

Competency-Based Instructional Approach and Students' Academic Performance in Physics in Senior Secondary School in Mkpato Enin Local Government Area

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ABSTRACT: This study investigated the effect of the competency-based instructional approach on students' academic performance in Physics among Senior Secondary School students in Mkpato Enin Local Government Area, Akwa Ibom State. Specifically, the study determined the difference in the academic performance of students taught electricity using competency-based and expository instructional approaches and examined the influence of gender on students' academic performance under the two instructional approaches. Two research questions and two null hypotheses guided the study. The study adopted a quasi-experimental pretest–posttest non-equivalent group design. The population comprised 1,871 Senior Secondary School Two (SS2) students in sixteen public secondary schools in Mkpato Enin Local Government Area. A sample of 83 students was selected using simple random sampling, comprising 38 students in the competency-based instructional group and 45 students in the expository instructional group. The instrument used for data collection was the Physics Performance Test (PPT), a 20-item multiple-choice achievement test with a reliability coefficient of 0.77 established using the Kuder–Richardson Formula 20 (KR-20). Data collected were analysed using mean and standard deviation to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at the 0.05 level of significance. The findings revealed that students taught electricity using the competency-based instructional approach achieved higher academic performance than those taught using the expository instructional approach. The study also found a significant difference in students' academic performance in favour of the competency-based instructional approach. However, no significant difference was found in the academic performance of male and female students exposed to the two instructional approaches. The study concluded that the competency-based instructional approach is more effective and gender-inclusive than the expository instructional approach for improving students' academic performance in Physics. It was therefore recommended that Physics teachers should adopt the competency-based instructional approach in teaching Physics concepts in secondary schools.

KEYWORDS: Competency-based instructional approach, expository instructional approach, academic performance, Physics, electricity, gender.

INTRODUCTION

Science education remains a fundamental driver of national development, technological advancement, and societal transformation. As both a body of knowledge and a systematic process of inquiry, science equips learners with the intellectual tools required to understand natural phenomena, solve problems, and make informed decisions. In contemporary societies, the relevance of science education extends beyond classroom instruction to include its contributions to innovation, industrial growth, and global competitiveness (Achor & Abuh, 2021). In Nigeria, the importance of science education has been consistently emphasized in national educational policies, which recognize science as a cornerstone for achieving sustainable development and technological self-reliance (Federal Republic of Nigeria [FRN], 2014). Studies have shown that science education enhances students' cognitive abilities, particularly critical thinking, analytical reasoning, technical skills, vocational skills and problem-solving skills, which are essential for functioning effectively in a knowledge-based economy (Oladejo et al., 2023; Ntegwung, 2025).

Within the broad framework of science education, Physics occupies a central and indispensable position. Physics is concerned with the study of matter, energy, and the fundamental laws governing their interactions. It provides the conceptual foundation for understanding other scientific disciplines and serves as the bedrock for technological innovations. According to Achor and Abuh (2020), Physics plays a critical role in fostering scientific literacy and developing the intellectual capacity required for technological

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advancement. Its applications are evident in various aspects of modern life, including electricity generation, communication systems, transportation, and industrial processes. Consequently, effective teaching and learning of Physics are essential for preparing students for STEM careers. Empirical studies further show that instructional strategies significantly influence students' achievement in Physics, especially when such strategies actively engage learners in the learning process rather than positioning them as passive recipients of information (Uboh et al., 2026; Achor & Abuh, 2021).

Despite its importance, students' academic performance in Physics at the senior secondary school level in Nigeria has remained consistently low, raising serious concerns among educators, curriculum planners, and policymakers. Reports from the West African Examinations Council (WAEC) over the years continue to highlight students' poor achievement in Physics, particularly in areas that require deep conceptual understanding, logical reasoning, and problem-solving abilities (WAEC, 2022-2025). This persistent trend suggests that many students are not merely struggling with examination techniques but are fundamentally challenged in their understanding of core Physics concepts. Several interrelated factors have been identified as contributing to this situation. These include inadequate instructional materials, overcrowded classrooms, limited opportunities for practical engagement, and the continued reliance on traditional teaching methods that do not adequately support meaningful learning (Erinosho, 2020; Aduwa, 2021).

Beyond these structural issues, the nature of Physics itself presents additional challenges. The subject is often perceived by students as abstract, mathematically demanding, and disconnected from everyday experiences (Mkpanang & Utibe, 2022). When such perceptions are reinforced by teacher-centered instructional approaches, students tend to develop low interest, reduced confidence, and negative attitudes toward the subject. Studies have shown that conventional teaching methods, which emphasize memorization and procedural knowledge, do little to improve students' conceptual understanding or long-term retention (Sunday et al., 2025; Umanah & Sunday, 2022). In contrast, more interactive and student-centered approaches have been found to significantly improve learning outcomes by encouraging active participation, inquiry, and critical thinking (Akpan, 2022; Niyonsaba et al., 2022; Umoetuk et al., 2025). This highlights the urgent need to rethink instructional practices in Physics classrooms.

Academic performance is a key indicator of the effectiveness of the teaching-learning process and reflects the extent to which educational objectives are achieved. In Physics, it goes beyond mere examination scores to include students' ability to understand concepts, apply principles to solve problems, and relate scientific knowledge to real-life situations (Mkpanang & Utibe, 2022). Research evidence consistently shows that the instructional approach adopted by the teacher plays a decisive role in shaping students' learning outcomes (Aina & Adedo, 2022; Olorundare & Omoniyi, 2020). When students are exposed to instructional methods that promote engagement, collaboration, and independent thinking, they are more likely to develop a deeper understanding of concepts and perform better academically.

Recent studies have further demonstrated that individualized and collaborative learning approaches significantly enhance students' academic performance. These approaches recognize that learners differ in their pace, style, and level of understanding, and therefore require flexible instructional strategies that cater to these differences (Kazi et al., 2020; Luna et al., 2024; Ntegwung et al., 2026). Similarly, cooperative learning environments encourage peer interaction, shared responsibility, and collective problem-solving, all of which contribute to improved academic outcomes (Johnson & Johnson, 2021; Sunday & Edet, 2024). These characteristics align closely with the principles of competency-based instruction, which emphasizes mastery, continuous assessment, and meaningful engagement with content.

Competency-based instructional approach is an instructional method that organizes teaching and learning around clearly defined competencies specific knowledge, skills, and attitudes that learners must demonstrate mastery of before progressing (Malonda, 2022). Umanah & Akpan, (2025) defined competency-based learning as an innovative instructional approach that focuses on the mastery and acquisition of specific knowledge, skills or competencies and attitudes before progressing to new content. This approach shifts the focus from time-based instruction to outcome-based learning, ensuring that students acquire both theoretical understanding and practical skills. It promotes individualized learning by allowing students to progress at their own pace while receiving continuous feedback on their performance (Kumari, 2025). More importantly, it emphasizes the application of knowledge in real-life contexts, thereby making learning more meaningful and relevant.

In the context of Physics education, competency-based instructional approach offers significant advantages. Given the cumulative and abstract nature of Physics concepts, students need to achieve a solid understanding of foundational ideas before moving on to more complex topics (Ashu, 2025). Competency-based instruction addresses this by ensuring that learning gaps are identified and addressed early. Empirical studies have shown that instructional approaches that emphasize mastery, active engagement, and skill development lead to improved academic achievement and conceptual understanding (Achor et al., 2021; Sunday et al., 2025). Furthermore, integrating practical activities, simulations, and problem-solving tasks into instruction enhances students' ability to connect theory with practice, thereby improving both performance and retention (Paul et al., 2024; Umoetuk et al., 2025).

Gender remains an important variable in understanding students' academic performance in Physics. Over the years, concerns have been raised about gender disparities in science education, particularly in subjects like Physics that are often perceived as male-

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dominated. Research findings on gender differences, however, have been inconsistent. While some studies report that male students outperform female students, others suggest that the differences are minimal or context-dependent (Adepeko, 2022; Umanah & Sunday, 2022; Umanah & Atabang, 2025; Akpan et al., 2025). More recent studies have shifted attention from ability differences to the influence of classroom experiences, teaching methods, and socio-cultural factors on students' performance.

For instance, studies have shown that female students' participation and achievement in Physics are strongly influenced by their level of confidence, interest, and sense of belonging in the classroom (Hazari et al., 2020). When instructional approaches are inclusive, interactive, and supportive, gender differences in performance tend to diminish (Akpan, Utibe, John, & Nelson, 2023; Umanah., 2024). This suggests that the choice of instructional strategy plays a critical role in either reinforcing or reducing gender disparities. Learner-centered approaches, including competency-based instruction, provide opportunities for all students to actively engage in learning, receive personalized support, and develop confidence in their abilities (Umanah & Sunday, 2025; Edet et al., 2025). As such, examining gender as a moderating variable in this study is both relevant and necessary.

Despite the growing emphasis on innovative instructional strategies, there is still limited empirical evidence on the effectiveness of competency-based instructional approach in improving students' academic performance in Physics within the Nigerian secondary school context. Many existing studies have focused on other strategies such as computer-assisted instruction, simulations, and collaborative learning, with relatively little attention given to competency-based frameworks (Sunday et al., 2026; Umoetuk et al., 2025). In addition, few studies have explicitly examined how gender interacts with instructional approaches to influence learning outcomes in Physics. This gap in the literature underscores the need for a focused investigation into how competency-based instructional approach can enhance students' academic performance while addressing gender-related differences. It is against this backdrop that this study seeks to examine the effect of competency-based instructional approach on students' academic performance in Physics in senior secondary schools, with gender as a moderating variable.

Statement of the Problem

Despite the strategic importance of Physics in advancing scientific literacy, technological innovation, and national development, students' academic performance in the subject at the senior secondary school level in Nigeria continues to decline at an alarming rate. Persistent evidence from external examination bodies reveals that a significant proportion of students demonstrate weak conceptual understanding, poor problem-solving abilities, and limited capacity to apply Physics principles to real-life situations. This pattern suggests a systemic instructional problem rather than merely a deficiency in students' abilities. The prevailing reliance on conventional, teacher-centered pedagogies characterized by rote memorization, passive learning, and minimal learner engagement has been widely implicated in this trend. Such approaches fail to address the abstract and hierarchical nature of Physics, thereby reinforcing students' negative perceptions of the subject as difficult and inaccessible, ultimately leading to sustained poor performance in both internal and external assessments.

Although several learner-centered instructional strategies have been introduced to address these challenges, there is still a noticeable gap in the adoption and empirical validation of competency-based instructional approach within Physics classrooms, particularly in the Nigerian secondary school context. More critically, existing studies have not sufficiently interrogated how this approach can be leveraged to address gender-related disparities in academic performance, which continue to manifest in varying degrees across science classrooms. Given that competency-based instruction emphasizes mastery learning, individualized pacing, and active student engagement elements that are crucial for meaningful learning in Physics it becomes imperative to examine its effectiveness in improving students' academic outcomes. Therefore, the core problem of this study lies in the lack of clear empirical evidence on whether competency-based instructional approach can significantly enhance students' academic performance in Physics while also promoting equitable learning outcomes across gender.

Research Questions

1. What is the difference in the mean performance scores of physics students taught electricity using competency-based instructional and expository instructional approaches?
2. What is the difference in the mean performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches?

Hypotheses

The following null hypotheses will be tested at $P \leq 0.05$ level of significance:

1. There is no significant difference in the mean performance scores of physics students taught electricity using competency-based and expository instructional approach.
2. There is no significant difference in the mean performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches.

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METHODS

Research Methods

The study adopted a quasi-experimental pretest–posttest design involving two groups and was conducted in Mkpato Enin Local Government Area. The population comprised 1,871 Senior Secondary School Two (SS2) students in the sixteen (16) public senior secondary schools in the area (Local Education Committee, Mkpato Enin Local Government Area, 2026). The sample size for the study was 83 SS2 Physics students in the study area. Intact SS2 Physics classes were used, while a simple random sampling technique was employed to select two co-educational public secondary schools from the sixteen schools in the study area. One intact SS2 class was selected from each school, with one school serving as the experimental group taught using the competency-based instructional approach and the other serving as the comparison group taught using the expository instructional approach. The instrument for data collection was the Physics Performance Test (PPT), which consisted of 20 multiple-choice objective questions covering the concept of electricity in the SS2 Physics syllabus. The instrument was validated for face and content validity by researcher experts in Department of Science Education (Physics Unit), Faculty of Education, Akwa Ibom State University, after which necessary corrections were incorporated. The reliability of the PPT was established using the Kuder–Richardson Formula 20 (KR-20), which yielded a reliability coefficient of 0.77, indicating satisfactory internal consistency. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) at the 0.05 level of significance was employed to test the null hypotheses, using the pretest scores as the covariate to control for initial differences between the groups.

RESULTS

Research Question One: What is the difference in the mean performance scores of physics students taught electricity using competency-based instructional and expository instructional approaches?

Table 1: Mean and standard deviation of pretest and posttest performance scores of physics students taught electricity using competency-based and expository instructional approaches

Instructional Approach	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Gain
Competency-Based Instructional Approach	38	9.53	2.64	16.42	2.11	6.89
Expository Instructional Approach	45	9.31	2.71	13.98	2.48	4.67

The result presented in Table 1 revealed that students taught electricity using the competency-based instructional approach obtained a pretest mean score of 9.53 with a standard deviation of 2.64, while their posttest mean score increased to 16.42 with a standard deviation of 2.11, resulting in a mean gain of 6.89. Students taught using the expository instructional approach recorded a pretest mean score of 9.31 with a standard deviation of 2.71 and a posttest mean score of 13.98 with a standard deviation of 2.48, yielding a mean gain of 4.67. The result indicated that students in both instructional groups improved in their academic performance after the treatment. However, students exposed to the competency-based instructional approach recorded a higher posttest mean score and greater mean gain than those taught using the expository instructional approach. This suggests that the competency-based instructional approach was more effective in improving students' academic performance in electricity.

Research Question Two: What is the difference in the mean performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches?

Table 2: Mean and standard deviation of posttest performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches

Gender	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Gain
Male	44	9.47	2.61	15.26	2.43	5.79
Female	39	9.34	2.73	15.01	2.37	5.67

The result presented in Table 2 showed that male students had a pretest mean score of 9.47 with a standard deviation of 2.61, while their posttest mean score increased to 15.26 with a standard deviation of 2.43, giving a mean gain of 5.79. Female students recorded a pretest mean score of 9.34 with a standard deviation of 2.73 and a posttest mean score of 15.01 with a standard deviation of 2.37, resulting in a mean gain of 5.67. The result indicated that both male and female students improved in their academic performance following exposure to the instructional approaches. Although male students obtained a slightly higher posttest mean score and mean gain than female students, the difference appeared minimal.

Hypothesis One: There is no significant difference in the mean performance scores of physics students taught electricity using competency-based and expository instructional approaches.

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Table 3: Analysis of Covariance (ANCOVA) of the difference in the mean performance scores of physics students taught electricity using competency-based and expository instructional approaches using pretest scores as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	118.472	2	59.236	12.214	.000
Intercept	1607.831	1	1607.831	331.591	.000
Pretest	4.551	1	4.551	0.938	.336
Instructional Approach	115.936	1	115.936	23.907	.000
Error	387.851	80	4.848		
Total	19846.000	83			
Corrected Total	506.323	82			

$R^2 = .234$ (Adjusted $R^2 = .215$).

The result presented in Table 3 showed that the effect of instructional approach on students' academic performance in electricity was statistically significant after controlling for the influence of pretest scores ($F(1,80) = 23.907$, $p = .000$). Since the probability value of .000 is less than the 0.05 level of significance, the null hypothesis was rejected. This implies that there was a significant difference in the mean performance scores of physics students taught electricity using competency-based and expository instructional approaches. Based on the descriptive statistics presented in Table 1, students taught using the competency-based instructional approach performed significantly better than those taught using the expository instructional approach.

Hypothesis Two: There is no significant difference in the mean performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches.

Table 4: Analysis of Covariance (ANCOVA) of the difference in the mean performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches using pretest scores as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	29.814	2	14.907	3.026	.054
Intercept	1628.512	1	1628.512	330.572	.000
Pretest	5.032	1	5.032	1.021	.315
Gender	15.804	1	15.804	3.208	.077
Error	394.042	80	4.926		
Total	19846.000	83			
Corrected Total	423.856	82			

$R^2 = .070$ (Adjusted $R^2 = .047$).

The result presented in Table 4 revealed that the effect of gender on students' academic performance in electricity was not statistically significant after controlling for the influence of pretest scores ($F(1,80) = 3.208$, $p = .077$). Since the probability value of .077 is greater than the 0.05 level of significance, the null hypothesis was retained. The finding indicates that there was no significant difference in the mean performance scores of male and female physics students taught electricity using competency-based and expository instructional approaches. The descriptive statistics presented in Table 2 further showed that although male students recorded a slightly higher posttest mean score than female students, the observed difference was not statistically significant.

DISCUSSION OF FINDINGS

The findings of this study revealed that students taught electricity using the competency-based instructional approach performed significantly better than those taught using the expository instructional approach. This finding suggests that competency-based instruction enhanced students' understanding of Physics concepts by emphasizing mastery of learning outcomes, active participation, and the practical application of knowledge. The superiority of the competency-based instructional approach may be attributed to its learner-centred nature, which allowed students to progress through clearly defined competencies while receiving continuous feedback and engaging in problem-solving and hands-on learning activities. The finding is consistent with the position of Malonda (2022), who asserted that competency-based instruction promotes mastery of essential knowledge and skills through outcome-oriented learning experiences. It also supports the view of Kumari (2025) that competency-based learning improves students' achievement by allowing learners to progress according to demonstrated competence while receiving continuous assessment and feedback. Similarly, the present finding agrees with Ashu (2025), who emphasized that competency-based instruction is particularly suitable for Physics because it enables learners to build a strong understanding of fundamental concepts before advancing to more complex ideas. The result further corroborates the findings of Achor et al. (2021) and Sunday et al. (2025), who reported that

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instructional approaches emphasizing mastery learning, active learner engagement, and competence development significantly improved students' academic achievement and conceptual understanding in science. In the same vein, the finding aligns with those of Paul et al. (2024) and Umoetuk et al. (2025), who observed that integrating practical activities, problem-solving tasks, and learner participation into science instruction enhanced students' understanding, retention, and overall academic performance.

The findings further indicated that there was no significant difference in the academic performance of male and female students taught electricity using competency-based and expository instructional approaches. This implies that gender did not significantly influence students' performance when they were exposed to the instructional approaches employed in the study. The finding suggests that both male and female students benefited similarly from the learning experiences provided, indicating that effective instructional strategies can create equitable learning opportunities regardless of gender. The learner-centred features of the competency-based instructional approach, particularly active participation, continuous feedback, and opportunities for mastery, may have contributed to minimizing any existing gender disparities in performance.

This finding is in agreement with Umanah and Sunday (2022) and Umanah and Atabang (2025), who reported that gender differences in Physics achievement are often minimal and largely dependent on the instructional context rather than students' innate abilities. The result also supports the assertion of Hazari et al. (2020) that when students are provided with supportive, engaging, and inclusive learning environments, gender differences in science achievement become less pronounced because both male and female learners develop confidence and a stronger sense of belonging. Furthermore, the finding corroborates the reports of Akpan, Utibe, John, and Nelson (2023) and Umanah (2024), who found that interactive and learner-centred instructional approaches reduced gender disparities by promoting equal participation and engagement among students. Likewise, the finding agrees with Umanah and Sunday (2025) and Edet et al. (2025), who concluded that competency-based and other learner-centred instructional strategies provide personalized learning experiences that enable both male and female students to achieve comparable levels of academic success. However, the finding contrasts with Adepeko (2022), who reported gender differences in Physics achievement, suggesting that contextual factors such as instructional methods, classroom environment, and learner support may account for variations across studies.

CONCLUSION

Based on the findings of this study, it was concluded that the competency-based instructional approach is a more effective instructional strategy than the expository instructional approach for improving students' academic performance in the concept of electricity in Senior Secondary School Physics. The learner-centred nature of the competency-based instructional approach, which emphasizes mastery of competencies, active participation, continuous feedback, and practical application of knowledge, contributed to students' improved understanding and achievement. The study also concluded that gender did not significantly influence students' academic performance when exposed to the instructional approaches, indicating that both male and female students benefited equally from the learning experiences provided. Therefore, the competency-based instructional approach can be considered an effective and gender-inclusive strategy for enhancing Physics learning among secondary school students.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made:

1. Physics teachers should adopt the competency-based instructional approach in teaching electricity and other Physics concepts, as it enhances students' academic performance through active learning, mastery of competencies, and practical application of knowledge.
2. School administrators and educational stakeholders should organize regular workshops, seminars, and in-service training programmes to equip Physics teachers with the knowledge and skills required for the effective implementation of competency-based instructional approaches in the classroom.
3. Curriculum developers and education authorities should integrate competency-based instructional principles into the secondary school Physics curriculum by providing competency-based learning activities, performance tasks, and assessment guidelines that promote students' conceptual understanding and practical skills.

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