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Effect of Reflective Teaching Approach on Achievement in Longitude and Latitude Among Secondary School Students in Bosso, Niger State

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Abstract

This study investigated the effects of reflective teaching approach on academic achievement in longitude and latitude among secondary school students in Bosso Local Government Area, Niger State. Two research questions and two null hypotheses were formulated, and tested at 0.05 level of significance. The study employed quasi-experimental research design, which comprises pretest, posttest, control and experimental group. The target population of the study comprised of 4478(2430Males; 2048 Females) SS II Students distributed over 17 public schools during the 2024/2025 academic session. Simple random sampling technique was used to select two schools, one school assigned as experimental group while the remaining one as control group, giving experimental group 135 (75 males; 60 females) students, whereas control group 120 (85 males; 35 females) students. The instruments for data collection was Longitude Latitude Achievement Test (LLAT) which covered the contents of longitude and latitude. developed by the researcher, and contain twenty (20) objective items with options A-D. LLAT is of two versions A and B. LLAT(A) is per-test and LLAT(B) is posttest which contained all items in LLAT(A) but has all its items reshuffled. Validation of the instruments were established by three experts. Test-retest was used to determine reliability, while PPMC was utilized to estimate the reliability coefficient and found to be $r = 0.83$. Mean, Standard deviation, Mean difference and Analysis of Covariance (ANCOVA) were statistical tools employed for data analysis. The result indicates that reflective teaching is more effective in improving students' performance in longitude and latitude concepts than conventional mode. Also, male students had a little academic mean gain than their female counterparts. Based on the findings, the followings recommendations were made, among others. Mathematics teachers should adopt using reflective teaching mode as alternative of conventional mode.

Keywords: Reflective, Conventional, Achievement, Mathematics, Longitude, Latitude

Introduction

Mathematics is the backbone of technological advancements and innovations, driving progress in fields like engineering and computing. Mathematics is an instrument for the development of science and technology. No nation can achieve meaningful scientific and technological development without solid foundation in school Mathematics (Asika, 2025). It is an academic subject that is crucial globally, and holds significant role in countries like Nigeria.



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Despite of the importance of Mathematics as one of major intellectual discipline taught at basic education and secondary school levels, researchers, mathematics educators revealed that there is high rate of poor achievement in the subject (Benjamin & Usman, 2019; Ahmad, et al., 2024). Achievement is defined as a measure of student's level of knowledge, skills or performance. It is an extent to which a student is profiting from lesson delivering in given task of learning, and that is reflected by the knowledge or skill has imparted to student. Ahmad (2024) described achievement as a yard stick for assessing learner's success or failure on a particular task, typically assessed as either high or low, corresponding to good or poor performance. It is an indicator to measure the extent has attained their short or long-term educational goals.

Research evidences shows that students have continuously recording low achievement as less than 42% of registered candidates obtained credits pass in Mathematics (Benjamin & Usman, 2019). Some contents of Mathematics have posed lots of challenges to students' academic achievement, these contents include: order of basic operations, directed number basically negative integers, bearing, logical reasoning, geometric constructions, trigonometric relations/values of angles, longitude and latitude. These contents in Mathematics curricula are found to be difficult to teach by teachers. And also found to be difficult to understand by students, which causes them to record failure in both internal and external examinations (Ameen & Salma, 2016). Reports from WAEC on students' poor achievement in Mathematics consistently in the Chief Examiners' reports from 2020 to 2024, the results demonstrate both progress and setbacks in Nigeria's educator. Many reasons levied against students' poor achievement in Mathematics as reported by some researchers, these reasons include: poor teaching methods, inadequate resources, teacher quality, Mathematics phobia, examination-related factors, gender disparities and socio-economic disparities (Ameen & Salma, 2016; Salma, 2018; Benjamin & Usman, 2019; Zakariyya & Ahmad, 2022).

In addition, as part of the attributed factor is that majority of Mathematics teachers still hold to using conventional/traditional teaching method in their class instructions. This method does not produce desired learning outcome, and it is teacher-centered which encourages teacher often talks to the students instead of creating opportunities for them to interact, discuss, ask question or sharing knowledge with their peers (Chinda et al., 2024). To address this problem, there is need to incorporate innovative instructional modes that would improve students' performance in Mathematics, especially longitude and latitude. Since longitude and latitude is identified as difficult topic. Longitude and latitude are vital topics in Mathematics and perceived difficult by students at senior secondary school level, that made study on it pertinent. The content has been consistent poor performance as submitted by the Chief Examiners' report from 2014 – 2025. Thus, this study will focus on content of longitude and latitude. Moreover, reflective teaching approach (RTA) is one of innovative teaching approach that combine methods utilized by teacher to translate a complex or an abstract theory in the classroom to a real-life reality based on experience in order to ensure that students understand what is taught easily (Chinda et al., 2024). Reflective teaching approach is a teachers' practice of critical analyzing their own teaching styles, methods and strategies to identify what works, what doesn't, and why, with intention of improving student performance and professional growth (Okigbo & Chukwunyelu, 2025). It is learner's centered that engages the students in series of questioning and thinking processes of self- regulation, self- evaluation, self – motivation and continuous improvement. These are done through researching the activities in the classroom, critically observing and evaluating the acquired information of the students' and teachers' themselves. Another scholar, Awodun (2020) defined RTA as an inquiry- based approach to teaching



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that involves critical thinking and a personal commitment to continuous learning and improvement, which create opportunity to construct their knowledge through interaction with peer without depending on teacher. RTA has the following key structures: self – analysis- the teacher systematically assesses or examine their lessons, asking their approaches and effectiveness of their instructions. Focus on improvement – working toward the setting goal to enhance student learning, develop more effective instructional strategies, and a more proactive role in the classroom. Professional development – the approach promotes on going learning and professional growth for the teacher, leading to increased confidence and a more proactive role in the classroom. All these are achieved through the following techniques, assertive question, thinking skill, scaffolding, oral discourse and collaborative learning. According to Awodun (2020) that RTA create conducive and meaningful learning environments for learners. It also provides rooms for teachers' professional growth and innovative teaching practices. He asserts that RTA generates the self-awareness of teachers in their teaching process that rather than teaching, making students to be self – directed learners who have accountability and commitment.

Types of Reflective Teaching Approach

To some scholars, like Kaung (2020) and Chinda et al. (2024) submitted that RTA are primarily classified as reflective-in- action, reflective- on- action and reflective-for- action. Reflective –in- action: This is thinking during the delivering of lesson. It is moment of reflection, where a teacher revisits their approach in real –time based on learner engagement or immediate problems. Reflective- on- action: This take place after a lesson or event, allowing the teacher to review the learning experience, analyze what work and what didn't, and identify areas of weakness and strength. Reflection- for – action: This kind of reflection is looking ahead, using insights from past reflections to plan for future tasks, and taking necessary adjustments to teaching practices ahead. These types of reflective teaching approach are implemented through practical approaches, like keeping a teaching journal, engaging in collaborative observations, conducting action research, seeking critical feedback from colleagues or analyzing student feedback. Chinda et al., (2024) commented that using RTA in class instruction improved classroom management, enhanced professional development and growth, and create positive and supportive rapport between teacher and students. In addition, RTA foster collaborative learning and also more adaptable and receptive to individual students' needs. Studies have been carried out in the past that are related to this study on effects of reflective teaching approach on students' academic achievement in longitude and latitude in different institutions of learning in Nigeria and world at large. The available ones to the researcher are reviewed in this study.

Mandy (2010) conducted research on using reflective practice in a Mathematics class, and reported that the practice enhances learning and can lead to deeper learning as learners use metacognitive practice to engage with their learning process. The study also revealed that reflection can improve the quality and depth of student learning by developing students' capacity to evaluate their learning and pass judgement in regards to the way forward. However, student found the practice very time consuming and could not always see any value in reflective writing in a Mathematics module. Nwoke (2015) explored impact of problem-solving approach on senior secondary school students' achievement in Mathematics. The findings revealed that the approach improve students' academic achievement in Mathematics and it is not gender bias. He maintained that teachers have to involve students in critical thinking and activities that will allow the students' participation for higher academic achievement. But Glory and Ihenko (2017) submitted that female students performed better than male students in science-based subjects. Furthermore, Benjamin and Usman (2019) commented that there is no significant difference in the mean achievement scores of male and female



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students taught longitude and latitude using improvised instructional materials and those taught with traditional teaching method. In another research work by Arslan, et al. (2012) reported that female students have more positive attitude than male counterparts towards learning Mathematics and had higher mathematics scores. Aliyu (2017) stressed that using innovative approaches that address different learning styles within instructional classrooms has been shown to encourages females' achievement in Mathematics. Also, study by Garba and Salim (2020) on effects of problem-solving on students' academic achievement in geometry. They reported that problem-solving strategy improve students' academic achievement better than traditional strategy, and also showed clearly that female students' outperform their male counterpart by having high mean score in the post test. Awodun (2020) investigated on the effects of reflective teaching strategy on students' academic performance and gender in secondary school Physics in Ekiti State. The findings revealed that reflective teaching strategy produced better achievement in students. In addition, there is no significant differences in the achievement measures of male and female students before and after treatment. Chinda, et al., (2024) submitted that reflective teaching approach enhanced professional growth, class management, create a positive and supportive rapport between teacher and students, foster collaborative learning. The reflective instructional strategy allows the teacher to evaluate their teaching to assist their students learn as much as possible, and using the approach are more adaptable and receptive to individual learner needs. Furthermore, reflective teaching is a sign of a caring teacher who can analyze the assumptions, values, and beliefs, underpin their methods of teaching.

Another study conducted by Okigbo and Chukwunyelu, (2025) on effects of reflective instructional strategy on secondary school students' achievement in Mathematics. The results revealed that students taught Mathematics using reflective instructional strategy achieved more than the students taught Mathematics using lecture method. They found that reflective instructional strategy is very effective in improving students' achievement in Mathematics when comparing with lecture method. Moreover, gender does not have significant effect on the achievement of students taught Mathematics using reflective instruction strategy and lecture method. In the research work conducted by Chukwunyela and Okigbo (2025) described reflective instructional strategy as learners' centered which engages learners to think deeply, discuss, collaborate and share their experiences together on a particular subject matter. They also reported that the use of reflective and flipped instructional strategies in secondary school improved their interest and performance in Mathematics, but does not have significant differences on gender. Some research works have shown that male students can perform better in innovative strategies than female students when they receive the right support, and vice-versa (Chinda, et al. 2024).

It is against this background, this present study tries to investigate effect of reflective teaching approach on academic achievement in longitude and latitude among secondary school students in Bosso Local Government Area of Niger State, Nigeria. The model on RTA is presented on following the steps and title Reflective Teaching Approach Lesson Model (RTALM): Plan the lesson, Class instruction, Reflection experience and refine the lesson instruction.

Statement of the Research Problem

The academic performance of students in Mathematics, especially longitude and latitude is consistently poor and has been an issue of interest to Mathematics educators and researchers. Most students cannot comprehend longitude and latitude content due to adherence to conventional teaching method, which does not promote meaningful learning of Mathematics as it appeals to



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hearing only, and favor the educational advantaged students (gifted, high ability) at detriment of the educationally disadvantages students (Zakariyya & Ahmad, 2022). To tackle these problems and fill in the gaps, this study proposes to investigate the effect of reflective teaching approach on academic achievement in longitude and latitude among secondary school students.

Aim and Objectives of the Study

This study investigated the effects of reflective teaching approach on academic achievement in longitude and latitude among secondary school students in Bosso Local Government Area, Niger State. Specifically, the objectives of this study are to:

1. determine the effect of reflective teaching approach on the students' academic achievement when taught longitude and latitude using reflective teaching approach and convention teaching method.
2. examine the effect of reflective teaching approach on academic achievement of male and female students when taught longitude and latitude.

Research Questions

The following questions were asked to guide this study. These are:

1. What is the difference between achievement mean scores of students taught longitude and latitude using reflective teaching approach and conventional teaching method?
2. What is the difference between achievement mean scores of male and female students taught longitude and latitude using reflective teaching approach?

Null Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significant.

Ho₁: There is no significant difference between achievement mean scores of students taught longitude and latitude using reflective teaching approach and conventional teaching method.

Ho₂: There is no significant difference between achievement mean scores of male and female students taught longitude and latitude using reflective teaching approach

Methodology

This study employed quasi-experimental research design, which comprises pretest, posttest, control and experimental group. This design is conducted in classroom experiment were control and experimental groups are naturally assembled as intact class or pre-existing group (Benjamin & Usman). The groups were tested with pretest to assess their homogeneity, thereafter they were exposed to treatment, and then tested with posttest to assess their academic performance. The target population of the study comprised four thousand, four hundred and seventy-eight SS II students (4478: 2430Males; 2048 Females) distributed over 17 public schools in Bosso Local Government Area. Through simple random sampling technique, two schools were selected out of 17, one school assigned as experimental group while the remaining one as control group. At second stage of randomization process in each of the school selected one intact class was selected, giving experimental group 135 (75 males; 60 females) students, whereas control group 120 (85 males; 35 females) students. The instruments for data collection for this study was Longitude Latitude Achievement Test (LLAT) which covered the contents of longitude and latitude. developed by the researcher, and contain twenty (20) objective items with options A-D. LLAT is of two versions A and B. LLAT(A) is per-test and LLAT(B) is posttest which contained all items in LLAT(A) but has all its items reshuffled. This reshuffle is to guide against familiarization of participants with arrangement pattern. Validation of the instruments were established by three experts from Federal University of Education Kontagora and Abdulkadir Kure University Minna. In addition, a pilot test was conducted to ascertain the effectiveness of the instruments. Test-retest reliability was used and PPMC was



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utilized to estimate the reliability coefficient and found to be $r = 0.83$. Mean, Standard deviation, Mean difference and Analysis of Covariance (ANCOVA) were statistical tools employed for data analysis.

Presentation of Results

Research Question 1

What is the difference between achievement mean scores of students taught longitude and latitude using reflective teaching approach and conventional teaching method?

Table 1: Means and Standard Deviations of Pretest and Posttest on Achievement Test

Group	N	Mean	SD	Mean	SD	Mean Diff.
Experimental	135	13.57	2.01	20.01	2.20	6.44
Control	120	12.83	1.40	14.18	4.07	1.35

From the data provided in Table 1, the experimental group which stands as those taught longitude and latitude with reflective teaching approach recorded a mean achievement score of 13.57 and a standard deviation of 2.01 in pretest, while a mean achievement score of 20.01 and standard deviation of 2.20 in posttest. The experimental group obtained a mean difference of 6.44 between pretest and posttest. The control group which represents those taught longitude and latitude with conventional teaching method obtained mean score of 12.83 and a standard deviation of 1.40 in pretest, while in posttest mean score reads 14.18 and a standard deviation of 4.07. The control group recorded a mean difference of 1.35 between pretest and posttest. This resulted to mean gain of 5.09 in favor of experimental group. The result thus indicates that reflective teaching is more effective in improving students' performance in longitude and latitude concepts than conventional mode.

Hypothesis One: There is no significant difference between achievement mean scores of students taught longitude and latitude using reflective teaching approach and conventional teaching method.

Table 2: Results of Test between Experimental and Control Group in Posttest

Source	Type III Sum of Square	Df	Mean Square	F	Sig
Corrected Model	1987.563	2	988.779	363.631	.000
Intercept	570.677	1	570.677	218.513	.000
Pretest	600.063	1	600.013	180.366	.000
Groups	1326.320	1	1326.320	194.277	.000
Error	548.417	252	2.75	452.645	
Total	47246.000	255			
Corrected Total	2446.000	254			

Results in Table 2, shows that main effect was significant at 0.05 level of significance, thus the null hypothesis of no significant difference in the mean achievement scores of students taught longitude and latitude with reflective teaching approach and conventional teaching method is hereby rejected. Since the P-value (.000) is less than 0.05. Therefore, there is significant difference in the mean achievement score of students taught longitude and latitude using reflective teaching approach and conventional teaching method.

Research Question Two

What is the difference between achievement mean scores of male and female students taught longitude and latitude using reflective teaching approach?

Table 3: Means and Standard Deviations of Pretest and Posttest on Genders

Group	N	Mean	SD	Mean	SD	Mean Diff.
Male	75	12.54	3.61	15.90	1.61	3.36
Female	60	11.78	2.82	13.87	1.52	2.09



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The data in Table 3 revealed that male students recorded mean achievement score of 12.54, with standard deviation of 3.61 in pretest. While, in posttest mean achievement score is 15.90 and with standard deviation of 1.61. The mean difference between pretest and posttest is 3.36. Moreover, the female students had mean achievement score of 11.78, with standard deviation of 2.82 in pretest. While, in posttest mean achievement score is 13.87, with standard deviation of 1.52. The mean difference between pretest and posttest is 1.27. However, to establish the statistically significant, ANCOVA was applied to test the null hypothesis.

Hypothesis Two: There is no significant difference between achievement mean scores of male and female students taught longitude and latitude using reflective teaching approach

Table 4: Results of Test of Male and Female Students in experimental Group

Source	Type III Sum of Square	Df	Mean Square	F	Sign
Corrected Model	86.438	2	23.766	56.736	.000
Intercept	823.726	1	823.726	1580.872	.000
Pre-test	74.088	1	74.088	123.207	.000
Gender	3.268	1	3.268	4.775	.061
Error	54.612	132	.646		
Total	30906.000	135			
Corrected Total	132.000	134			

From above in Table 4, P-value = 0.061 which is greater than 0.05. This implied that there is no significant difference in the mean achievement scores of male and female students taught longitude and latitude using reflective teaching approach is hereby retained.

Discussion of Findings

The results in Table 1 and 2, revealed that the reflective teaching approach had better performance when comparing to conventional teaching method evidenced by a high achievement mean score, which was found to be significant. This finding agreed with the results of Mandy (2010), Chinda, et al. (2024) and Okigbo and Chukwunyelu, (2025). They reported that reflective teaching approach is learner’s center which engages active participation, thinking deeply, discussion and collaboration which brings better performance in Mathematics. It also improved classroom management, create a positive support and rapport between teacher and students, and enhanced professional development and growth of the teacher. From the data in Table 3 and 4, male students had a little academic mean gain than their female counterparts. The findings confirm the results of Awodun (2020), Chukwunyela and Okigbo (2025) and Okigbo and Chukwunyelu, (2025) that gender does not have significant effect on the achievement of male and female students when taught Mathematics using reflective teaching approach. But this contradicts the findings of Arslan et al (2012) and Garba and Salim (2020) on that showed clearly that female students have more positive attitude towards Mathematics learning and outperform their male counterpart by having high mean scores. They reported that gender has significant difference on students’ achievement.

Conclusion

According to the reflective teaching lesson model, which involves deeper thinking, keeping a teaching journal, engaging in collaborative observations and learning, conducting action research and seeking critical feedback from colleagues or analyzing student feedback. Students taught longitude and latitude using the RTA model had higher scores than their peers academically. The study also, revealed that there was no discernible difference in the achievement mean scores of male and female students who were taught longitude and latitude using reflective teaching mode.

Recommendations

The following recommendations were made:



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1. Professional organizations such as STAN, MAN, NERDC and others should include Reflective teaching approach into their workshops, seminars and conferences to train Mathematics teachers on how to use reflective teaching approach.
2. Mathematics teachers should adopt using reflective teaching mode as alternative of conventional.
3. Curriculum planners should incorporate reflective mode into Mathematics curriculum

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