

Effect of peer tutoring instructional strategy on secondary school students' achievement in physics in Awka South Local Government Area, Anambra State

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Abstract

Academic achievement is strongly influenced by instructional strategies that promote collaboration and active knowledge construction. Based on this premise, this study examined the effective of peer tutoring instructional strategy (PTIS) among secondary school students' academic achievement in physics in Awka South Local Government. Two research questions and two hypotheses tested at 0.5 level of significance guided the study. A pretest-posttest quasi-experimental design was employed. The sample of the study was 105 Senior Secondary School Two (SS2) students selected through multi-stage sampling approach from a population of 1.493 during the 2024/2025 academic session. Data were collected using physics Achievement Test (PAT) validated by relevant experts in education. The reliability of the instrument was established using Kuder-Richardson 20 (KR-20) which yielded a reliability index of 0.70. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings revealed among others that students taught with PTIS achieved significantly higher than those taught using the lecture method. Further, gender had no significant influence on student's academic achievement in physics. Drawing from the study's findings, it is recommended that physics teachers receive sustained professional development through seminars and workshops, alongside adequate financial support, to enhance the adoption and effective implementation of PTIS in secondary school physics instruction.

1. Introduction

Education is widely regarded as the corner stone of human development. As a fundamental pillar, it enables individuals to reach their full potential, lead fulfilled lives and contribute to the overall development of the society. Beyond its intrinsic value as a fundamental human right, education serves as a critical driver of sustainable development and a strategic mechanism for addressing contemporary socio-economic, environmental, and ecological challenges confronting modern societies (Hanachor & Wordu, 2021). Furthermore, the ongoing pedagogical shift from conventional teacher-centred instruction to learner-centred approaches is driven by the need to address the evolving demands of 21st-century learners, who require high-quality learning experiences aligned with global educational standards (Ugwuoti et al., 2024). Education is art of the utilization of knowledge for complete living; it is a process of developing the child's moral, physical, emotional and intellectual power for his contribution in social reforms. It is the process of mastering the laws of nature, utilizing them effectively for the welfare of the individual and for social reconstruction. This is to say that the subjects which the students (secondary school) learn serves as a good foundation. One of such subjects is physics.

According to Ayeni (2021), science education is a fusion between the elements of science and education to produce a simplified and comprehensible concept of science that can be understood by individual not traditionally part of the scientific community. Science Education is the application of education (learning) theories especially those based on the philosophical, sociological and psychological perspectives in the endless search for knowledge which results in the development of the intellectual, psychomotor domains through some systematic processes involving careful observation, deduction and testing by empirical mean (Igbaji, Bello & Sanus, 2017). There are many options in science education like physics, chemistry, biology, integrated science and more.

Physics, as a scientific discipline, explains observable natural phenomena through systematic inquiry grounded in empirical evidence. Yusuf (2017) describes physics as a natural science that relies primarily on experimentation to generate explanations and make predictions about physical events in the environment. The International Union of Pure and Applied Physics (IUPAP) further defines physics as the study of matter, energy, and their interactions, emphasizing its status as a global scientific enterprise that plays a critical role in the future advancement of humanity. In this regard, Physics has been widely recognized as the bedrock of science and technology and as a core science subject that underpins technological development by deepening understanding of natural phenomena within an increasingly technology-driven society (Bello, 2012; Bello, 2016). The application of physics knowledge has resulted in numerous technological innovations, including electricity generation, telecommunications, household appliances, and modern manufacturing systems. Despite its central importance, students' academic achievement in physics remains persistently low, with empirical studies attributing this challenge to factors such as teacher quality, instructional approaches, inadequate instructional materials, poor study habits, peer influence, and teachers' limited use of innovative teaching strategies (Kareem, 2018).

Academic achievement is an outcome-oriented construct that explains the extent to which a student or a programme has attained either short- or long-term learning goal or task. It is often measured through examinations or continuous assessments and is reported using grades, marks, results and graduation rates (Horvath, 2016; Mberekpe, 2018). In addition to outcome-oriented, academic achievement is also referred to as the knowledge acquired or skills created as part of the learning process. It is expressed as result given by the teacher which is a measure of what an individual has accomplished after exposure to an educational programme (Azubuike, 2016; Topping, 2017). To optimize students' academic achievement especially in physics, students must be actively engaged in the construction of knowledge, such that learning is internally motivated and purposeful rather than externally imposed (Oguezue & Osuafor, 2021). There are multiple paths to optimizing students' academic achievement and peer tutoring is one of the potential strategies.

Peer tutoring instructional strategies (PTIS) according to Hartman (2010) is a collaborative learning approach where students work in pairs or small groups to support each other's learning. Within this framework as posted by (Eisenkopf, as cited in Ullah, Tabassum, & Kaleem, 2018) a more knowledgeable peer provides explanations, guidance, and feedback, fostering active engagement and shared knowledge construction. Empirical studies have consistently shown that peer tutoring enhances students' academic achievement, motivation, and social interaction, which encourages active participation amongst students. Further, Scruggs, Mastropieri, and Marshak (2016) describe PTIS as an instructional strategy in which students are systematically trained to alternate roles as tutor and tutee, utilise structured materials, ask purposeful questions, and provide constructive feedback. Similarly, Nawaz and Rehman (2017) emphasise the pairing of students of differing ability levels to maximise reciprocal learning benefits. In physics instruction, the application of PTIS has been associated with improved conceptual understanding, enhanced problem-solving and communication skills, increased learner confidence and reduced anxiety. Beyond instructional effectiveness, gender differences in students' academic achievement in physics remain a pertinent issue, necessitating empirical examination within peer-tutoring contexts.

Gender as defined by Okoye (2023) is a concept that refers to the roles, behaviors, identities and expectations that societies and cultures associate with individuals based on their perceived or assigned sex at birth. In science education, gender has been widely examined as a factor influencing students' academic achievement in physics and related disciplines, with some studies suggesting that entrenched socio-cultural stereotypes portray science and technology as male-dominated fields, thereby shaping students' attitudes, participation, and subject preferences (Akumah, 2018). According to (Ezeano, 2017), these perceptions may result in differential encouragement, with boys often directed toward physics and chemistry, while girls are steered toward subjects perceived as more female-friendly, such as Biology and Home Economics, a pattern that has been linked to achievement disparities in science subjects. However, other empirical evidence indicates that gender does not exert a significant influence on students' academic achievement in the sciences, implying that observed differences may stem more from instructional practices and learning environments than from gender itself (Orefor, 2016). Nevertheless, persistent gendered expectations within classroom contexts can undermine female students' confidence and engagement in physics, with potential implications for learning outcomes, subject choice, and future career pathways.

Consequently, it is essential to examine how instructional approaches, particularly PTIS, interact with gender to shape students' academic achievement in physics.

Conventional teaching methods are described as being teacher-oriented, lecture style delivery method and also inflexible. Lessons are usually taught by the teacher introducing skills on the board accompanied by a verbal explanation or lecture. Practical work for students is then assigned, followed by feedback from the teacher. Ojikutu (2015) further added that conventional method of teaching, as most of us have experienced, is classroom based and consists of lectures and direct instructions conducted by the teacher. This teacher-centered method emphasizes learning through the teacher's guidance at all times. Students are expected to listen to lectures and learn from them. In any case, Conventional method has some benefits to offer. According to Novak (2019) benefits of conventional teaching method includes: it gives the instructor the chance to expose student to unpublished or not readily available material, allows the instructor to precisely determine the aims, content, organization, pace and direction of a presentation and can be used to arouse interest in a subject, can complement and clarify text material and complements certain individual learning preferences. Albanese (2020) further added that some students depend upon the structure provided by highly teacher-centered methods. Because consensus is lacking on how gender and instructional strategies influence science education, this study aims to investigate the effects of peer tutoring on the interest and academic achievement of both male and female secondary school students in physics.

1.1. Statement of the Problem

Persistent poor achievement in physics in internal and external examinations, such as West African Senior School Certificate Examination (WASSCE), has raised significant concern due to the subject's critical role in national growth and development. One key factor implicated by previous studies is the persistent use of traditional, teacher-centred methods, like the lecture method which limit students' engagement, creativity, and higher-order thinking. As a result, physics educators are increasingly seeking innovative instructional strategies to enhance learning outcomes and produce scientifically literate students capable of addressing contemporary global challenges.

This means that instructional strategy like peer tutoring which solve problems by fostering creativity, problem solving skills and learning of deep concepts, can also be effective in improving students' academic achievement in physics. It is on this premise that the researcher decided to search for more effective instructional strategies that are likely to improve students' and academic achievement in secondary school physics. Therefore, the study seeks to investigate the effect of peer tutoring instructional strategy on secondary school students' academic achievement in physics in Awka South Local Government Area.

1.2. Purpose of the Study

This study investigated the effect of PTIS on secondary school students' academic achievement in physics in Awka South Local Government Area. Specifically, the study sought to determine the:

- a. Difference in the mean achievement scores of students taught physics using peer tutoring instructional strategy and that of those taught using the lecture method.
- b. Difference in the mean achievement score of male and female students taught physics using PTIS.

1.3. Research Questions

The study sought answers to the following research questions:

- a. What is the difference in the mean achievement scores of students taught physics using peer tutoring instructional strategy and that of those taught using the lecture method?
- b. What is the difference in the mean achievement scores of male and female students taught physics using PTIS?

1.4. Hypotheses

The following hypotheses were tested at 0.05 level of significance:

- a. There is no significant difference in the achievement scores of students taught physics using PTIS and those taught the same concepts using the lecture method.
- b. There is no significant difference in the achievement scores of male and female students taught physics using PTIS.

2. Method

The study adopted a pretest–posttest non-equivalent control group quasi-experimental design, which, according to Nworgu (2015), is appropriate for examining cause-and-effect relationships when random assignment of participants to groups is not feasible. Accordingly, the existing classroom arrangements in the sampled schools were maintained, with one class serving as the experimental group and the other as the control group. The study was conducted in Awka South Local Government Area, with a population of 1,493 senior secondary school students and a sample of 105 students (61 males and 44 females) drawn from two of the 19 public secondary schools use multi stage sampling technique (coin toss). Data were collected using the Physics Achievement Test (PAT), which was validated by three experts. Reliability was established using Kuder-Richardson Formula 20 which yielded a reliability index of (0.70). Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the hypotheses at the 0.05 significance level.

3. Results and Discussion

3.1. Results

3.1.1. Research Question

- a. Research Question One: What is the difference in the mean achievement score of students taught physics using PTIS and that of those taught using the lecture method?

Mean and standard deviation of achievement scores of students in experimental and control groups by Field Data (2025) can be seen in Table 1.

Table 1. Mean and Standard Deviation of Achievement Scores of Students in Experimental and Control Groups

Group	N	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	Mean Gain
Experimental (PTIS)	57	42.86	9.34	68.24	7.82	25.38
Control (LM)	48	43.12	8.97	54.67	9.15	11.55

Table 1 shows that the experimental group had a pre-test mean score of 42.86 (SD = 9.34), while the control group scored 43.12 (SD = 8.97). Following the intervention, the experimental group achieved a post-test mean of 68.24 (SD = 7.82), reflecting a mean gain of 25.38 points, compared to the control group’s post-test mean of 54.67 (SD = 9.15) and a mean gain of 11.55 points. These results indicate that the PTIS was substantially more effective in enhancing students’ achievement in physics than the lecture method.

- b. Research Question Two: What is the difference in the achievement scores of male and female students taught physics using PTIS?

Mean and standard deviation of achievement scores of male and female students in experimental group by Field Data can be seen in Table 2.

Table 2. Mean and Standard Deviation of Achievement Scores of Male and Female Students in Experimental Group

Group	N	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	Mean Gain
Male	33	43.25	9.67	69.18	7.54	25.93
Female	24	42.36	8.93	67.05	8.19	24.69

Table 2 shows that male students in the experimental group (PTIS) had a pre-test mean score of 43.25 (SD = 9.67), while female students scored 42.36 (SD = 8.93). Following the PTIS intervention, males achieved a post-test mean of 69.18 (SD = 7.54), with a mean gain of 25.93 points, whereas females scored 67.05 (SD = 8.19), with a mean gain of 24.69 points. The small difference in mean gains (1.24 points) indicates that the PTIS was equally effective for both male and female students in enhancing achievement in physics.

3.1.2. Hypothesis

- a. Hypothesis One: There is no significant difference in the achievement scores of students taught physics using PTIS and those taught the same concept using the lecture method.

ANCOVA results for students' achievement scores by teaching method can be seen in Table 3.

Table 3. ANCOVA Results for Students' Achievement Scores by Teaching Method

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3924.567	2	1962.284	33.789	.000	.437
Intercept	18456.332	1	18456.332	317.892	.000	.785
Pre-test (Covariate)	1234.876	1	1234.876	21.273	.000	.196
Teaching Method	2689.691	1	2689.691	46.316	.000	.347
Error	5053.433	87	58.087			
Total	378945.000	90				
Corrected Total	8978.000	89				

Table 3 shows a statistically significant difference in the mean achievement scores of students taught physics using the Peer Tutoring Instructional Strategy compared to those taught using the conventional lecture method ($F_{1,87} = 46.316, p < .001$). Since the p-value (.000) is below the 0.05 threshold, the null hypothesis is rejected, indicating that students exposed to peer tutoring achieved significantly higher than their counterparts in the lecture method.

- b. Hypothesis Two: There is no significant difference in the achievement score of male and female students taught physics using PTIS.

ANCOVA results for male and female students' achievement scores in experimental group can be seen in Table 4.

Table 4. ANCOVA Results for Male and Female Students' Achievement Scores in Experimental Group

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	198.456	2	99.228	1.634	.206	.056
Intercept	7856.334	1	7856.334	129.432	.000	.734
Pre-test (Covariate)	167.223	1	167.223	1.754	.104	.055
Gender	31.233	1	31.233	0.514	.477	0.11
Error	2854.567	85	60.735			
Total	237645.001	90				
Corrected Total	3053.023	89				

Table 4 shows that there is no statistically significant difference in the mean achievement scores of male and female students taught physics using the PTIS ($F_{1,47} = 0.514, p = .477$). Since the p-value (.477) exceeds the 0.05 threshold, the null hypothesis is not rejected, indicating that gender does not significantly influence students' achievement in physics under the PTIS.

3.2. Discussion

The findings of the present study suggest that PTIS enhances students' academic achievement in physics compared to conventional lecture method approach. This aligns with the findings of Akanbi (2022), who reported a positive correlation between interest and student achievement in physics. The present study extends this understanding by demonstrating that PTIS can be an effective tool for boosting academic achievement, and that students have strong perception about peer-led and students-collaborative instructions like PTIS (Oguezue et al., 2025)

Similarly, the results support the work of Hidayat and Saad (2025), who found that peer tutoring instructional strategy significantly influences students' academic achievements in physics. The substantial improvement in achievement scores observed in the present study suggests that peer tutoring instructional strategy creates a more engaging learning environment that stimulates students' academic achievements in physics. This enhanced achievement could be attributed to the interactive and visually stimulating nature of peer tutoring instructional strategy, which makes learning more appealing compared to conventional lecture method.

These findings indicate that while PTIS significantly enhances motivation for all students, the effectiveness is not significantly differentiated by gender. This is consistent with the results of Nwafor, Ezeanya and Onuigwe (2023), who independently found no significant influence of gender on students' academic achievement. The present study extends this understanding by specifically examining the interaction effect of teaching methods and gender confirming that the benefits of peer tutoring instructional strategy for academic achievement are experienced similarly by both male and female students. The finding suggests that well-designed PTIS can be equally motivating for all students regardless of gender. This finding has important implications for educational equity and the universal applicability of peer tutoring instructional strategy in physics education.

3.3. Recommendations

The following recommendations are made in the light of the findings of the study:

- a. The post primary schools service commission should expose teachers to annual training and retraining programmes on the use of Peer Tutoring Instructional Strategy to enable them to upgrade their skills in using the techniques in presenting lessons to bring about improvement in students' academic achievement.
- b. Sensitization, workshops and seminars should be organized regularly by government to train science(physics) teachers on the development and utilization of Peer Tutoring Instructional Strategy.
- c. Curriculum planners should include peer tutoring instructional strategy in physics curriculum.

4. Conclusion

The findings of this study showed that peer tutoring instructional strategy significantly improved the academic achievement of students in physics. Based on the findings, the researcher concluded that peer tutoring instructional strategy is more effective for enhancing students' academic achievement in physics in Awka South Local Government Area. Also, gender has no significant influence on students' academic achievement in physics.

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All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

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