–posttest quasi-experimental control group design to investigate the effect of the Think–Pair–Share (TPS) instructional strategy on Senior Secondary School I (SS I) students' interest and academic achievement in ecological concepts in Biology within the Federal Capital Territory (FCT), Abuja, Nigeria. The design incorporated one experimental groups and one control group using intact classes to maintain the natural classroom structure without random assignment of participants. The population comprised 34,636 SS I students across seventy-six public senior secondary schools in the FCT, from which a sample of 141 students was purposively selected from three co-educational schools that met defined criteria, including consistent presentation of candidates for SSCE and availability of multiple class arms offering Biology. The participants were distributed into Experimental Group (taught using Think–Pair–Share), and a Control Group (taught using the conventional teaching method). Data were collected using two researcher-developed and validated instruments: the Ecological Concepts Achievement Test (ECAT), a 40-item multiple-choice test measuring cognitive achievement, and the Ecological Concepts Interest Scale (ECIS), a 20-item four-point Likert scale assessing students' interest in ecology. The instruments were subjected to expert validation and pilot testing, yielding reliability coefficients of 0.78 (KR-20) for ECAT and 0.88 (Cronbach's Alpha) for ECIS, indicating satisfactory internal consistency. Following the administration of pretests to establish baseline equivalence, a five-week instructional intervention was conducted by trained Biology teachers under the supervision of the researcher, after which posttests were administered. Data were analyzed using descriptive statistics (mean and standard deviation) to answer research questions, while Analysis of Covariance (ANCOVA) at the 0.05 level of significance was used to test the hypotheses and control for pre-existing differences among group

Results

Research Question One: What is the difference in the interest level of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and their counterparts taught Ecological Concepts using teacher's conventional method?

***Table 1**: Mean Interest Scores of Students taught Ecological Concepts using Think-Pair-Share Strategy and Conventional Method*

Group	Method of Teaching	N	Mean	Std. Deviation
Experimental Group	Think-Pair-Share	71	4.52	0.637
Control Group	Conventional	70	4.l9	0.735
Mean Difference			0.33	

Results in Table 1 show the mean interest scores of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and conventional teaching method. The results revealed that the mean interest score of the students in the experimental group after exposure to TPS strategy was 4.52, while that of their counterparts in the control group was 4.19 with a mean difference of 0.33.

Research Question Two: What is the difference in the mean achievement scores of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and those taught using teacher's conventional method?

Table 2: Mean Achievement Scores of Students taught Ecological Concepts using Think-Pair-Share Strategy and conventional teaching Method

Group	Method of Teaching	N	Mean	Std. Deviation
Experimental Group	Think-Pair-Share	71	23.10	4.42
Control Group	Conventional	70	19.73	4.45
Mean Difference			**3.37**	

Results in Table 2 show the mean achievement scores of students taught Ecological Concepts using Think-Pair-Share (TPS) teaching strategy and conventional teaching method. The results revealed that the mean achievement score of the students in the experimental group after exposure to TPS strategy was 23.10, while that of their counterparts in the control group was 19.73 with a mean difference of 3.37.

Hypothesis One

Ho_1: There is no significant difference in the mean interest scores of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and those taught using conventional teaching method.

Table 3: ANCOVA Comparison of the Mean Interest Scores of TPS and Control Groups

Tests of Between-Subjects Effects

Dependent Variable: POST TEST

Source	Type III Sum of Squares	df`	Mean Square	F	Sig.
Corrected Model	3.539[a]	2	l.769	3.737	0.027
Intercept	138.057	1	l38.057	291.57	0
PRETEST	0.461	1	0.461	0.974	0.326
TREATMENT	3.002	1	3.002	6.339	0.013
Error	50.664	107	0.473		
Total	2138.811	110			
Corrected Total	54.203	109			

a. R Squared = 0.065 (Adjusted R Squared = 0.048)
b Computed using alpha = 0.05

The results presented in Table 3 revealed that, at 0.05 level of significance, Sig. value of 0.013 was obtained. The Sig. value obtained is less than the level of significance. Hence, the null hypothesis was rejected.

Hypothesis Two

Ho_2: There is no significant difference in the mean achievement scores of students taught Ecological Concepts using Think-Pair-Share (TPS) instructional strategy and those taught using conventional teaching method.

Table 4: ANCOVA Comparison of the Mean Achievement Scores of TPS and Control Groups

Tests of Between-Subjects Effects
Dependent Variable: P0STTEST

Source	Type III Sum of Squares	df`	Mean Square	F	Sig.
Corrected Model	398.003[a]	2	199.002	10.06	0
Intercept	2778.87	1	2778.87	140.483	0
PRETEST	0.175	1	0.175	0.009	0.925
TREATMENT	302.521	l	302.521	15.294	0
Error	2709.968	137	19.781		
Total	67308	140			
Corrected Total	3107.971	139			

a. R Squared = .l28 (Adjusted R Squared = .115)
b. Computed using alpha =.05

The result presented in Table 4, showed that the Sig. value is 0.00 after treatment which is less than the level of significance of $\alpha = P \leq 0.05$. This means that there is significant difference between the post-test scores of the two groups in favour of the experimental group. Thus the null hypothesis was rejected. The findings thus showed that students in the Think-Pair-Share group had a significantly higher mean achievement score in Ecological Concepts after exposure to the treatment using TPS strategy than their counterparts in the control group who were taught Ecological Concepts using conventional method.

Discussion of Finding

The findings of this study clearly demonstrate that the use of the Think–Pair–Share (TPS) instructional strategy significantly enhanced students' interest in Ecological Concepts when compared with the conventional teaching method. The mean interest score of 4.52 recorded by students in the experimental group, as against 4.19 for the control group, with a mean difference of 0.33, indicates that TPS had a positive influence on learners' affective disposition toward ecology. This suggests that when students are actively engaged in thinking individually, discussing with peers, and sharing ideas with the larger class, their curiosity and enthusiasm for learning ecological concepts increase. The relatively lower standard deviation in the experimental group (0.637) compared to the control group (0.735) also implies more consistent interest levels among students exposed to TPS, further reinforcing the strategy's stabilizing effect on learners' engagement.

Beyond descriptive statistics, the inferential analysis using ANCOVA provides stronger empirical support for the effectiveness of TPS in fostering interest. The treatment effect was statistically significant ($F = 6.339$, $p = 0.013$), leading to the rejection of the null hypothesis. This confirms that the observed difference in interest was not due to chance but attributable to the instructional strategy employed. The non-significant effect of the pretest ($p = 0.326$) suggests that prior differences in students' interest levels did not significantly influence the outcome, thereby strengthening the internal validity of the findings. The implication is that TPS creates a participatory classroom climate that promotes interaction, shared responsibility, and active cognitive processing, which are essential components for stimulating sustained interest in abstract ecological concepts.

Similarly, the results on academic achievement reveal a substantial advantage for students taught using TPS. The experimental group recorded a mean achievement score of 23.10 compared to 19.73 for the control group, with a notable mean difference of 3.37. This indicates that TPS not only improves students' interest but also translates into measurable cognitive gains. The ANCOVA results further confirmed a statistically significant treatment effect ($F = 15.294$, $p = 0.00$), resulting in the rejection of the second null hypothesis. With an adjusted R^2 of 0.115, the model suggests that a meaningful proportion of the variance in post-test achievement can be attributed to the instructional approach. These findings imply that TPS enhances comprehension and retention of ecological concepts by promoting peer explanation, clarification of misconceptions, and deeper processing of content, thereby leading to improved academic performance among secondary school students.

In conclusion, this study provides compelling empirical evidence that the Think–Pair–Share (TPS) instructional strategy significantly enhances both students' interest and academic achievement in Ecological Concepts when compared with the conventional teaching method. The consistent superiority of the experimental group in both affective and cognitive outcomes, as confirmed by the mean scores and ANCOVA results, underscores the effectiveness of TPS as an active, learner-centered pedagogical approach. By fostering collaboration, critical thinking, and meaningful peer interaction, TPS creates an engaging learning environment that supports deeper understanding and sustained motivation. Therefore, integrating Think–Pair–Share into Biology classrooms in secondary schools holds strong potential for improving instructional quality and promoting better learning outcomes in ecological studies.

Recommendations

Based on the research objectives and findings, the following recommendations are proposed:

1. Biology teachers should adopt the Think–Pair–Share instructional strategy in teaching Ecological Concepts, as evidence shows it significantly enhances both students' interest and academic achievement compared to conventional methods.
2. Educational authorities and curriculum planners in the Federal Capital Territory (FCT) should integrate cooperative learning strategies such as TPS into the Biology curriculum guidelines to promote learner-centered classroom practices.
3. Teacher training institutions and professional development programs should organize workshops and in-service training to equip teachers with practical skills for effectively implementing TPS in science classrooms.

4. School administrators should encourage collaborative classroom environments by providing adequate instructional time, flexible seating arrangements, and supportive supervision that facilitate pair and group interactions.
5. Further research should be conducted across other science topics and educational levels to validate the generalizability of TPS in improving students' interest and achievement beyond Ecological Concepts in secondary school Biology.

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